Housing for Adults with Autism Spectrum Disorder (ASD): Creating an Integrated Living Community in Salem, MA

Tara Pearce
University of Massachusetts Amherst

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HOUSING FOR ADULTS WITH AUTISM SPECTRUM DISORDER (ASD):
CREATING AN INTEGRATED LIVING COMMUNITY IN SALEM, MA

A THESIS PROPOSAL PRESENTED

BY

TARA PEARCE

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

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Department of Architecture
HOUSING FOR ADULTS WITH AUTISM SPECTRUM DISORDER (ASD):
CREATING AN INTEGRATED LIVING COMMUNITY IN SALEM, MA

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TARA PEARCE

Approved as to style and content by:

Erika Zekos, Chair

______________________________

Stephen Schreiber, Department Chair

Department of Architecture
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ABSTRACT

HOUSING FOR ADULTS WITH AUTISM SPECTRUM DISORDER (ASD):
CREATING AN INTEGRATED LIVING COMMUNITY IN SALEM, MA

DEPARTMENT OF ARCHITECTURE

MAY 2021

TARA PEARCE, B.A., BOSTON COLLEGE
M.Arch., UNIVERSITY OF MASSACHUSETTS AMHERST

Directed by: Erika Zekos

While some adults with autism spectrum disorder (ASD) are high functioning and go on to lead successful and independent lives, many still face the difficult challenge of finding and securing adequate housing. As our economy changes and buying a house or renting an apartment become less and less affordable, many adults with ASD have to continue living with their aging parents. Government funding for adults with autism is limited and group homes are scarce and are typically poor in quality. Additionally, with ASD steadily increasing in prevalence, these options are becoming even more limited. Adults with ASD and their families are then confronted with the extreme stress of finding housing with limited budgets, quality, and time. This thesis proposes a model living community for adults with ASD that promotes connection to the larger community, nature, and builds life success through its architecture and programming. Set in Salem, Massachusetts, this model community was developed through analysis of recent literature on the topic of autism-friendly design, as well as interviews with professionals in field and parents of adult children with ASD. This thesis seeks to realize a model living community for adults with ASD and how connections and relationships can be
strengthened between residents and the city of Salem, so that these adults not only have housing but also better access to critical resources and improved quality of life.
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CHAPTER I
THE NEED FOR NEW MODELS

Autism, or autism spectrum disorder (ASD), is a serious developmental disorder that impairs the ability to communicate and interact. Moreover, this neurodevelopmental disorder refers to a broad range of conditions and symptoms characterized by challenges with social skills, repetitive behaviors, speech and nonverbal communication (Autism Speaks, “What Is Autism?”). According to the Centers for Disease Control, ASD affects an estimated 1 in 54 children in the United States today (Centers for Disease Control and Prevention 2020). It is also estimated that autism affects more than 1 in 100 people worldwide (ibid). Every person on the autism spectrum is extremely unique with learning, thinking, social, and problem-solving abilities ranging from gifted to severely challenged. While some individuals with ASD need a lot of help in their daily lives, others are more independent; while some individuals need constant care and supervision, others can be self-sufficient and live on their own. Once the latter reach adulthood and are ready to move out of their parents’ home, they are then confronted with the daunting task of finding somewhere to live where they feel safe and accepted into their new community.

Housing for ASD Individuals

Challenges with social interactions and repetitive behaviors are not the only obstacles that individuals with autism spectrum disorder (ASD) must face over the course of their lifetime. Finding and maintaining housing that addresses individualized needs and fosters independence is also especially difficult for those who choose to move out of
their parent’s home. Reportedly, only 19% of young adults with ASD live independently without supervision after their high school years, meanwhile 14% go on to live in a supervised living arrangement (Roux et al. 2015). Additionally, as an ASD individual matures into adulthood, their parents age with them and over time become less able to provide the care or guidance that their adult child needs. Parents and families are then confronted with the difficult question: Where is our child going to live when we can no longer take care of them or when we are no longer here? Even for the most independent individuals with ASD, some degree of support from family members is needed to maintain housing. In addition to the problem of aging parents, individuals with intellectual and developmental disabilities like ASD are further challenged with the limited availability of government funding for housing (The Arc 2020). Successful models of supported living are necessary in order to relieve the stresses that these families face by assuring them that their family member is going to have a safe and comfortable place to live, somewhere that not only provides physical comfort but is also a place that keeps them involved in the community and strengthens their independence.

Research Questions

This thesis seeks to answer a number of fundamental research questions related to the topic of housing for individuals with autism spectrum disorder (ASD). These questions include: How does one design an integrated living community for adults with autism and other neurodiverseies in the context of Salem, Massachusetts? What do family members and experts believe are the best spatial configurations and programming options for adults with ASD? Furthermore, what forms, colors, and materials are
preferred? How can one develop such a community that promotes connections within families and the community at large?

**Thesis Statement**

This project demonstrates how to design an integrated and inclusive living community for adults with autism spectrum disorder (ASD) in the context of Salem, Massachusetts. Furthermore, this project illustrates how this sort of development can promote independence, alleviate comorbid symptoms, and enhance connections within families and the community at large. This is accomplished specifically through the infusion of biophilic design throughout the project, from the exterior finishes to the configurations of key transition and escape spaces for refuge and sensory recalibration. Additionally, biophilia influences the project program with its focus on gardening as a means to build independence skills, as well as strengthen connections to the surrounding community.

**Scope and Boundaries**

Several boundaries need to be established in order to answer the aforementioned research questions in a succinct and accurate manner. First, the design portion of this thesis project is specific to Salem, Massachusetts. That is, this model is not intended to be applied widely as site context is critical in good design (although some ideas may be applied more universally). Second, this project addresses housing for adults with autism spectrum disorder (ASD) that do not require specialized care (individuals do not require hospitalization or extreme medical care). Moreover, this project is intended to address the
housing needs for individuals with ASD that can live independently with minimal aid.
Finally, this thesis is not going to propose how government funding for housing programs can be improved. While this thesis does not propose a funding model for this living community, it could be successful with government, private funding, or a mix of both.
CHAPTER II

UNDERSTANDING AUTISM SPECTRUM DISORDER (ASD)

What is Autism Spectrum Disorder (ASD)?

As previously stated, autism spectrum disorder (ASD) refers to a broad range of conditions and symptoms characterized by challenges with social skills, repetitive behaviors, speech, and nonverbal communication. It is important to note that ASD is a complex developmental disorder in which no single type of autism exists; there are many subtypes and variations of ASD which are influenced by a combination of genetic and environmental factors (Autism Speaks, “What Is Autism?”). Consequently, every individual with autism has a unique combination of strengths and challenges affecting their social, learning, and problem-solving abilities (ibid)

Unfortunately, there are many misconceptions surrounding ASD and the individuals who are diagnosed with it. For instance, there is a myth that ASD individuals are intellectually disabled. In actuality, amongst individuals with ASD, 46% have an intelligence quotient (IQ) greater than 85, indicating that they have average or above-average intelligence (Swetlik et al. 2019, 543). Many ASD individuals, including those with average or above-average intelligence, struggle at varying degrees with interpersonal relationships, employment, housing, and other potential comorbidities or health conditions. Due to this variance, while some individuals with ASD require significant and daily support, others can be entirely self-sufficient. It is well known that a complex relationship of several factors may influence the development of autism, and the disorder is often accompanied by sensory sensitivities, medical issues such as gastrointestinal (GI) disorders, seizures or sleep disorders, as well as mental health
challenges such as anxiety, depression and attention issues (Autism Speaks, “What Is Autism?”). In fact, “Up to 70% of children and young people living with autism spectrum disorder (ASD) experience a co-morbid mental health problem or disorder, most commonly anxiety and depression” (Hartley et al. 2019, 4306). ASD does not discriminate based on race or socioeconomic status. However, ASD is four times more common in boys rather than girls (Centers for Disease Control 2020).

**Signs & Symptoms**

As previously stated, autism spectrum disorder (ASD) is characterized by challenges with social skills, speech and nonverbal communication, emotion regulation, and repetitive behaviors. Key symptoms of ASD centered around challenges with social communication include but are not limited to: not understanding or appropriately using spoken language, physical gestures, eye contact, facial expressions, tone of voice, and expressions not meant to be taken literally (Autism Speaks, “What Are the Symptoms of Autism?”). Additional social challenges can include difficulty with recognizing the emotions or intentions of others, recognizing one’s own emotions, expressing emotions, seeking emotional comfort from others, feeling overwhelmed in social situations, taking turns in conversation, and gauging personal space (ibid).

Individuals with autism spectrum disorder (ASD) tend to experience difficulties with emotion regulation, as well. Emotion regulation has been defined as “an individual’s ability to manage and change his or her emotional responses by engaging in behavioral strategies and cognitive processes to regulate continuous affective states in order to accomplish one’s goals” (Reyes, Pickard, Reaven 2019, 206). Additionally, individuals
with ASD appear to have greater difficulty using adaptive emotion regulation strategies across their life span, suggesting that these difficulties persist over time (Reyes, Pickard, Reaven 2019, 210). Difficulty with or absence of these emotion regulation skills is associated with several psychiatric conditions (Reyes, Pickard, Reaven 2019, 207). Common comorbidities include: attention deficit/hyperactivity disorder (ADHD), anxiety disorders, and mood disorders. Challenges with managing anxiety and disproportionately responding to otherwise benign triggers is also common amongst individuals with ASD (Theoharides et al. 2019, 1). Biologically speaking, stress and environmental stimuli trigger unique immune cells, known as mast cells, which could then “trigger microglia leading to abnormal synaptic pruning and dysfunctional neuronal connectivity” (ibid). Microglia are a type of neuroglial cell found within the brain, which when activated, can potentially cause localized inflammation and lead to symptoms of ASD (Theoharides et al. 2019, 2). As a result, there could be alteration in the amygdala’s “fear threshold” leading to an exaggerated “fight-or-flight” reaction (Theoharides et al. 2019, 1). The amygdala is an important region of the brain known to play an important role in the processing of emotions, behavior, and fear.

In addition to challenges with social communication and emotion regulation, restricted and repetitive behaviors are other core symptoms of autism spectrum disorder (ASD). These behaviors vary in severity and form greatly across the spectrum and include, but are not limited to: repetitive body movements, repetitive motions with objects, staring at lights or spinning objects, ritualistic behaviors, narrow or extreme interests in specific topics, a need for unvarying routine and a resistance to change (Autism Speaks, “What Are the Symptoms of Autism?”). Core social and behavioral
symptoms of autism spectrum disorder (ASD) and common comorbidities are outlined in Figure 1 below.

For many children, symptoms of ASD can improve with age and behavioral treatment, however, individuals with ASD typically continue to need services and support into adulthood (National Institute of Neurological Disorder and Stroke 2015). Depending on the severity of their symptoms, some ASD individuals can successfully work and live independently, or within a supportive environment (ibid).

**Figure 1: Core ASD Symptoms and Common Comorbidities and Biomarkers**

For many children, symptoms of ASD can improve with age and behavioral treatment, however, individuals with ASD typically continue to need services and support into adulthood (National Institute of Neurological Disorder and Stroke 2015). Depending on the severity of their symptoms, some ASD individuals can successfully work and live independently, or within a supportive environment (ibid).

**Diagnosis**

Signs of autism spectrum disorder (ASD) usually appear by age two or three, yet associated development delays can appear even earlier and can even be diagnosed as
early as 18 months (Autism Speaks, “What Is Autism?”). Fortunately, research shows that early intervention and treatment correlates with positive outcomes later on in life (ibid). While many individuals with ASD are diagnosed in this window of early to mid-childhood, some may not receive formal diagnosis until much later (Swetlik et al. 2019, 545). In particular, individuals with “fluent language and normal-range IQ are likely to be overlooked” (ibid). Diagnosing ASD in adults can be especially difficult given that many studies and diagnostic tests, such as the Autism Diagnostic Observation Schedule-2 (ADOS-2) and the Autism Diagnostic Interview-Revised (ADI-R), are typically focused on and are used to diagnose ASD in children (Swetlik et al. 2019, 546).

In 2013, the American Psychiatric Association released the fifth edition of its Diagnostic and Statistical Manual of Mental Disorders, which is referred to simply as the DSM-5. The DSM-5 is the current and standard reference that healthcare providers reference in the diagnosis of mental and behavioral conditions, including autism spectrum disorder (ASD). Under the umbrella of autism spectrum disorders, the DSM-5 includes previously distinct disorders such as Asperger syndrome, childhood disintegrative disorder, and pervasive developmental disorders not otherwise specified (PDD-NOS). Since the DSM-5 combined autism and Asperger syndrome under the diagnosis of ASD, it is now left up to the clinician to then “specify whether the patient with ASD has accompanying intellectual or language impairment and to assign a level of severity based on communication deficits and restrictive behaviors” (Swetlik et al. 2019, 544). This shift in diagnostic labeling was particularly worrisome for clinicians treating patients with DSM-IV Asperger syndrome since by losing that label, some feared potential
stigmatization now being classified with the more general ASD diagnosis (Swetlik et al. 2019, 545).

Future revisions to the Diagnostic and Statistical Manual of Mental Disorders (DSM) may include further changes in classification or diagnostic labeling, such as grouping adults with autism spectrum disorder (ASD) according to their independence and cognitive ability to generate a more pragmatic and generalized characterization of their needs (ibid). At least three informal groupings of adults with ASD have already been described that consider both cognitive ability and independence. These three groups include: (1) Those with low cognitive and social abilities requiring lifelong support, (2) Those with midrange cognitive and social limitations who can often find employment in supervised settings or work involving repetitive tasks, and finally (3) Those who have greater cognitive ability and some social skills. Individuals identifying with the third group may have the prospects of attending college in addition to working and living independently (ibid).

**Believed Causes**

Although the exact cause of autism spectrum disorder (ASD) is still unknown, researchers do know that there is no single cause of ASD. Rather, research suggests that ASD develops from a complex combination of genetic and nongenetic (or environmental) influences (Autism Speaks, “What Causes Autism?”). Certain combinations of these influences appear to increase the risk of developing ASD; however, it is important to note that increased risk is still not equivalent to cause. Regarding genetic risk factors, research indicates that ASD tends to run in families (ibid). If a parent (even one that does not have
ASD) carries one or more genetic changes, these changes may then get passed to a child (ibid). In other instances, genetic changes arise spontaneously in early embryonic development. However, although numerous gene mutations have been reported in patients with ASD, they have only explained less than 5% of cases (Theoharides et al. 2019, 1).

Research also indicates that certain influences may further increase, decrease, or have no effect on the risk of developing autism spectrum disorder (ASD) in people who are genetically predisposed to the disorder. Importantly, the increase or decrease in risk appears to be small for any one of these risk factors (Autism Speaks, “What Causes Autism?”). For example, certain environmental risk factors like advanced parent age, pregnancy and birth complications, and pregnancies spaced less than one year apart are factors that have been associated with a small increased risk in developing ASD (ibid). Meanwhile, supplementing with prenatal vitamins containing folic acid throughout the pregnancy has been associated with a small decrease in risk (ibid). Additionally, with over two decades of extensive research, it has been determined that childhood vaccinations do not cause ASD, as once theorized (ibid). Other factors that have shown strong links to ASD include prenatal stress (Theoharides et al. 2019, 3) and birth complications associated with trauma or ischemia and hypoxia (lack of blood supply and oxygen in tissues, respectively) (Maria et al. 2020, 104). By contrast, other pregnancy-related factors such as maternal obesity, maternal diabetes, and cesarean section have shown weak associations in affecting the risk of developing ASD (ibid).
The History of Autism

Autism spectrum disorder (ASD) was first medically recognized in the early to mid-20th century, however there are a number of historical accounts indicating that the disorder has existed long before then. Yet, retrospective diagnosis is obviously speculative. The word "autism" derives from the Greek word "autos," meaning "self." Since ASD is characterized by having challenges with social interaction, an ASD individual could then be considered an “isolated self”. The term “autism” was first used around 1911 by Eugen Bleuler, a Swiss psychiatrist, in reference to a group of symptoms related to schizophrenia (Evans 2013). By the 1940s, researchers in the United States began to use the term “autism” to describe children with emotional or social problems (WebMD 2019). The diagnostic label “autism” was first recognized in 1942 by Dr. Leo Kanner at Johns Hopkins Hospital. An Austrian-American psychiatrist, Kanner is commonly referred to as the “father of child psychiatry” in the United States and is often considered to be one of the most influential American clinical psychiatrists of the 20th century (Britannica). Kanner is perhaps best known for his description of “early infantile autism” in 1943 as a distinct clinical syndrome (ibid). Through the observation of 11 children with similar sets of behavior and characteristics, Kanner developed and described a common profile marked specifically by a shared obsessive desire for sameness (ibid).

Hans Asperger, an Austrian pediatrician, was practicing around the same time as Kanner performing studies with a similar group of children in Europe. Although Hans Asperger described a similar condition as Kanner had defined, Kanner’s work ultimately became more influential. What was considered a milder form of autism, Asperger
syndrome, was later named after him. His later recognition is partly due to the work of Lorna Wing, who published a paper in 1981 in *Psychological Medicine*, which ultimately thrusted Asperger’s clinical observations onto a global stage. Lorna Wing was an English psychiatrist and a pioneer in the field of childhood developmental disorders. Wing was a critical figure who advanced the understanding and awareness of autism worldwide and was involved in founding the National Autistic Society in the United Kingdom (Baron-Cohen 2018).

As much as the cause of autism spectrum disorder (ASD) is still a mystery to us today, its believed causes and experimental treatments were certainly unsubstantiated when the disorder was emerging into the general public’s consciousness decades ago. For instance, it was once believed that autism was caused by “cold, rejecting” mothers with the targeted treatment often focusing on the interactions between the mother and her child (Britannica). Kanner coined the phrase “refrigerator mother” to describe the “emotional frigidity” of parents who he thought caused or contributed to their children’s autistic behavior, a term he later repudiated (ibid). From the 1960s through the 1970s, treatments for autism shifted in focus to other unfounded methods including: medications such as LSD, electric shock, and behavioral change techniques, with the latter relying on pain and punishment (WebMD 2019). During the 1970s and 1980s, a shift in focus on neurobiological mechanisms led to new treatment strategies, including discrete trial training (the Lovaas method) and structured teaching (Schopler’s TEACCH program) (Patriquin 2019, 199-200). Also, while it was first believed that autism might be an early form of childhood schizophrenia, by 1979 this myth was debunked (Wolff 2004, 201). Then, during the 1980s and 1990s implementing behavioral therapy and using highly
controlled learning environments emerged as the primary treatment options for autism and related conditions (WebMD 2019). In 1994, the American Psychiatric Association (APA) recognized the diagnosis of Asperger syndrome in the fourth edition of its Diagnostic and Statistical Manual (DSM). As previously discussed, the APA then abandoned the label Asperger syndrome in 2013 in favor of a unified category and diagnosis, autism spectrum disorder (ASD).

**Treatment Options**

To date, there is no cure for autism spectrum disorder (ASD). Unfortunately, treatment options for ASD are complicated and obscured by the “lack of reliable biomarkers, distinct pathogenesis and presence of subgroups” (Theoharides et al. 2019, 1). However, certain therapies and behavioral interventions have been designed to improve specific symptoms according to individualized needs. Most health care professionals agree that the earlier the intervention is implemented, the better (National Institute of Neurological Disorders and Stroke 2015). Educational and behavioral interventions, medications, and alternative treatment options for ASD will now be briefly discussed.

**Educational and Behavioral Interventions**

In early behavioral and educational interventions, therapists use structured and skill-oriented training sessions to help children develop social and language skills. Although most programs focus on children, some of the following interventions, such as occupational therapy, have been shown to be helpful in the alleviation of symptoms in adults as well. Some popular interventions include:
• **Applied Behavior Analysis (ABA):** Applied behavior analysis (ABA) is widely used in schools and treatment clinics and is based in the science of learning and behavior. ABA works by encouraging positive behaviors and discouraging negative ones to improve a variety of skills.

• **The Early Start Denver Model (ESDM):** ESDM is a type of ABA designed to help children with ASD between the ages of 12-48 months. Through the ESDM, parents and therapists use play and joint activities to advance their child’s social, language, and cognitive skills.

• **Floortime:** Floortime is another relationship-based therapy specifically aimed at children with autism spectrum disorder (ASD) that involves playtime between parent and child. This interaction meets the child at their individualized needs and development to build specific skills. Floortime is considered an alternative to ABA and is sometimes used in conjunction with ABA therapies.

• **Occupational Therapy (OT):** Occupational therapy teaches and develops skills that build independence. OT programs can take on many forms and involve play skills, learning strategies, and self-care. Specific skill building may include dressing, eating, bathing, socializing, and managing sensory issues.

• **Pivotal Response Treatment (PRT):** Pivotal response treatment aims to increase a child’s motivation to learn and mindfulness of their own behavior, and to improve communication with others. PRT targets
“pivotal” areas of a child’s development, instead of focusing on one specific behavior.

- **Relationship Development Intervention (RDI):** Relationship development intervention (RDI) is a family-based, behavioral treatment which focuses on building social and emotional skills. Parents act as the primary therapist in most RDI programs. RDI helps people with ASD form strong emotional bonds with others.

- **Speech Therapy:** Speech therapy helps to improve an ASD individual’s verbal and nonverbal communication skills in more useful or productive ways.

- **The TEACCH® Autism Program:** The TEACCH® Autism Program is a clinical, training, and research program based at the University of North Carolina Chapel Hill and it was developed by Dr. Eric Schopler and Dr. Robert Reichler in the 1960s. This approach focuses on external organizational supports to address challenges with attention and executive function, visual and/or written information to supplement verbal communication, and structured support for social communication.

- **Verbal Behavior Intervention (VBI) or Verbal Behavior Therapy (VB):** VBI is a type of applied behavior analysis (ABA) that focuses on developing verbal and language skills. VBI teaches critical language skills including connecting words with their purposes by focusing on the meaning of words and how they are useful in communicating ideas.
• Cognitive Behavioral Therapy (CBT): Cognitive behavioral therapy has been around since the 1960s and it is usually recommended for children with milder symptoms of ASD. Cognitive behavioral therapy aims to identify the triggers of particular behaviors so that children can recognize those anxiety or fear inducing triggers themselves.

• Sensory Integration Therapy: Sensory integration therapy is designed to improve a child’s ability to receive, process, and make sense of multiple sensory inputs at the same time. This therapy specifically aims to resolve poor sensory integration, such as how to control body movement.

Medications

Of course, medication alone cannot cure autism spectrum disorder (ASD) or even treat its all of its core symptoms; however, there are medications that can help with an individual’s comorbid disorders such as anxiety, depression, and obsessive-compulsive disorder. For instance, while many people with ASD take antidepressants, researchers are not yet certain whether they actually help with core ASD symptoms. Regardless, they may be useful for treating the symptoms of their comorbid condition. Some options include antipsychotic medications if the person with ASD struggles with severe behavioral problems including aggression and self-harm. Since some people with ASD have epilepsy, anticonvulsant medications are an option. Additionally, medication used to treat people with attention deficit disorder (ADD) can be prescribed to decrease impulsivity and hyperactivity in people with ASD. For example, stimulants such as methylphenidate (Ritalin) are generally used to treat ADHD, but they may also help with overlapping ASD symptoms.
Alternative treatments

There are countless alternative treatment options that people can try in order to alleviate symptoms of autism spectrum disorder (ASD). However, not much conclusive research exists proving the efficacy of these methods. Potential alternative treatments requiring more conclusive research include: a gluten-free/casein-free diet, weighted blankets, and supplements such as melatonin, vitamin C, omega-3 fatty acids, dimethylglycine, vitamin B-6 and magnesium combined, oxytocin, and CBD oil.

An encouraging and emerging alternative treatment is mindfulness-based treatments. Previous findings indicate that mindfulness-based or meditative interventions may be efficacious in addressing emotion regulation skills in individuals with ASD (Reyes, Pickard, Reaven 2019, 219). For example, in “Mindfulness for Children and Adults with Autism Spectrum Disorder and Their Caregivers: A Meta-Analysis” the authors found that caregivers, children, and adults who received mindfulness interventions all reported significant improvements in subjective wellbeing immediately post-intervention and that these effects were maintained at a three-month follow up (Hartley et al. 2019, 4306). Adults with ASD commonly self-report moderate to severe symptoms of depression and anxiety, and encouragingly mindful awareness and mindfulness interventions have been shown to reduce these symptoms of psychological distress and improve overall wellbeing in general and clinical populations (ibid). Furthermore, “Mindfulness interventions have also been shown promise in the management of psychological distress in adults with high functioning ASD, even assisting emotional regulation over time” (ibid). Interestingly, these benefits can also extend to caregivers of individuals with ASD. These mindfulness interventions include a
combination of face-to-face therapy with a trained practitioner as well as formal home practice.

**Conclusion**

Autism spectrum disorder (ASD) is a complex condition that necessitates an individualized approach for every person diagnosed with the disorder. Even with decades of extensive research, there are still many unknowns: When did ASD first appear historically? What exactly causes it? What is the cure? Increasing awareness and research into these issues is critical in advancing the wellbeing of this growing population. Understanding what *is* known and what myths have been proven false is one of the first steps that must be taken for any designer or architect engaging in the advocacy of these individuals to ultimately create a more inclusive and supportive built environment.
CHAPTER III
AUTISM-AWARE DESIGN

This chapter summarizes and synthesizes what research currently exists on the topic of autism-aware design; a topic that has often been left out of discussions regarding accessible design. While the Americans with Disabilities Act (ADA) has addressed the needs of those with physical impairments, it has yet to truly address the needs of those with mental or behavioral disabilities. The term “universal design” was first coined in the early 1990s, and along with ADA, it sought to provide the best solution for most. However, universal design and ADA has focused more on the needs of people with physical disabilities and has yet expanded to include the emotional, mental, sensory, cognitive, and developmental needs of other users (Sanchez et al. 2011). Current literature on the topic reveals that design factors can positively and negatively affect sensory issues for individuals with autism spectrum disorder (ASD). Several sources propose their own set of design guidelines and recommendations that can be applied to a multitude of project types, such as housing. Many of the authors recognize that no set of autism-focused, design guidelines should be strictly adhered to, yet they provide a satisfactory launching point for design.

The ASPECTSS™ Design Index

Dr. Magda Mostafa presents her influential and frequently cited set of design guidelines, the ASPECTSS™ Design Index, in the context of home environments in the article “An Architecture for Autism: Application of the Autism ASPECTSS™ Design Index to Home Environments”. Her pioneering research has shown that “sensory input
from the built environment can positively influence autistic behavior” (Mostafa 2014, 25). From interviews, focus groups, and her own literature review, Mostafa developed the Autism ASPECTSS™ Design Index which is comprised of a checklist of seven design criteria. These include: acoustics, spatial sequencing, escape spaces, compartmentalization, transitions, sensory zoning, and safety. Each of these will be explored in depth in the current chapter.

**Acoustics**

During the exploratory stage of Mostafa’s research, acoustics were ranked as the most influential feature of the sensory environment upon autistic behavior. In educational spaces for children, empirical research has shown that by reducing noise levels and echo, attention spans, response times, and behavioral temperament improved (Mostafa 2014, 27). In some instances, reducing noise meant a tripling of attention span, a 60% decrease in response time (impulsivity), and a 60% decrease in instances of self-stimulatory behavior (Mostafa 2008, 197-203). Consequently, Mostafa proposes that the acoustical environment should be controlled to minimize background noise, echo, and reverberation, and that the level of acoustical control should vary according to the level of focus required within the given space, as well as the skill level and symptom severity of its users. For example, activities requiring higher focus should be given greater acoustical control and belong to low-stimulus zones. In order to allow greater acoustical control, she recommends that windows and walls be sound-treated with weather trim and, in some instances, covered by heavy curtains. Sharing a bedroom wall with plumbing
flow should be avoided, whenever possible. Additionally, fluorescent lighting is not typically recommended since its hum and flickering can be distracting.

New Zealand-based architect Thomas Denhardt analyzes Dr. Magda Mostafa’s suggestions proposed in her ASPECTSS™ Design Index and confirms how acoustics or auditory sensitivities are an acute challenge for many autistic individuals. However, he suggests that implementing complete soundproofing and full acoustical control is “counter-productive” due to the risk of the individual's behavior becoming accustomed to that environment and resulting in an inability to generalize that skill outside of that space (Denhardt 2017, 33). This phenomenon is referred to as ‘the greenhouse effect’ and it is considered unsustainable in achieving the long-term goal of inclusion and independence. Mostafa’s research further investigates both the extent of the “green-house” effect and the means to wean users off of it. She recommends that the Autism ASPECTSS™ Design Index be applied with user-fit in mind. It is suggested that this flexibility should allow for future weaning off of full compliance to the index once the environment has allowed the opportunity for coping skills to be developed. Accordingly, Mostafa recommends gradated acoustical control so that individuals can “graduate” from one level of acoustical control to the next, slowly moving towards a typical, uncontrolled environment in order to avoid the “greenhouse effect” (Mostafa 2014, 27).

As previously mentioned, research by Mostafa (2008) showed acoustical properties to be the most important element in the built environment that affects people with autism spectrum disorder (ASD). Therefore, unnecessary background noise and other excess stimuli should be highly controlled, whenever possible. By identifying and removing distracting acoustical sources, people with ASD are then better able to increase
their focus and have fewer outbursts. Sanchez et al. (2011) suggested adding “pink noise”
to create privacy in certain spaces as well as adding biophilic background noise to help
relax and focus the mind of users. Pink noise is a mix of high and low frequencies, like
the sound of failing rain or gentle ocean waves, making it soft and calming. Since it
comprises both high and low frequencies, it also has sound blocking benefits that can
help to drown out distracting noises, such as those that keep one from falling asleep.

External Walls and Openings

Mostafa considers the external wall perimeter of the building as the “primary
noise filter” (Mostafa 2010, 42). Sound-reducing techniques such as hollow block-work,
cavity wall systems, increased cross-section and sound reflection are just some
recommendations for external walls, especially for buildings adjacent to noisy sources
like heavy traffic streets, parks or schools (ibid). Additionally, she recommends that
external openings should be treated. For example, if a space requires higher acoustical
control such as a bedroom or therapy room, Mostafa suggests that it may be preferable to
reduce the number of openings, as well as the size of windows, which should be double
or triple glazed (Mostafa 2010). She also suggests sound-trap louvered fins and heavy
curtains using fabrics such as velvet or thick gauzy cotton to cover openings and reduce
noise permeability (ibid).

Internal Walls and Adjacent Noise Sources

Mostafa suggests that there are a number of ways to control internal noise
sources, which may also involve enlisting other criteria from the ASPECTSS™ Design
Index. Spatial organization and zoning, as previously discussed, play a key role in this.
For instance, quieter spaces should be grouped together and separated from spaces
requiring less acoustical control. Mostafa suggests that internal walls, like external walls, be treated to decrease sound permeation. She states that this can be achieved by acoustical paneling in walls and ceilings, sound insulation of plumbing and their adjacent walls, soundproofing HVAC systems, and non-reflective sound absorbent materials for floors, walls and ceilings (Mostafa 2010). An example of this to reduce the amount of acoustically reflective materials like ceramic tiling in bathrooms, and rather opt for more insulating materials like soft, waterproof vinyl-based materials.

**Spatial Geometry**

According to Mostafa, spatial geometry deals with the scale, proportion and form of spaces and their corresponding relationship to acoustics (Mostafa 2010, 42). For example, larger spaces with nonsound absorbent finishes may create distracting and unpleasant echoes for the ASD individual. Proportion, in particular, plays a key role in this issue such as in exceedingly high spaces, like egress stairwells, and exceptionally long spaces, like corridors. The echoes created in such spaces by users transitioning through their leaving and coming home routine may disrupt all hypersensitive users in adjacent spaces daily (ibid). Stairwells and corridors that are minimally contained ultimately help minimize problems with echo.

**General Finishing Materials and Texture**

Mostafa proposes the use of non-reflective and sound-absorbent materials when designing autism-friendly environments, reasoning that it is always easier to add sound sources rather than remove those causing distraction after the fact. For finishes, the use of natural materials such as cork boarding, soft woods like pine, or certain sound absorbent vinyls are recommended. Mostafa also suggests that walls can be inexpensively finished
with non-glossy textured paints for the hyper-textural user or smooth, sound absorbent wallpaper for the hypo-textural user (Mostafa 2010, 43).

**Spatial Sequencing**

According to Mostafa, spatial sequencing capitalizes on the affinity of individuals with autism spectrum disorder (ASD) for routine and predictability. Accordingly, this criterion requires that areas be organized based on the typical scheduled use of such spaces thereby supporting one’s daily routine. Mostafa recommends that these spaces should flow seamlessly from one activity to the next through one-way circulation whenever possible, with minimal disruption and distraction (Mostafa 2014, 27). For instance, in one of Mostafa’s case studies, the individual with autism spectrum disorder (ASD) had a bedroom located at the end of a corridor. The home was arranged so that adjacent to his bedroom was his bathroom where he showered and got dressed for school every day. Next, was his study area where he prepared his school bag and had his breakfast. He could then proceed to the entrance vestibule and out the door to begin his day. His mother noted that the day that routine was altered, he was invariably late for school. Mostafa points out that while some may argue that indulging in the autistic child’s obsessive need for routine may only make him more dependent upon it and unable to deal without it, however, through the workshop it was found that this was not entirely true (Mostafa 2014, 29-30). Furthermore, it was discovered that such routine can be capitalized upon so that the individual may gain and develop new skills by adhering to it (ibid).
**Spatial Organization**

Mostafa claims that furniture distribution plays an important role in achieving spatial definition, particularly in group or common spaces (Mostafa 2010, 44). Grouping furniture and objects may help create subtle physical and behavioral boundaries for each activity and encourage certain desirable behaviors (ibid). For example, circular or "conversation" type arrangements in group areas may help encourage interaction and create an opportunity for social skill development. However, if other activities requiring higher focus or more controlled acoustics are located within these group areas, compartmentalization is suggested (ibid). In this case, furniture like a workstation cubicle could be set up partially partitioned off from the group area.

With respect to individual spaces, like bedrooms and bathrooms, other aspects need to be taken into consideration. Mostafa’s research suggests that ASD users prefer smaller bedrooms with a single bed against one of the walls (Mostafa 2003, 204). If a user deals with extreme sensitivity issues, this area may even be designed as a sort of alcove which provides a sense of enclosure with strong visual boundaries and acoustical limitation. It is recommended that no other activities like studying, working or eating should be combined in bedroom and individual areas (Mostafa 2010, 44). It is also suggested that sufficient storage should be available in a well-organized and accessible manner to promote life skill-building. These too should ideally be organized in accordance with one’s daily routine, a strategy which will capitalize on the adherence to routine to help promote essential life skills.

Regarding the programming of social spaces, Kinnaer et al. (2016) found that providing a range of spaces for different kinds of social interaction is best. Common
rooms intended to promote social interaction should be spacious, given that individuals with autism spectrum disorder (ASD) have the potential of feeling crowded in shared spaces. When social situations become too overwhelming in common spaces, a place to retreat or escape should be provided and be easily accessible. These spaces can present in a variety of ways such as an alcove at the edge of the room, a platform, or even a completely separated escape space (which will be discussed in the next section). To increase the feeling of controllability, it is recommended to plan several means of egress from common areas. However, having too many options to exit in a large open space can also present a potentially overwhelming situation. While open spaces are preferred by some ASD individuals because it affords having an overview, both increasing predictability and being able to distance oneself from others without being isolated, others might like this space to be subdivided or compartmentalized into several separate spaces. This would afford a sense of structure and reduce sensory inputs present in one space. These nuanced strategies should be considered along with the intended activities taking place within shared or common areas to determine the overall spatial organization.

As previously mentioned, individuals with autism spectrum disorder (ASD) tend to need structure in the form of schedules and routines in order to limit negative consequences of unpredictability. Accordingly, Kinnaer et al. (2016) recommends that places should be specified according to particular activities and be organized in accordance with daily routines to support the ASD individual in remembering and completing several succeeding tasks. Examples of this include providing clear lines for circulation patterns such as memorable edges like curved or half-walls, landmarks such
as sculptures or fountains, noticeable junctions to increase familiarity, or using color coding to create different zones or districts.

**Escape Spaces**

Mostafa claims that empirical research has shown the positive effect of including escape spaces, which provide a place of rest and refuge from over-stimulating events. Such spaces may include a small, partitioned area or a nook within a quiet room. She recommends that these spaces provide a neutral sensory environment with low levels of stimulus so that the space can be customized by the user to provide the desired sensory input (Mostafa 2014, 28). In one case study, Mostafa provides a successful example of an escape space in the context of how a bed is positioned within a bedroom. In this case, the bed was flanked by a structural beam on one side and the bed had a low ceiling covering it, therefore providing a sense enclosure that helps hypo-tactility and proprioceptive imbalances (Mostafa 2014, 31). These imbalances refer to the stimuli that are produced and perceived within an individual, especially those associated with the position and movement of the body. In this example, the bed was also arranged so the user could not see the door, which may lower a sense of anticipation and anxiety.

Additionally, Denhardt (2017) explains that the escape space criterion is readily applicable universally and at varying degrees. For example, escape spaces can range from visually, acoustically, and spatially separate spaces, like a small quiet room, a quiet bench or seat under a tree, or in a nook of a room. Such spaces allow someone with autism spectrum disorder (ASD) the opportunity to seek a calm place that helps them self-regulate so that they can participate in activities with others again once they feel
comfortable (Clouse et al. 2019, 5). Ideally, these spaces should be designed according to individualized needs, with distinct levels of stimulation, privacy, and socialization, which in turn can help build confidence and nurture self-esteem (Gaines et al. 2016). Nagib and Williams (2017) cite different design strategies that families have used to create and tailor these escape spaces. They discovered that families had commonly taken out closets for storage and inside placed some pillows and hung curtains and Christmas lights to provide soft, white light (Nagib and Williams 2017).

**Compartmentalization**

The philosophy behind this criterion is to define and limit the sensory environment of each activity and organize these activities or programmatic elements into separate compartments (Mostafa 2014, 28). Mostafa recommends that each compartment should include a single and clearly defined function and corresponding sensory level. However, the separation between compartments does not need to be harsh, such as in the form of a wall, rather it can be made through strategic furniture arrangement, differences in flooring, changes in elevation, or even changes in lighting. The sensory qualities of each space should be used to define its function and separate it from adjacent compartments (ibid). When coupled with consistency in activity, Mostafa claims that this will help provide sensory cues as to what is expected of the user in each space, and thereby minimize ambiguity. Providing visual instructions or cues that indicate steps to be followed when performing specific activities is also recommended.
**Transitions**

Dr. Magda Mostafa describes that transition zones assist in the recalibration of the user’s senses as they move from one level of stimulus to the next (Mostafa 2014, 28). Transition zones can take on a variety of forms ranging from a distinct node that indicates a gentle shift in stimulus to an entire sensory room that allows complete sensory recalibration (ibid). In addition to wayfinding, transition zones help people with autism spectrum disorder (ASD) prime their senses as they move from one form and level of stimulus to the next. To aid in this process, Clouse et al. (2019) recommends that designers provide opportunities for individuals to preview entrances, exits, and spaces, so that they can evaluate the environment and better adjust to a new setting (Clouse et al. 2019). Including nodes of transition that invite socialization along pathways when moving from one space to another is also recommended. Research has shown that providing ASD individuals with transition spaces helps prepare them for entering spaces when they are ready, which can boost their self-esteem, decrease anxiety, and ultimately assist them with their socialization and communication skills (Gaines et al. 2016).

**Sensory Zoning & Sensory Issues**

Sensory zoning proposes that spaces be organized in accordance with their sensory, rather than functional, quality. This requires designers to group spaces according to their allowable stimulus level, or into high-stimulus and low-stimulus zones, with transition zones aiding in the shift from one zone to the next. Figure 2 illustrates how these sensory zones could be organized and separated by a biophilic transition, aiding in the process of sensory recalibration.
Typical architectural processes arrange zones according to functional qualities, such as private zones for sleeping, public zones for family and guests, and service zones for bathrooms, the kitchen, and laundry. However, when designing for individuals with ASD, Mostafa claims that zoning may serve a greater purpose if based upon the sensory, rather than functional, characteristics of the spaces. High stimulatory elements in the home include the kitchen and bathroom area, as the kitchen has poor acoustical quality, various appliances, and for both the kitchen and the bathroom, water flow. Mostafa’s research suggests that locating these zones at the center of a home seems to cause distraction, and thereby compromises life-skill development (Mostafa 2014, 29).

Due to differences in information processing, individuals with autism spectrum disorder (ASD) deal with their environment in unique ways, which also influences their spatial experience and interaction with the surrounding world. To address these sensory challenges, Kinnaer et al. (2016) advises creating a neutral and consistent environment, not in a sterile manner, but in a way in which stimuli can be added or removed as needed (especially in the case of sensory rooms and escape spaces). Sensory rooms offer multi-
sensory experiences through textures, light, colors, and sounds. Soft lighting, warm colors, interesting textures and thoughtfully positioned pieces of art, plants and natural elements are recommended to make a room more hospitable.

**Sensory Issues**

The article “Toward an Autism-Friendly Home Environment” by Nagib and Williams (2017) closely analyzed the most and least prevalent autism-related sensory sensitivities. Unsurprisingly, a majority (87%, n = 146) of the respondents reported that their children were sensitive to noise (Nagib and Williams 2017, 151). Disturbance from visual stimuli at home was the second most commonly reported problem (67%), of which 27% of the respondents reported disturbance by indoor sights (ibid). For example, seeing food left out and uncleaned or reflective surfaces. Clutter was also a commonly reported disturbance by 26% of the respondents (Nagib and Williams 2017, 152). Sensitivity to light was the third most commonly reported issue by the 66% of respondents, with sunlight being the greatest source of disturbance (32%, n = 54), followed by flickering light (26%, n = 44) (Nagib and Williams 2017, 152-153). Sensitivities to smell or specific colors were less common (Nagib and Williams 2017). Due to these findings, designers should be keenly aware of the most commonly reported sensory disturbances and seek to limit their potential by controlling acoustics, providing ample storage and easy cleaning of surfaces, as well as reducing the potential for glare and the use of fluorescent lighting.

**Lighting**

In addition to acoustics, other sensory issues include intense, obstructive, or unpleasant lighting. Clouse et al. (2019) suggests adding dimmer switches throughout facilities to be able to appropriately adjust lighting levels, which can also limit
stimulation. Furthermore, to enhance flexible lighting solutions, each row of fixtures may have its own switch to allow individuals the ability to control the desired amount of light within any given space. Clouse et al. (2019) acknowledges the conflicting ideas regarding the use of fluorescent lighting; while some recognize the impact of fluorescent lighting upon people on the spectrum, others identify a need to be around fluorescents in less controlled public settings when working and living independently, referring back to the greenhouse effect (Clouse et al. 2019, 4). Clouse et al. (2019) offers the solution of incorporating a variety of light sources, such as overhead lighting, natural lighting, task lighting, and indirect lighting. Additionally, while providing sufficient daylight is important to occupant comfort, designers should be cautioned against the use of low windows to minimize the impact of visual distractions (Gaines et al. 2016).

Textures, Materials and Colors

Materials and textures are well debated in relation to their effect on symptoms of autism spectrum disorder (ASD), but it is commonly agreed upon that the material environment should be predictable, consistent, comprehensible, and controllable. As many ASD individuals have heightened sensitivities, many unfortunately develop allergies and asthma (O’Neill 1999, 89). It is therefore recommended that designers specify using building materials, furniture and finishes that are free of toxic substances and chemicals, can be easily cleaned, do not emit gases, and prevent the accumulation of too much dust. Additionally, the durability of materials should be balanced to create aesthetically pleasing, homelike environments. For example, carpet tiles which are easier to replace than wall-to-wall carpeting or linoleum or cork flooring which are easy to maintain, and yet comfortable. Clouse et al. (2019) advises designers to use natural
materials within a space such as cork, cotton, and porcelain to help calm the senses. The use of subdued colors such as soft green or blue is commonly recommended, and while designers should limit the color palette for a project, the overall product should of course avoid an institutional aesthetic (Clouse et al. 2019).

When discussing the tactile environment, Mostafa raises two points: texture and closure. For the hyper-textural user, she recommends smooth and soft materials, meanwhile the hypo-textural user needs stimulation through rough textures. Natural materials often provide a positive balance for both types of users. Closure also plays a major role in the tactile character of a space in which hypo-tactile autistic users seem to prefer smaller spaces, particularly when conducting calm activities like sleep or meditation (Mostafa 2010, 43). A popular application of this is Temple Grandin's “squeezemachine”, a chair which closes upon its user to provide stimulation (Grandin 1996, 64). Users also seem to prefer single beds placed against one wall, or tent-like structure, but she clarifies that this does not mean that all spaces should be small and highly enclosed.

**Flexibility**

Since autism spectrum disorder (ASD) affects individuals in a variety of ways and at varying levels of severity, it is important that spaces are flexible. For example, being able to control the temperature within a space provides opportunities for people to choose their own level of thermal stimulation or comfort. Clouse et al. (2019) suggests providing ceiling fans, operable windows, and accessible thermostats to further promote autonomy. However, ceiling fans are not recommended widely as they can often cause visual distraction or disturbance. Flexible and customizable layouts can provide a sense of
control to a person with sensory needs through physically exploring different spatial relationships. Therefore, the use of movable furniture is one way that designers can allow an individual to customize their space based on their comfort level (Clouse et al. 2019, 5).

Organization

As previously mentioned, individuals with autism spectrum disorder (ASD) frequently report disturbance from clutter and, as a result, require environments that reflect clarity and order (Brand 2010). This can be accomplished with sufficient and integrated storage options and partition walls. However, it is important to note that while some ASD individuals want to keep everything out of sight, others enjoy displaying their special collections or hobbies, so designing for both users in mind is important (Kinnaer et al. 2016, 184).

Safety

The final ASPECTSS™ design criterion not to be overlooked when designing environments for children and adults with autism spectrum disorder (ASD), is safety. Safety is more of a concern for ASD individuals who may have an altered sense of their environment or certain sensory issues. One of the top safety issues that has been reported by architects is elopement, or the tendency to escape from home (Nagib and Williams 2017, 147). Design strategies to address this range from using low-tech locks or deadbolts to more sophisticated security systems. Regarding sensory issues, some people with ASD do not appropriately feel sensations of coldness or warmth, as such it is recommended that water temperatures in sinks, bathtubs and showers be regulated with temperature control valves and to use underfloor heating instead of radiators (Kinnaer et
al. 2016, 188). Other safety related modifications in the bathroom included installing non-skid flooring, tempered glass and mirrors, and water sensors and floor drains to avoid flooding.

Some individuals with autism spectrum disorder (ASD) may struggle with forgetfulness, which comes with its own risks. For example, if an ASD individual becomes distracted during certain activities like cooking or washing, this may result in a stove not being turned off, or a tap left running (Brand 2010). Additionally, some people with ASD may be—deliberately or not—hard on materials, appliances, and furniture (Kinnaer et al. 2016, 189). This kind of behavior not only affects the building’s overall durability, but more importantly jeopardizes the safety of the ASD individual and other people in the space. Kinnaer et al. (2016) recommends using brick with impact-proof plasterboards, fortified windows with layered glass, durable paints and easy-to-maintain or soft wall or floor furnishes, and firmly anchoring all kinds of appliances. Other safety-related strategies include: using soft or rounded edges whenever possible, clarifying external boundaries, and providing multiple exits in a space to allow others to exit when aggressive behaviors arise.

Conclusion

Clearly, symptoms of autism spectrum disorder (ASD) can be aggravated or lessened through certain planning and design decisions. While it is hugely important to consider the design guidelines developed for individuals with ASD, like the ASPECTSS™ Design Index, it is also important to note that the challenges for designers is much more nuanced than simply following these alone. Just like any other person,
individuals with ASD will have differing preferences that need to be taken into account and accommodated. This does not mean, however, that the proposed design guidelines cannot offer a valuable starting point, as they can bring attention to certain design challenges and strategies that might otherwise go unrecognized.
CHAPTER IV

BIOPHILIA & BIOPHILIC DESIGN

The term “biophilia” was coined by Harvard professor E. O. Wilson describing a hypothesis that speculates the innate attraction that human beings possess for natural forms and other living organisms, or connections to nature (Gaines et al. 2016, 168). Increasing evidence supports the emotional and psychological benefits of nature, which when extrapolated to architecture, indicates that nature has the capacity to make buildings more enjoyable and therapeutic for all, including those on the spectrum (ibid). In the text, Designing for Autism Spectrum Disorders, Gaines et al. (2016) states that nature has the ability to “promote new skill sets and experiences (instorative) for individuals with autism” (ibid). Furthermore, “visual representations of nature, symbols of nature, views to nature, and indoor plants and other natural design elements appeal to one’s innate affinity and can evoke positive experiences in the built environment” (ibid). Having this direct access to nature can also “help individuals with autism spectrum disorders manage their behaviors, encourage learning, and improve their sense of well-being” (Gaines et al. 2016, 177). Meanwhile, having reduced access to nature is “linked to worsened outcomes including attention deficit/hyperactivity disorder symptoms, higher rates of anxiety, and higher rates of clinical depression” (ibid). As a result of these findings, that biophilic design and access to nature is therapeutic for individuals with autism spectrum disorder (ASD), the design of this thesis will incorporate biophilia as an additional design criterion along with the design criteria presented in the ASPECTSS™ Design Index. The following chapter discusses what biophilic design really means, how it can be
implemented into an architectural design, and how its benefits are extended to individuals with ASD.

Stephen Kellert, a pioneer in biophilic design, asserted that there are two dimensions or branches to the hypothesis of biophilic design: organic design and vernacular design (Gaines et al. 2016, 169). Organic design includes forms, shapes, colors, textures, and patterns found in natural materials (ibid). However, it can also include elements like access to natural lighting and ventilation, and the presence of water and vegetation (Gaines et al. 2016, 170). Vernacular design, on the other hand, references a connection to a particular place, and this can be done either culturally, historically, or ecologically (ibid). Another way to consider the two dimensions is whereas organic design produces positive emotional and psychological benefits from the attraction to nature, vernacular design fosters a connection to the specific place that people live (Gaines et al. 2016). Strategies suggested in this text are not restricted to simply referencing natural images, patterns, forms and colors alone, however. For organic design, for example, attention could be placed on the qualities of light and space, or to address the vernacular, one could try to incorporate geological and landscape features, use local building materials, or reference certain historical and cultural traditions or motifs.

**Spatial Orientation & Views to Nature**

Climatic issues were one design challenge raised Dr. Magda Mostafa, which involves the interaction of the building and its natural surroundings and the influence of its orientation on its physical characteristics. For example, a north facing room will
generally be colder than a south facing room (in the Northern hemisphere). Mostafa brings attention to this example to demonstrate how these interactions and influences can manifest in autism-aware design depending on each user's sensitivities. Accordingly, attention should be paid to how a hyperactive individual may require a cooler environment than a less active or sedentary one at rest, how hypo-tactile users may enjoy breezy areas as a form of tactile stimulation, or how hyper-olfactory users may require additional natural ventilation to flush out unpleasant odors (Mostafa 2010, 44).

When it comes to lighting and views, natural approaches have been found to be more successful (ibid). Hyper-visual users, however, may prefer fewer window openings to reduce what would be perceived as intrusive light. Mostafa highlights that in areas where high levels of focus are required, like a workspace or study, such openings may produce distracting views. However, when calmness is the objective of a space, such views, if pleasant, may be calming to the hypo-visual individual (Mostafa 2010, 44-45). Such findings support the proposition to include therapy spaces that reveal views of natural landscapes, such as a gardens or ocean shores. Finally, Mostafa recommends using clear-story or indirect natural lighting in general, with views to nature accessible when necessary or important.

**Spatial Integration: Landscaping**

Mostafa writes that nature is a strong strategy in the alleviation of symptoms of autism spectrum disorder (ASD), and it is essential that it be incorporated into any autism-aware project through landscaping (Mostafa 2010, 45). Here, she notes that the therapeutic effects of this connection to nature are well documented (Crisp 1998) and
(Hartig and Cooper-Marcus 2006). Mostafa believes that the daily sensory requirements of individuals with ASD need to be balanced and that a garden or natural landscaped area is optimal for this balancing or recalibrating effect (Mostafa 2010, 45). Furthermore, by providing elements like water, rocks, grass, herbs and flowers arranged in defined yet organic organizations, each user can create their own "sensory balancing" experience (ibid). Furthermore, Mostafa states that it is important that landscaping elements be interactive and dynamic, rather than static (ibid). She suggests channeling water using rocks or levers and combining this water experience with other elements like stone to creation different textures (ibid). Additionally, she suggests that seating around these areas be modular and flexible and to include trees or tall shrubs for areas requiring privacy.

Gardens

Additionally, Mostafa reflects on the therapeutic powers of gardening. Some attribute this effect, particularly observed in individuals with autism spectrum disorder (ASD), to its gradual and predictable progress, two factors which are also especially important to autistic comfort (Mostafa 2010, 45). Gardening also provides many opportunities for sensory stimulation through the inclusion of colors, smells, and textures, as well as the opportunity for physical activity and psycho-motor association development (Mostafa 2010). This last point involves development of skills using the mind-body connection learned through physical experience. Additionally, active processes in nature such as gardening “provide rehabilitation, habitation, acceptance, and inclusion” meanwhile passive processes “provide tranquility, peace, and spirituality”
(Gaines et al. 2016, 172). Furthermore, the active aspect of gardening, “promotes cognitive enrichment, self-worth, productivity, and social connectedness” (ibid).

In designing gardens and outdoor spaces, Gaines et al. (2016) suggests thoughtfully considering the location of the garden space, as it should be tranquil and quiet. Some strategies include: inclusion of an orientation map, providing a variety of seating areas, creating cave-like spaces with a low hanging tree or rock formation, using smooth non-glare paving, and including wide paths to accommodate vestibular (senses movement and imbalances in the body) and proprioceptive (brain information about the location/movement of body in space) variations, as well as clear fenced in perimeters for safety purposes.

**Conclusion**

As previously stated, the benefits of incorporating biophilic design elements cannot be overstated in how they can improve an ASD individual’s overall sense of well-being. The work of Mostafa (2008, 2010, 2014) and Gaines et al. (2016) necessitate the inclusion of biophilic design, thoughtful landscaping, and gardens into the design of this thesis project in order to alleviate undesirable symptoms such as anxiety, enhance overall well-being, and promote social connectedness for residents.
CHAPTER V
ADDRESSING COMMUNITY INCLUSION AND PREDICTORS OF INDEPENDENT LIVING

Given that community skills may be related to independent living, this thesis will propose an integrated community-based model of semi-independent living. Through activities structured through the project’s program that are shared with the Salem community, it is expected that residents would then be able to improve living skills. For an adult with autism spectrum disorder (ASD) to live and function semi-independently, they need to develop vocational training, life skills, have mental and physical health support, as well as have assistance in finding employment, public transportation, and public housing (Gaines et al. 2016). The importance of living near public transport should be particularly highlighted, as the potential for independence begins with the choice of neighborhood (Kinnaer et al. 2016, 187). That is, if the site is selected carefully, many places can be reached without assistance and social networks can be enhanced, which in turn leads to better independence-skill development. Unfortunately, limited attempts are being made to address the vocational needs and desires for independence for mid- to high-level functioning adults with ASD (Clouse et al. 2019, 7). Yet, the trend of developing more vocational centers holds out a promise for ASD individuals towards more independent living.

“Adult Outcomes in Autism: Community Inclusion and Living Skills,” by Gray et al. (2014) investigates the problem surrounding how the social outcomes for adults with autism spectrum disorder (ASD) are restricted. This is the case particularly in terms of employment and living arrangements. This study followed a community sample of
children and adolescents with ASD into adulthood and traced their social outcomes in relation to community inclusion and living skills. They also looked at the predictive role of a range of individual factors such as socio-economic disadvantages. The study found that the degree of community inclusion and living skills was restricted for the majority of participants, and while childhood IQ was an important determinant of these outcomes, it was not the sole predictor. Furthermore, they discovered that fewer adults with ASD are now living in care and they are more engaged in activities during the day. While this can be seen as an improvement, a significant number of individuals continue to live at home with their families and employment numbers are still relatively low. Researchers note that the reliance on aging parents as primary caregivers for adults with ASD is particularly concerning and that efforts to enhance accommodation is necessary (Gray et al. 2014).

In terms of employment, Gray et al. (2014) states that the research indicates that a relatively small number of adults with autism spectrum disorder (ASD) have paid work. In samples where the majority of participants did not also have intellectual disabilities, rates of paid employment ranged from 20 to 55%, with the majority of adults working in sheltered workshop programs or participating in day programs (Gray et al. 2014, 3007). Even among higher functioning adults, rates of independent or semi-independent living range from 16 to 36 % (ibid). Consistent with previous research, Gray et al.’s 2014 study found that the majority of individuals with ASD were either living with their parents or were in some form of care. Furthermore, 61 % of the individuals were living with their families at Time 5, with only eight adults living independently, or 9% of participants (Gray et al. 2014, 3011). Time 5 was approximately 17 years since the study first began.
This confirms that parents bear much of the burden of caring for their adult children with ASD and justifies the need for increased specialized housing.

Gray et al. (2014) proposed the possibility that young adults with autism spectrum disorder (ASD) are more likely to engage in activities that are organized and structured by others, rather than initiating their own activities. Although it was not asked in this study, it would be useful in future studies to ascertain to what extent adults with ASD initiated their own leisure activities or how this could be promoted. Other findings included that both paid employment and postsecondary education were associated with better living skills and there was at least some indication that community skills may be related to living independently (Gray et al. 2014, 3013).

Conclusion

Since an objective of this thesis is to propose a model which promotes independence for residents, the potential for community engagement, particularly through employment opportunities will be included. By clearly specifying certain activity spaces that allow for different spheres of social interaction with the community, by providing various options for vocational training, and by anticipating access to public transportation and resources for individuals with autism spectrum disorder (ASD), it is then hypothesized that residents would be able to improve living skills and eventually graduate towards more independent living.
CHAPTER VI

THE ASD CAREGIVER & DESIGNER SURVEY

The purpose of conducting this survey was to confirm current research on the topic of housing for individuals with autism spectrum disorder (ASD) and to uncover any potential contradictions or novel discoveries. The goal of the survey was to introduce more personal experience into this thesis from a variety of perspectives and to discover what these experts and family members believe to be the optimal residential environment for individuals with ASD and what programming and resources would be the most beneficial.

Methods

The survey consisted of 12 questions including multiple choice, ranking, and text-based responses. The survey was approved by the Institutional Review Board (IRB) and was distributed online using Qualtrics once a signature for the online consent form was obtained. The online consent form was distributed using DocuSign. Survey responses were analyzed using Qualtrics’ “Reports” tool and through an interpretation of qualitative data. Identifiable data was not collected.

Participants

The survey was distributed to seven participants in total and six responses were obtained. Recruitment emails were sent to personal contacts and there was snowball sampling from there on. Participants included adults only, adults being defined as individuals being 18 years or older. In the group of participants, three identified as a
parent of a young adult with autism spectrum disorder (ASD); one identified as a parent of a young adult with ASD and an author who researched live/work options for those with ASD and other neurodiversities; one identified as a social worker who works with adults with ASD; and one who identified as an architect that has completed a housing development specifically for individuals on the spectrum.

Results

**Building Typology, Roommates, and Caretakers**

Participants were asked to rank what they believe to be the optimal building typology for individuals with autism spectrum disorder (ASD). Participants were given the options of townhouses (one to two residents per townhouse), group living (two or more residents sharing common space), single-family (detached house), and apartment style (studio or one bedroom). Townhouses were ranked the highest, followed by group living, single family, and finally apartment style.

Participants were then asked whether or not they believe that individuals with autism spectrum disorder (ASD) would benefit from having roommates and why or why not. Of the six participants, four responded “yes” with little to no caveats and two responded expressing hesitations that having roommates would be beneficial for all. For example, the social worker expressed, “It’s really a matter of personality, preference and skill level. I couldn’t pick one living environment in the previous question because any or all would be best depending on the person” (social worker). The architect surveyed held a similar position and suggested that, “in more severe situations, the privacy and ability to move away from over stimulating situations may suggest single room bedroom
occupancy” (architect). All parents responded “yes” to having roommates. One parent elaborated on the benefits of this stating:

“when they first venture out into independent living, especially if it is a friend or someone they have a personal relationship with. This gives both of them a level of accountability toward the other; a "check-in" person. Having a friend to help and to help you navigate through the unknowns of adult life is always a benefit. Plus, a roommate requires interaction which teaches one how to socialize, negotiate and compromise; important skills to acquire” (parent 3).

As to design for roommates or not, it generally seems best to design for a range of unit types with single bedroom occupancy to both provide the potential for interaction as well as limit overstimulation from socialization. The third question asked participants whether or not they believed that an on-site caretaker and/or nurse would be necessary in the case of group housing for ASD individuals. Of the six participants, only one selected yes, four selected it may be necessary, and one selected no.

**Design Considerations**

The next series of questions aimed to identify key design considerations that would either confirm or contradict current literature regarding autism-aware design. Participants were first asked what type of spaces are generally preferred by individuals with autism spectrum disorder (ASD). Participants could check off as many options as they needed. Options given included: open, closed-off or enclosed, naturally daylit, bright, dark or shaded, large, and small. Of the choice count, closed-off or enclosed and naturally daylit made up the highest proportion of responses at 25%. This was followed by small at 20% and then dark or shaded at 15%. Open, bright, and large made up the lowest proportion of the total choice count, each at 5%.

Participants were also asked which aspects of the built environment seem to be the most burdensome for individuals with ASD. Again, participants could check off as
many options as they preferred. Options given included: loud spaces, transitional spaces (ex. hallways), stairs or steps, common or public spaces, bright or intrusive lighting, and reflective surfaces. Of the choice count, loud spaces made up the highest proportion of responses at 37.5%. This was followed by bright or intrusive lighting at 31.25%. Transitional spaces and common or public spaces each made up 12.5% of responses. Reflective surfaces made up just 6.25% of the responses and stairs or steps was not selected by any of the participants.

Regarding other design considerations, participants were asked what type of outdoor or green spaces would likely be used by individuals with autism spectrum disorder (ASD). Participants could again check off as many options as they found appropriate. Options included: park-like spaces, walking paths, gardens, private backyard, and other (ex. beaches, lakes). Of the total choice count, walking paths made up the highest proportion at 35.71% followed by gardens at 28.57%. Private backyard and other were equally 14.29% of the total choice count, while park-like spaces made up the lowest proportion at 7.14%.

**Programming Considerations**

Participants were then asked a series of questions related to what programming and/or resources they believed would be beneficial to individuals with autism spectrum disorder (ASD) and if they believed whether or not these programming elements could create a sense of community. All of these questions had open text responses in which respondents could write as little or as much as they wanted.

In this series of questions, participants were first asked what resources and/or programming would likely help adult ASD individuals feel more connected to their
community, especially in the case of young adults leaving home for the first time.

Majority of the responses included suggestions to have some collaboration with a local organization for individuals with ASD and other neurodiversities, such as The Arc. The Arc is the largest national organization that advocates for people with intellectual and developmental disabilities and it provides a variety of services ranging from vocational services to recreational activities. Access to local community services (libraries, gym/YMCA, parks, etc.) and a community center were also highly recommended. One response included other ideas stating, “Programming to help develop living and coping skills like cooking, financial management, housekeeping, self care [sic], etc. would provide the support young adults need to feel confident and grow into the people they’re meant to be” and that “access to a garden and gardening is also beneficial in so many ways!” (social worker). One parent reported specific programming as well including, “Structured social gatherings, organized therapies, such as music, art, pet, etc..” (parent 1). Another parent said, “Joining an activity within the local community, i.e., walking group, bowling league, a cooking class would also help these individuals feel involved in the town in which they live” (parent 3).

The next question specifically addresses whether or not respondents believed that having a dedicated community center on site would be likely visited by residents and whether or not this space could help ASD individuals feel connected to their community. All responses reported that having such a community center has the potential to be successful, just to varying degrees based on individual needs. One participant said, “Yes, many people would probably enjoy this.. it would be wonderful for the center to be designed to serve people without ASD too, to broaden the experience and promote full
integration into the community” (social worker). The architect surveyed shared a similar notion referring to his own project stating, “...we incorporated a separate community resource center for the residents, families, the community at large and special programming to help raise awareness of the varying degrees of autism” (architect). None of the responses included specific examples of the types of programming or spaces that could be incorporated into this onsite community center.

The next question regarding programming was more specific in asking whether having spaces for practicing mindfulness would be beneficial and why or why not. Four of the respondents reported that such as space would be beneficial with no reservations. Two of the respondents said that it could be beneficial depending on the individual. For example, one respondent expressed that “practicing mindfulness is imperative for anyone on the Spectrum to alleviate the overstimulation that is often present in their daily lives, yet I am not sure if ASD adults would feel comfortable engaging in these activities in the presence of others” (parent 3). Another respondent gave an alternative to a meditation specific space saying, “In designing spaces, I would say having MULTI-PURPOSE shared space is the way to go. It might hold a yoga class one hour, a gaming group another night, a pizza party the next” (parent/author). Another participant suggested that having a meditative space could serve different but similar purposes stating, “... this type of space could have multiple functions. It could serve as a quiet, meditative type space but could also be used to aid with calming during an acting-out scenario” (architect).

Participants were asked what they personally believe is the most critical element in creating a home and sanctuary for individuals with ASD. Responses varied greatly, addressing issues of materials, appliances, types of spaces provided, personalization, and
organization strategies. The architect’s response referenced criteria from the ASPECTSS™ Design Index including escape spaces, places to preview and transition, as well as “small pocket spaces for individual or small group activities” (architect). One parent listed several design strategies including:

“Simple to use appliances, clean/clear light spaces, moveable walls to create private environments if desired, labeled drawers, shelves, and voice-driven technology (Alexa?) for on-demand control of HVAC, lighting, security, reminders, shopping lists, etc. Non-slip surfaces on stairs and floors, no knobs on drawers, pulls are better, auto-off appliances, reverse osmosis water filtration system, pressure/temp controlled plumbing, emergency call system w/ voice activation, pet-friendly” (parent 2).

Another parent emphasized the importance of the organization in a space saying, “I have found that ASD individuals need to have a sense of knowing where things are and where they go. They feel more in control of their environment when there is order” continuing on to say that “their sanctuary is a space where their individual interests are displayed in their surroundings. They seem to find comfort in that familiarity of the thing(s) they love” (parent 3). The other parent surveyed gave more a specific suggestion regarding the number of residents living together stating, “I think the best living situation would be living in a group home of 10-12 individuals. All having their own room but have common areas (Kitchen, living room) into which they can socialize with others” (parent 1).

Question 11 asked participants if they have worked with or are currently working directly with an organization that provides services to adults with autism spectrum disorder (ASD) and what they have found to be the most successful and most difficult part their work or project. The architect, who recently had completed a new model for congregate living among ASD adults, responded saying, “we have had to make many
assumptions on the resident profile ranging from moderate to severe on the spectrum so gauging individual resident needs is difficult” (architect). The architect continued, “We worked very closely with the daily service provider and tried to learn what has worked well and not so well at other group homes. We intend to do a "Lesson Learned" next spring after the one year occupancy period is reached” (architect). One of the parents stated that, “Most difficult is that one size doesn’t fit all. All ASD individuals are completely different and have different needs. It’s best to find the common needs and focus on those. Then individually address the needs of the person” (parent 1).

The final question in the survey gave participants the opportunity to address anything that they felt was important in considering the design of housing for adults with autism spectrum disorder (ASD) that hadn’t been addressed in the previous questions. Some responses suggested precedents and other pieces of literature to consider. Two of the responses emphasized the importance of considering construction materials, specific finishes, and colors and their effect on individuals with ASD. One participant emphasized one of their previous responses saying, “As I mentioned above, I’ve seen the benefits of gardening and experiencing the outdoors countless times” (social worker).

**Conclusion**

Questions related to design considerations generally confirmed findings in the current literature regarding autism-aware design. For example, enclosed and naturally daylit spaces are typically the most preferred design considerations, meanwhile loud spaces were reported to be the most burdensome. In deciding a building typology, townhouses and group living seem to be the most viable options, as long as they are
flexible in how they can accommodate a range of needs and preferences. In considering
the types of green spaces to include in this project, walking paths and gardens seem to be
the preferred options. Regarding programming considerations, it was discovered that
having a community center would be beneficial to residents given that it provides
different or multi-purpose spaces for a range of activities to be held. In investigating
specific programming elements, meditation or therapy spaces were generally
recommended by all participants, as such they will be explored in this thesis design.
CHAPTER VII
FEARS OF INSTITUTIONALIZATION & THE FUTURE OF
COMMUNITY-BASED MODELS

This chapter will explore several precedents that provide, or provided, housing and programming for adults with autism spectrum disorder (ASD). The first of which is Danvers State Hospital, a historical precedent that illustrates why a lingering fear of designing specialized housing for individuals with ASD and other neurodiversities exists, a fear that society might regress back to a state of institutionalization. Then, Sweetwater Spectrum successfully illustrates how to create a community-based model that draws upon evidence-based design guidelines. Finally, First Place AZ shows how these guidelines can be employed at a larger scale with a focus on how circulation can enhance social connectivity.

Danvers State Hospital

The Danvers State Hospital, previously known as The Danvers Lunatic (or Insane) Asylum, was a psychiatric hospital located in Danvers, Massachusetts. It was built on a rural, isolated site in 1874 under the supervision of Boston architect Nathaniel Jeremiah Bradlee and it later opened in 1878 (Wikipedia). Danvers State was a multi-acre, self-contained psychiatric hospital designed and built according to the Kirkbride Plan (ibid). The Kirkbride Plan was a system of mental asylum design advocated by Philadelphia psychiatrist Thomas Story Kirkbride (1809–1883) in the mid-19th century. The asylums built according to the Kirkbride Plan, often referred to as Kirkbride Buildings (or simply Kirkbrides), were constructed across the United States during the
mid-to-late-19th century (ibid). The structural features of the hospitals were contingent on his theories regarding the healing and care of the mentally ill, in which exposure to the natural environment, such as natural light and air were critical (ibid). The hospitals built according to the Kirkbride Plan would also adopt various architectural styles, but they commonly shared the "bat wing" style floor plan, which housed numerous pavilions sprawling outward diagonally from the center. Danvers State employed the “bat wing” style floor plan and it was designed in a gothic modification of a Victorian style hospital.

Figure 3: Danvers State Hospital Postcard (Danvers State Hospital 2020)

The legacy of Danvers State Hospital contributes to a complicated history surrounding the institutionalization, housing and treatment of individuals with mental and developmental disorders. Unfortunately, its legacy also continues to influence the hindrance and concerns of creating specialized housing, such as that for individuals with autism spectrum disorder (ASD) today. Surprisingly, up until the 1980s, it was common practice to institutionalize people with ASD (Wright 2015). Since less people understood
what autism looks like in adults, behaviors such as repetitive body movements and other symptoms were often mistaken for signs of obsessive-compulsive disorder, psychosis, and most commonly, schizophrenia (ibid).

In the 19th and early 20th century, asylums like Danvers State were the main form of care for patients with severe mental illness (SMI) (Chow and Priebe 2013). The lives of patients were dictated by institutional routine and isolation from the wider society over extended periods of time (ibid). Overtime, these psychiatric hospitals became seen as establishments that shared similar characteristics as prisons, housing patients with restricted freedom and who also suffered from the stigma of being a psychiatric patient (ibid).

During the mid-19th century, interest in moral treatment was part of a growing trend among physicians who believed that patients did not have to be confined indefinitely (Allen 2019). This meant that patients could be treated, even cured, by getting enough rest, eating healthy food, and getting exercise outdoors to experience nature (ibid). Marking the progress of treatment was indicated in the configuration and spatial sequencing of the Kirkbride bat-wing plan itself. First, new patients would arrive at the administrative offices at the center of the “V”. Second, patients would be segregated by gender and then be further segregated by the severity of their symptoms, with the patients requiring the most care being kept in the pavilions furthest from the center (ibid). As a patient would demonstrate improvement, he or she would literally graduate back towards the building center, back towards the exit.

Since each of the pavilions along the “bat-wing” was set back slightly from the last, every room in the hospital received maximum natural ventilation and daylighting;
even in the mid-1800s, nature was believed to be curative. Kirkbride accordingly called for the asylum to be surrounded by uninterrupted, rolling landscapes (ibid). This connection to nature was reinforced in patients’ participation in gardening. In fact, many Kirkbrides contained working farms with vegetable gardens, greenhouses, dairies, and livestock. Kirkbride believed that keeping patients occupied was key to their recovery, therefore patients aided in farm work and other tasks regarding the daily operation of the asylum (ibid). While daily work was part of patients’ moral treatment, so too was amusement (ibid). Kirkbrides featured many amenities such as ballrooms, bowling alleys, baseball diamonds, and one even had a pre-electricity roller-coaster (ibid).

In 1840, the United States had just 18 asylums, forty years later there were 139, most of them built with state funds according to the Kirkbride Plan (ibid). By the late 1850s, asylums were highly desired by American towns as they had become symbols of civic and moral achievement leading to insanity’s possible cure (ibid). Postcards frequently featured drawings of an area’s Kirkbride, such as that of Danvers State as shown in Figure 3. However, the state mental hospitals constructed during the early 20th century grew even larger, resembling institutional buildings like prisons, the very thing that Kirkbride had wanted to avoid. By the mid-20th century, the fall of asylums began as the buildings had become overcrowded. During this time, psychiatrists had turned their focus to curing mental illnesses by more extreme measures such as physical interventions like lobotomies, insulin comas, electroshock treatments, and eventually chemicals marketed as psychiatric drugs (ibid). In the 1960s, new laws prohibited psychiatric patients from working and without the contribution of patient labor, many hospitals’ infrastructures were eventually brought to a halt (ibid). Then starting in the 1970s, the
process of deinstitutionalization began as American state mental hospitals were largely defunded and closed (ibid).

Throughout the 1970s, activists disclosed that the Massachusetts mental health system was corrupted with claims of abuse and neglect, filthy and unsafe conditions, and mismanagement on a system wide scale (Danvers State Hospital). A serious phasedown of institutions like Danvers State Hospital was implemented in the beginning of the 1990s as major scandals of abuse prompted investigation and sensational media coverage. On June 24, 1992 the last patients of Danvers State Hospital were transferred to Tewksbury and the hospital officially closed (ibid). Danvers State Hospital was demolished in 2006, but its unique place in history reminds us of the rise, fall, and lingering fear of the American asylum.

Dr. Kirkbride's approach of access to nature, fresh air, healthy food, gainful occupation, and spaciousness are strategies that are now considered standard in designing housing or facilities tailored to people with intellectual or neurodevelopmental disorders like autism spectrum disorder (ASD). These methods and the programs that Kirkbrides incorporated, specifically programs focused on horticulture and farming, are commonly used today. Yet, the image of the asylum was corrupted by the overcrowding in the 20th century and the later abuse of the patients it originally sought to cure. Although these effects were not instructed by Dr. Kirkbride, some of his guidelines should receive further criticism. Namely, the decision to physically isolate patients from the larger community deviates from the accepted community-based models of today. Community integration is a critical element in this thesis project, as it is critical in the development of ASD individuals seeking greater independence. This independence is fostered through
access to proper and individualized resources, noncompulsory employment, community involvement, and the development of personal relationships.

**Sweetwater Spectrum Community**

Sweetwater Spectrum is just one example of a community that draws upon evidence-based design guidelines regarding autism-aware design. In 2009, a group of families, professionals and civic leaders came together and founded Sweetwater Spectrum and selected Leddy Maytum Stacy Architects to design the project. Since opening its doors in January 2013, the community has continued to grow and remain dedicated to providing a viable model for families who are struggling with the lack of housing options for their adult children with autism spectrum disorder (Sweetwater Spectrum). The community leverages recent autism-aware design guidelines, encourages community engagement, meets residents at their individualized needs, and embraces sustainable design.

This precedent includes thoughtful programming which promotes engagement with the surrounding neighborhood and community through volunteer activities and outreach projects. Besides outreach projects, the Sweetwater Spectrum Community is further connected to the town since it is close to public transit and bicycle trails, something that is majorly important in selecting a site for an autism-focused housing development. Sweetwater Spectrum is situated on 2.79 acres and it is located a few blocks west of Sonoma’s downtown plaza. The previously undeveloped land had to be a safe and secure location for the residents and staff as well as be able to provide appropriate engagement with the neighborhood and community (Arch Daily). The
campus includes: four four-bedroom homes for sixteen participants (with the ability for future expansion). The four 3,250-square-foot homes include common areas as well as a bedroom and bathroom for each resident. There is also a single-level 2,300 square foot community center with a kitchen, exercise studio, media room, and library, all of which build critical life skills and improve overall wellbeing. Across from the community center is a large therapy pool and two hot tubs. Additionally, there is a 1.25-acre organic farm on site. Sonoma Farm also hosts has an energy-efficient greenhouse that provides opportunities for physical skill development as well as healthy eating (Sweetwater Spectrum). Microgreens grown in the greenhouse are sold to local restaurants and at local farmers markets, which helps promotes community engagement.

Figure 4: View of the Community Center at Sweetwater Spectrum (Griffith 2013)

The design for Sweetwater Spectrum draws upon evidence-based design guidelines for creating housing for adults with autism spectrum disorder (ASD), as
identified in a research study conducted by the Arizona State University Stardust Center and School of Architecture. A straightforward, legible, and consistent spatial organization as well as hierarchies at different scale across the site provide clearly defined transitions moving between public, semi-public, semi-private, and private spaces (Arch Daily). Starting with the most private space, this spatial organization begins with the individual’s room, this then expands to a wing with two bedrooms, then to the entire house with all four residents, then expanding outward to the sub-neighborhood of two homes, then the community center and commons, and then the other two homes on site, and finally extending to the broader community. Besides smart spatial organization, designers also paid key attention to incorporating escape spaces and places to preview. All four homes are similar in design, therefore increasing predictability and comfortability for visiting residents (ibid). Spaces were designed to reduce sensory stimulation by providing serene environments, keeping forms familiar, using subdued colors and finishes as well as indirect lighting, whenever possible. Sustainable design was also a strong focus for the project, some measures include: using durable materials, photovoltaic panels, high performance insulation and windows, shading devices, low-flow plumbing fixtures, draught-tolerant plants, and many more.

Sweetwater Spectrum provides a viable model for emerging autism-focused housing developments. The project draws upon evidence-based design guidelines and includes proven, beneficial programming that fosters the development of critical life skills for its residents and keeps them involved in the community. Additionally, the site is carefully landscaped throughout to maintain a connection to nature (as well
as having residents participate in Sonoma Farm). The mostly single-story campus is human and approachable in scale and includes a legible layout with buildings and amenities falling into a rectilinear grid. These are just some of the tested and researched methods that will be explored in the design of this thesis project.

**First Place AZ**

First Place AZ is an independent, non-profit organization for individuals with autism spectrum disorder (ASD) and other neurodiversities. The organization engaged RSP Architects to develop their vision, and since opening their doors in 2018, First Place AZ has aided individuals in the difficult transition from their secure family homes into greater society. Independence is promoted through programming such as a community garden, apartment style living, and classrooms. Additionally, First Place is a transit-oriented development that leverages the benefits of a supportive urban area.

Situated in Phoenix, Arizona, the proposal comprises three major components: The First Place Apartments, the First Place Transition Academy, and the First Place Leadership Institute. The apartments include a mix of 55 studio, one, two and four-bedroomed units with independent living services and amenities. The First Place Transition Academy is operated by the Southwest Autism Research & Resource Center (SARRC), where 32 residents can participate in paid internships and engage in volunteer activities each year. The First Place Leadership Institute is focused on continued education and training of support service providers, professionals, and physicians, and it also includes a hub for research and public policy advancements. The apartments are housed from the ground floor to the fourth floor, while the First Place Leadership
Institute and Transition Academy are organized around a central courtyard on the ground floor. Security is provided on the ground floor, as well, in addition to the community garden and pool.

*Figure 5: Exterior Rendering of First Place AZ (RSP Arch 2020)*

Special program areas are incorporated into circulation spaces to foster connection between residents; this design approach creates different venues and scales for social connections and builds networks that make independence possible (Denhardt 2017). Programming these circulation spaces make different types of social interactions possible, ranging from more spontaneous conversations after classes to meeting up to participate in a shared activity. These circulation spaces are emphasized externally through the use of gold metal panels, in which their symbolic importance is highlighted (see Figure 5).

A refined and repeated material palette is strategically placed throughout to increase familiarity with spaces and subtly colored visual paths and signage assist individuals in transitioning through them (ibid). Increased durability in materials is another measure applied throughout, including “acoustic baffles and inset entries for each
apartment, which limits noise transfer” (ibid). Other strategies include the use of diffused LED lighting, ample natural lighting, and operable windows (controlled access to fresh air and passive ventilation) (ibid). In terms of safety and security, a single point of entry with 24-hour concierge services is provided and individuals have different locking options available to apartments to promote greater independence. Lastly, natural materials that are chemical free or have low toxicity levels (no VOCs) were also considered when specifying paints, sealants, plastics, adhesives and carpets (ibid).

First Place AZ tests how circulation spaces in the building can encourage spontaneous conversations and interactions, and therefore improve residents’ social skills and relationships. In terms of design, the increased legibility through a repeated material palette and certain programming elements are to be explored in the current thesis project.

**Conclusion**

While these precedents vary greatly across style, location, and time, they nevertheless share design methods that have been proven to be beneficial for individuals with autism spectrum disorder (ASD). Access to natural daylight, fresh air, nature, and community are critical to the wellbeing of all, but even more so for ASD individuals with hypo- and hyper-sensitivities. Increased wayfinding and legibility, increased security measures, and a refined and repeated material palette are other methods that have been employed in these precedents and will be employed in this thesis project, as well. However, how connections between residents and the wider community can be further strengthened through the actual spatial organization and arrangement of the architecture and green spaces has not been thoroughly addressed in any of these examples. As a
result, this thesis seeks to explore a spatial sequencing and sensory zoning strategy that addresses this insufficiency directly and demonstrates the potential to strengthen these types of relationships.
CHAPTER VIII
SITE ANALYSIS: SALEM, MA

Although Massachusetts paves the way in many industries, it has lacked innovation in the realm of developing plentiful and successful housing options for individuals with autism spectrum disorder (ASD). Currently, there are 12 major residential communities for adults with ASD in the state. Most of these programs accommodate less than a dozen residents. In Massachusetts, these residential communities are clustered in Boston and scattered to the west. However, along the coast there are no options north of Boston until nearly at the New Hampshire border, or all the way southeast on Cape Cod. Six adjacent parcels of land in the city of Salem were selected as the site for this thesis due to their intermediate location between Boston and an existing ASD-focused residential community to the north, the features of Salem, and the features of the site itself.

Salem is a richly historic and vibrant city that makes a great fit for this housing type. Specifically, it is very pedestrian-friendly, and it provides residents and visitors with tons of things to do and places to work. There are also several day programs available for adults with autism spectrum disorder (ASD) and other neurodiversities in Salem and in neighboring towns, so this network already exists. Salem also has several public transportation options available, making it much easier for individuals with ASD to get around (since most do not drive or own a car). Once at Salem Station downtown, one can get on the commuter rail which connects the north and south shores of Massachusetts, passing through Boston. While there is a bus route throughout Salem, there is not a stop within a 10-minute walking distance of the site, so a new stop location...
will be proposed. There is also Salem Ferry nearby, which provides a scenic ride to Boston. These features are outlined in Figure 6 below.

Figure 6: Site Analysis Diagram

The site for this project is comprised of six parcels of land, all of which are currently vacant except for a small gravel parking lot that is owned by H&H Propeller Shop located next door (see Figure 7). In total, the lot is on the smaller side at just 2.3 acres. Features of the site include waterfront views of Collins Cove to the north and close proximity to the downtown area (while simultaneously being located on a non-busy street). Since it is relatively quiet, the issue of noise is already somewhat resolved by virtue of the location. Besides the previous public transportation options aforementioned, getting around town is made even easier with a recently paved bike and walking path that runs across the southwest edge of the site. This path connects downtown Salem up north to Salem Willows Park and to the west towards Beverly bridge.
Figure 7: View from Site from Current Parking Lot

The site includes visual and physical connection to different natural landscapes, waterfront views of Collins Cove to the north and green spaces of David J. Beattie Park to the southeast. Just east of the site are single-story low-income housing properties owned by Salem Housing Authority and to the west are a combination of residential and commercial properties, such as H&H Propeller Shop, Saint Nicholas Orthodox Church, and Ziggy’s & Sons Donuts.

The zoning for the site is currently listed as R2, meaning residential/multi-family. The current zoning allows for 35% building coverage on the site and a maximum building height of 35’, or two and a half stories. Minimum setbacks include 15’ in the front, 10’ at sides, and 30’ at the rear of the property. Variance on parking will be proposed, given the reality that many residents would not own a car or drive. Again, a parcel of the site is owned by H&H Propeller Shop located next door, otherwise the remaining parcels are owned by the City of Salem.
Over the years, the City of Salem has gone back and forth deciding what would come of the site. As a result of this irresolution, it has been enclosed with a chain link fence and has become overgrown with weeds and littered with junk (see Figure 8). It is surprising that a site with so much potential—this nexus between a calm residential area and a thriving downtown, a coastal and a green landscape—has been left in such a state for so many years. While this thesis proposes a housing development for individuals with autism spectrum disorder (ASD), it is likely that the site in actuality will provide expansion opportunities for Salem Housing Authority located next door, which is due for redevelopment (Luca 2020).
CHAPTER IX
PROGRAM ANALYSIS

After selecting the site and researching the zoning requirements for the area, the project program could then be defined. The project would test a mid-sized, community-based model for housing for adults with autism spectrum disorder (ASD). This would mean aiming to accommodate more than 16 residents as seen at the precedent of Sweetwater Spectrum Community, but not greater than the 55 units as seen at First Place AZ. The site would include not only units for housing, but also a community center for resources and clearly defined green spaces.

Housing

Early calculations for program space requirements indicated that roughly 40 residents could be accommodated on the site. After significant design development however, the final design accommodates 31. Two buildings for housing were developed: one building that includes a two- and three-bedroom apartment and another that included two four-bedroom apartments. In total, there are three of the smaller building units, and two of the larger building units. A small apartment for a caretaker is also proposed in one of the larger unit buildings. Within each apartment, each resident has a spacious bedroom and their own ADA-compliant bathroom. Each apartment also includes a separated living room and kitchen, a hallway with an escape space, and space for storage, laundry, and mechanical equipment.
The Community Center

The community center functions as a place for job-training, community engagement, recreation, and administrative services. Pathways to independence were then proposed to define the type of spaces that would be required within the community center and across the site. Besides the strong focus of horticulture, the arts, culinary, mechanical or retail, health and fitness, and administration are also proposed as alternative options for job-training and independence skill-building (see Figure 9). Once these were defined, so were the spaces in the community center, which include: a bike shop, bike repair store, café and café kitchen, gallery and reception, gallery store, maker spaces, office space for full-time and visiting staff, nurse’s office, recreation room, gym, computer lab, classroom, demonstration kitchen, therapy rooms, and a library.

Green Spaces

Gardens and outdoor rooms are also proposed to support job-training and provide therapeutic effects. Four different types of green spaces are defined: sensory gardens, therapy gardens, a farm, and bioswales. Bioswales provide not only aesthetic value to the site, but also necessary flood mitigation given the site’s waterfront location. Outdoor rooms are also proposed to function as transition spaces, or recalibration nodes, across
Program Sequencing

Given that it is important for ASD individuals to build a strong daily routine, it was also considered how different elements of the project program could be organized in a sequential order so that one can transition seamlessly through different aspects of their routine with minimal distraction. As previously discussed, by adhering to routine, an ASD individual is able to focus on building independence skills rather than being overwhelmed or distracted by unpredictable events. How the program was sequenced by following a typical daily routine is illustrated in Figure 10 below. Here we see the ASD individual's daily activities presented through types of spaces and levels of stimulus, from waking up, to taking a shower, to eating a meal, participating in community activities and gardening.

*Figure 10: Program Sequencing Diagram*
Length of Residency & Associated Programming

Programming is also considered in reference to how long a resident may live on the site. Given the project’s focus on developing independence skills, the program is developed so that residents could “graduate” from certain resources until they require them less and less until they feel ready to then move off the site and achieve full independence. The proposed length of residency is two years on an accelerated track, four years on a typical track, and a more extended track being longer than five years. Programming has a strong focus on developing life and wellness skills in the first year. Job training opportunities are provided on site and continue through the remaining years with an increasing focus on paid employment with each year. For individuals in the typical or extended program, this would mean finding employment off site and identifying a specific vocation. Basic independence-skill building would continue throughout the entire program, but would become a lesser focus with increased time.
CHAPTER X

DESIGN

Conceptual Design

The conceptual design for this thesis developed from an analysis of the term “biophilic design” itself. The term biophilic design has been previously described as having two branches: the organic and the vernacular. Essentially, the organic is referencing shapes, patterns, and colors found in natural materials, as well as access to natural light, ventilation, water and vegetation. The vernacular, on the other hand, references a connection to a particular place and this can be done either culturally, historically, or geologically. An early decision in conceptual design was to designate that the organic would inform interior details, finishes, and spatial organizations to allow in natural light and views to nature. The vernacular would then inform the exterior envelope of the buildings. Since the site is located in Salem, the vernacular would include references to the coastal nature of the site, the use of timber construction, and traditional

![Biophilic Design Diagram]

Figure 11: Conceptual Design Diagram
residential forms, such as the salt box roofline. This process of placing these terms in accordance with their architectural manifestations is illustrated in Figure 11.

**Schematic Design**

Early schematic design started with planning overall site strategies including how different elements such as the community center, units, and gardens would be connected and located (see Figure 12). A major consideration was dividing up the site

*Figure 12: Early Schematic Design Iterations*
according to its intrinsic sensory zoning. This meant distinguishing between high and low-stimulus areas (high-stimulus areas being located near traffic and where people are able to pass by and low-stimulus areas being defined by their distance away from loud and busy stimuli). When looking at Figure 13, this resulted in identifying the eastern edge of the site as low-stimulus, a side that is adjacent to single-story housing.

![Figure 13: Sensory Zoning of the Site](image)

Consequently, this was then identified as the location for the housing. Meanwhile, the high-stimulus bands near the main intersection became the location for the community center. The garden spaces became a fluid element that would surround the buildings. The farm would engage with the bike path, sensory gardens would engage along the main road to welcome visitors, therapy gardens would be located in between units for residents’ easy access, and the bioswales would be closest to the water’s edge (see Figure 14).
For the buildings, considerations as to how the buildings could relate to the vernacular of Salem was established and certain formal strategies were explored. For the community center, this meant raising the building on pilotis to optimize views of the cove and giving the sense of sailing above the water. Also, ways to make biophilic elements more porous throughout the building was explored by introducing voids (see Figure 15).
For the units, attention was paid to how these buildings could reference the New England vernacular and the characteristics of neighboring homes. Typically, in this area, this includes references to timber construction and simple rectilinear forms (see Figure 16).

*Figure 15: Schematic Section through Community Center*

*Figure 16: Schematic Exterior Perspective of an Apartment Building*
Design Development

Site planning continued to develop after the general location of major elements, such as the community center and units, were placed within their corresponding sensory zones. After differentiating the high and low-stimulus zones, the need for biophilic-focused transitions for sensory recalibration became more apparent at a site scale. Specific green rooms were identified to assist residents transitioning between sensory levels. These included bridges over the bioswales, a platform for viewing near the farm, and a grove with seating heading towards the community center (see Figure 17).

![Figure 17: Sensory Zoning of Site with Biophilic Transitions](image)

Smaller units began to take on the form of a saltbox home and the larger units began to take on the form of a contemporary farmhouse, as seen in Figure 18. Access to natural light was achieved by daylighting the hallway at both ends and introducing a lightwell into the hallway. On the first floor, light from the lightwell cascades down upon
an intimately scaled escape space with built-in seating. On the second floor, the lightwell includes frosted glass to allow diffused daylight into the hallway.

Figure 18: Design Development of Apartments

The community center began to take form organically by placing spaces in accordance to their sensory qualities and the degree at which they are either shared with the general public or they are just for residents and staff only. The ground floor became
dominated by retail and job training space, the second floor became a place for visitors and staff, and the third floor was designated for residents and staff only. The ground floor was partially raised on pilotis to combat potential flood damage, as well as optimize views of the cove by then adding a necessary third floor.

Final Design

Site

The final site plan (see Figure 19) locates the units within the low-stimulus zone previously identified, and locates the community center within the highest-stimulus zone near the main intersection to capitalize on visibility and community engagement. Staff and visitors enter the site to the north off of Szetela Lane, turning into a small parking lot outside of the café. One way vehicular access continues on the ground floor of the community center, in which there is covered staff parking before turning right towards the street exit. Residents and visitors of the farmstand enter the site from the south side off of Fort Avenue in which parking forks into two separate lots, a small one for temporary parking for the farmstand and a larger one for residents. A service road continues from the resident parking lot and creates a main passageway for residents to access their apartments, in which there are five buidlings grouped together in a regular and predictable fashion. Along the bike path, visitors on foot or on bike are first greeted with a sensory garden, then the communal farm, and then the farmstand for the sale of vegetables. A bike rest area is located outside of the bike retail store, providing a place of rest.
When addressing the site, it was also important to define the characteristics of the different types of green spaces. Transitional nodes are then included to recalibrate the senses moving between zones, such as bioswale bridges, a grove with seating, and a platform for viewing. However, major garden spaces such as the farm, sensory gardens, therapy gardens, and bioswales are described with greater specificity through manual and digital collage.
Figure 20: Farm Drawing

Figure 20 illustrates the character of the communal farm, which is centrally located on the site and receives optimal amounts of sun. The farm is intended for vegetable production with plants that can easily be grown in this climate. Carrots, cucumber, kale, squash, and tomatoes are some vegetables suggested. The farm would be partitioned off for safety and pest control and would include wood, raised garden beds.
Figure 21 represents what the sensory garden on the main corner where Szetela Lane meets the bike path would feel like. This garden is intended for users seeking sensory stimulation through vivid colors and varieties of textures and scents. This is an active space where residents come into direct contact with the surrounding community. The inclusion of native, pollinator-friendly plants like butterfly bush further elevates the stimulus level for this garden space. Multiple places for seating are included, some more hidden behind lush bushes and shrubs in the case that an escape space is needed. Granite planters help distinguish more formal spaces like the square shown, to less formal spaces like the meandering path, and provide a buffer to the street condition. Sculptural artwork is also suggested and provides a preview to the gallery space adjacent to this space on the second floor of the community center.
Figure 22: Therapy Garden Drawing

Figure 22 shows the character of a typical therapy garden, a space which is intended to be intimate in scale and provide a place of rest and retreat. These gardens are located within pockets between the apartments, giving them more privacy away from the general public and providing better access to residents who want to occupy them. The therapy gardens are a calming place that are gently sheltered to give a sense of enclosure. Additionally, they provide different seating options to suit one’s own comfort level and they include shade plants given the location’s low levels of sunlight. Seating that can gently rock or move and plants such as lavender are recommended.
The last garden or green space defined was the bioswale as depicted in Figure 23. As previously stated, the bioswale is primarily intended to provide flood mitigation given the site’s unfortunate and potential susceptibility to flooding. However, the bioswale adds a lush texture and aesthetic value to the site, as well. The addition of bridges over the bioswale provides intentional places of transition in which users can preview other spaces or retreat out of the main means of circulation. Bioswales would include sun and shade plants.
Figure 24: Two-Bedroom Apartment Plan, First Floor

Figure 24 shows a typical plan for a two-bedroom apartment, which is located on the first floor of the building. Residents enter the building off of the front porch. Residents living in the two-bedroom apartment enter their apartment to the left, whereas an open passageway to the shared recreation room is on the right. The recreation room is intended to promote socialization outside of the unit with the inclusion of a game table and media center to watch movies and play video games.
Figure 25: Three-Bedroom Apartment Plan, Second Floor

Main design strategies within the apartments included placing bedrooms away from high sensory areas like the kitchen and living room, using closets and storage as acoustic buffers, and compartmentalizing the kitchen and living space, defining each by their functional qualities. Escape spaces are provided within each bedroom in the form of a nook with a window with a view to nature (see Figure 31). On the first floor, an escape space is provided in the hallway which receives natural light from a lightwell above. On the second floor, the escape space becomes a balcony (see Figure 25) and the lightwell provides diffused light through frosted glass.
Figure 26: Four-Bedroom Apartment, First Floor

All plans attempt to organize spaces in accordance with routine so that one could flow seamlessly from space to space, leaving and returning for the day’s activities. Additionally, ample storage is provided within bedrooms and certain common areas to reduce clutter. Inclusion of some built-in furniture helps reduce the ambiguity of the function of some spaces. All of the above strategies are also applied to the four-bedroom unit plans as seen in Figure 26 and 27.
Figure 27: Four-Bedroom Apartment Plan, Second Floor

Figure 28 illustrates a section through a two- and three-bedroom apartment, emphasizing the changes in escape spaces between units. On the first floor, the escape space is intimate and is provided built-in seating. A sloped ceiling helps reduce the scale of this space as the lightwell is extruded through the roof, revealing its symbolic importance to the project.
Figure 28: Section through Two- and Three-Bedroom Apartments

Figure 29: Front and Rear Elevations of the Apartments
Figure 29 shows the front and rear elevations for all apartment buildings. These reveal the use of vertical wood cladding and the traditional saltbox form, thereby referencing the vernacular. A main strategy was to use alternating variations of wood cladding in order to break down the overall massing into smaller, individualized forms. Curtainwalls are given more privacy with strategic landscaping.

Figure 30 shows an exterior rendering of the apartments as if following the wide path that divides the units. This rendering reveals that buildings be painted in commonly and locally used paint colors, which also gives residents a sense of identity within their own smaller communities. A therapy garden is also reflected in this rendering.

*Figure 30: Exterior Rendering of Apartments*
The Community Center

For the community center, the program is divided up so that only retail was located on the ground floor, this includes the bike shop, bike repair, café, and café kitchen. A covered bioswale is also on this level, which can provide a space for calm if work becomes overstimulating or overwhelming (see Figure 32).
Figure 32: Community Center Ground Floor Plan

Figure 33: Community Center Second Floor Plan
The second floor (see Figure 33) is divided between more public spaces like the gallery and reception area and then staff and resident services. Escape spaces are provided at the ends of hallways and the lower deck space provides both refuge and sensory recalibration for residents moving between zones. Interior spaces are daylit from voids, one being the lower deck space, another being a lightwell outside the nurse’s office over a waiting area, and another being centrally located in the gallery space in which a small tree ascends up through the entire building.

Similar strategies were also used on the third floor (see Figure 34), which is a floor intended for residents and staff only. This floor includes spaces for recreation, job-training, therapy, socialization, and skill-development. Higher sensory spaces like the gym are separated from low-stimulus zones like the therapy rooms and library. Upper deck spaces provide access to nature and aid in the transitioning between sensory zones.
Figure 35 illustrates how these voids are represented in section, cutting through the building at different levels, and allowing in different organic, biophilic elements. These voids allow access to natural views, light, and ventilation, and thereby connect the user to nature. Elevations and renderings on the following pages reveal the return of phenolic wood paneling on certain masses, meanwhile neutral and subtly colored terracotta tiles comprise the remainder of the exterior envelope. Additionally, wood louvers on the south elevation help control the amount of daylight through the curtainwalls, thereby reducing potential for glare.
Figure 36: Community Center North and South Elevations
Figure 37: Community Center East and West Elevations
Figure 38: Rendering of Gallery Space

Figure 39: Community Center Exterior Rendering 1
Figure 40: Community Center Exterior Rendering 2

Figure 41: Site Axonometric
Figure 42: Project within Site Context
CHAPTER XI

CONCLUSION & REFLECTION

The research and design of this thesis has aimed at creating a community tailored to individuals with autism spectrum disorder (ASD). Through its programming, spatial organizations, and focus on biophilic design, this project aims to promote independence for its residents, alleviate their co-morbid symptoms, and enhance connections within their families and then the larger community. By addressing the organic and vernacular features of Salem, MA and connecting residents with nature at multiple scales, the project is able to fit within its context, promote crucial skill-building, and support residents within an autism-aware environment.

After a final review of this thesis project, there were several limitations encountered. For one, methods such as introducing voids and lightwells may not give the desired effect in actuality given the scale of the buildings, meaning that the desired effect of natural light would be better suited at larger scales. This becomes potentially troublesome at moments such as the lightwell and escape spaces within the units. Another iteration may suggest how to adjust the scale of such spaces and how additional light could be brought in from different perspectives (not just from above). Additionally, there was concern for how the units more central to the site do not have a clear front or rear side. Through design, this clarity was resolved through the addition of privacy windows that turn the view to the side of the building instead of directly out of the bedroom into the backyard space. Privacy was also given through placing rows of trees dividing the units from more public areas of the site. However, another iteration in organization and
design could consider how else there could be a clearer sense division between public outdoor space and the backyard of more central units.

Despite these limitations in design, this thesis still proposes viable and easy to employ strategies for designers creating an autism-aware project. These can include: using storage spaces as acoustic buffers, using voids as generators of natural light, using sensory zoning and program sequencing as central organizational strategies, and referencing the vernacular of the site. By doing so, designers can begin to consider the sensory needs of a more diverse range of occupants and connect users to nature, therefore alleviating behavioral comorbidities. Additionally, by carefully considering program elements that relate to the site and can also provide job training, designers are building in the ability for residents to develop independence and social skills. It is the designer’s responsibility to not only consider how the project can alleviate residents’ symptoms of the time, but also how the project’s organization and programming can promote independent futures.
APPENDICES

SURVEY RESPONSES

Participant: Parent 1

**Question 1:** What housing type do you believe is best for adults with ASD?
(ranking townhouses (1-2 residents per townhouse), group living (2+ residents sharing common spaces), single-family (detached house), apartment style (studio or 1 bedroom))

**Response 1:**

1. townhouses
2. group living
3. single-family
4. apartment style

**Question 2:** Do you believe individuals with ASD would benefit from having roommates? Why or why not?

**Response 2:** The people with ASD benefits with multiple roommates because they need socialization as much as possible.

**Question 3:** Do you believe an on-site caretaker/nurse would be necessary in the case of group housing for ASD individuals?

**Response 3:** Yes, it would be necessary.

**Question 4:** What sort of spaces do individuals with ASD generally seem to prefer? (options: open, closed-off or enclosed, naturally daylit, bright, dark or shaded, large, small)

**Response 4:** closed-off or enclosed, naturally daylit, small
**Question 5:** What resources and/or programming would likely help adult ASD individuals feel more connected to their community (especially for young adults leaving home for the first time)?

**Response 5:** Structured social gatherings, organized therapies, such as music, art, pet, etc..

**Question 6:** Do you believe that independent individuals with ASD would be likely to visit a community center dedicated to helping them connect to their community? Why or why not? If so, what would type of programming would be the most helpful?

**Response 6:** I think independent ASD individuals need help to navigate and introduce them to social situations. Once they are comfortable, they would need less help.

**Question 7:** What aspect(s) of the built environment seem(s) to be the most burdensome for individuals with ASD? (options: loud spaces, transitional spaces (ex. hallways), stairs or steps, common or public spaces, bright or intrusive lighting, reflective surfaces)

**Response 7:** loud spaces, bright or intrusive lighting

**Question 8:** There has been some research suggesting that practicing mindfulness may benefit adults with ASD, as well as their families. Do you think providing a space for such practice would be beneficial? Why or why not?

**Response 8:** This would be beneficial because they like quiet, meditative spaces.

**Question 9:** What type of outdoor/green spaces would likely be used by individuals with ASD? (options: park-like spaces, walking paths, gardens, private backyard, other (ex. beaches, lakes, etc.))

**Response 9:** park-like spaces, gardens
Question 10: What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD? What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD?

Response 10: I think the best living situation would be living in a group home of 10-12 individuals. All having their own room but have common areas (Kitchen, living room) into which they can socialize with others.

Question 11: If you have worked or are currently working directly with an organization that provides services to adults with ASD, what have you found to be the most successful part your work/project? What have you found to be the most difficult?

Response 11: Most difficult is that one size doesn’t fit all. All ASD individuals are completely different and have different needs. It’s best to find the common needs and focus on those. Then individually address the needs of the person.

Question 12: Is there anything that this study has not asked that you feel is important to consider in designing housing for adults with ASD?

Response 12: I think that the group home may need a nurse on occasion for meds and medical needs but having a caretaker 24/7 would be beneficial for the rest of the needs.
Participant: Parent 2

**Question 1:** What housing type do you believe is best for adults with ASD? (ranking townhouses (1-2 residents per townhouse), group living (2+ residents sharing common spaces), single-family (detached house), apartment style (studio or 1 bedroom))

**Response 1:**

1. group living
2. townhouses
3. apartment style
4. single-family

**Question 2:** Do you believe individuals with ASD would benefit from having roommates? Why or why not?

**Response 2:** Yes, but carefully matched based on each individual's specific interests, challenges, physical/emotional capacities, familiarity, mobility, social/emotional abilities. Every ASD adult has different abilities and challenges, temperaments and coping skills, aligning personalities, strengths and weaknesses may ensure more independence for each roommate.

**Question 3:** Do you believe an on-site caretaker/nurse would be necessary in the case of group housing for ASD individuals?

**Response 3:** It may be necessary.

**Question 4:** What sort of spaces do individuals with ASD generally seem to prefer? (options: open, closed-off or enclosed, naturally daylit, bright, dark or shaded, large, small)

**Response 4:** closed-off or enclosed, naturally daylit, dark or shaded
Question 5: What resources and/or programming would likely help adult ASD individuals feel more connected to their community (especially for young adults leaving home for the first time)?

Response 5: Both a strong social support systems and technology-enabled support systems encourage regular communication and interaction with family, friends, coworkers and medical professionals. A community center where ASD young adults are encouraged to meet and share ideas, resources, develop relationships with both typical and atypical young adults would be of value.

Question 6: Do you believe that independent individuals with ASD would be likely to visit a community center dedicated to helping them connect to their community? Why or why not? If so, what would type of programming would be the most helpful?

Response 6: I think so but I've not seen such a center as yet. Depending on the person's level of ASD (high functioning vs low functioning) there may be a sense of feeling too obvious (I know I'm autistic but I don't want other people to know I am) or in the case of a low functioning ASD adult, a greater sense of comfort knowing they have a community of friends/specialists nearby to support them.

Question 7: What aspect(s) of the built environment seem(s) to be the most burdensome for individuals with ASD? (options: loud spaces, transitional spaces (ex. hallways), stairs or steps, common or public spaces, bright or intrusive lighting, reflective surfaces)

Response 7: loud spaces, common or public spaces, bright or intrusive lighting
**Question 8:** There has been some research suggesting that practicing mindfulness may benefit adults with ASD, as well as their families. Do you think providing a space for such practice would be beneficial? Why or why not?

**Response 8:** I'm attending the Mindfulness Coaching School, so I'm a bit biased...big yes for me, mindfulness is adaptable for everyone.

**Question 9:** What type of outdoor/green spaces would likely be used by individuals with ASD? (options: park-like spaces, walking paths, gardens, private backyard, other (ex. beaches, lakes, etc.))

**Response 9:** walking paths, gardens, other (ex. beaches, lakes, etc.)

**Question 10:** What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD? What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD?

**Response 10:** Simple to use appliances, clean/clear light spaces, moveable walls to create private environments if desired, labeled drawers, shelves, and voice-driven technology (Alexa?) for on-demand control of HVAC, lighting, security, reminders, shopping lists, etc. Non-slip surfaces on stairs and floors, no knobs on drawers, pulls are better, auto-off appliances, reverse osmosis water filtration system, pressure/temp controlled plumbing, emergency call system w/ voice activation, pet-friendly.

**Question 11:** If you have worked or are currently working directly with an organization that provides services to adults with ASD, what have you found to be the most successful part your work/project? What have you found to be the most difficult?
Response 11: I am not currently working directly with an organization providing services to adults with ASD.

Question 12: Is there anything that this study has not asked that you feel is important to consider in designing housing for adults with ASD?

Response 12: While this is design-centric, construction materials are an important consideration. Otherwise, I think all the questions were relevant and thoughtful.
Participant: Parent 3

**Question 1:** What housing type do you believe is best for adults with ASD? (ranking townhouses (1-2 residents per townhouse), group living (2+ residents sharing common spaces), single-family (detached house), apartment style (studio or 1 bedroom))

**Response 1:**

1. townhouses
2. group living
3. single-family
4. apartment style

**Question 2:** Do you believe individuals with ASD would benefit from having roommates? Why or why not?

**Response 2:** I believe it would be beneficial for autistic individuals to have roommates when they first venture out into independent living, especially if it is a friend or someone they have a personal relationship with. This gives both of them a level of accountability toward the other; a "check-in" person. Having a friend to help and to help you navigate through the unknowns of adult life is always a benefit. Plus, a roommate requires interaction which teaches one how to socialize, negotiate and compromise; important skills to acquire.

**Question 3:** Do you believe an on-site caretaker/nurse would be necessary in the case of group housing for ASD individuals?

**Response 3:** It may be necessary.
Question 4: What sort of spaces do individuals with ASD generally seem to prefer? (options: open, closed-off or enclosed, naturally daylit, bright, dark or shaded, large, small)

Response 4: closed-off or enclosed, dark or shaded, small

Question 5: What resources and/or programming would likely help adult ASD individuals feel more connected to their community (especially for young adults leaving home for the first time)?

Response 5: A local facility that coordinates meetings and outings with other adult ASD individuals (like The Arc or a Collaborative) would be a great resource to help connect the group with each other and their surroundings. Joining an activity within the local community, i.e., walking group, bowling league, a cooking class would also help these individuals feel involved in the town in which they live.

Question 6: Do you believe that independent individuals with ASD would be likely to visit a community center dedicated to helping them connect to their community? Why or why not? If so, what would type of programming would be the most helpful?

Response 6: Though many adults with ASD may find it hard to take the initiative to try something new, I do believe with some coaching from their loved ones and/or friends, most desire socialization. If there is a community center that helps with that, I think they would be more likely to check it out.

Question 7: What aspect(s) of the built environment seem(s) to be the most burdensome for individuals with ASD? (options: loud spaces, transitional spaces (ex. hallways), stairs or steps, common or public spaces, bright or intrusive lighting, reflective surfaces)
**Response 7:** loud spaces, transitional spaces (ex. hallways), bright or intrusive lighting

**Question 8:** There has been some research suggesting that practicing mindfulness may benefit adults with ASD, as well as their families. Do you think providing a space for such practice would be beneficial? Why or why not?

**Response 8:** I do agree that practicing mindfulness is imperative for anyone on the Spectrum to alleviate the overstimulation that is often present in their daily lives, yet I am not sure if ASD adults would feel comfortable engaging in these activities in the presence of others.

**Question 9:** What type of outdoor/green spaces would likely be used by individuals with ASD? (options: park-like spaces, walking paths, gardens, private backyard, other (ex. beaches, lakes, etc.))

**Response 9:** walking paths, private backyard

**Question 10:** What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD? What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD?

**Response 10:** Organization. In my experience, I have found that ASD individuals need to have a sense of knowing where things are and where they go. They feel more in control of their environment when there is order. Also, their sanctuary is a space where their individual interests are displayed in their surroundings. They seem to find comfort in that familiarity of the thing(s) they love.
**Question 11:** If you have worked or are currently working directly with an organization that provides services to adults with ASD, what have you found to be the most successful part your work/project? What have you found to be the most difficult?

**Response 11:** (no response)

**Question 12:** Is there anything that this study has not asked that you feel is important to consider in designing housing for adults with ASD?

**Response 12:** (no response)
**Participant: Parent/author**

**Question 1:** What housing type do you believe is best for adults with ASD? (ranking townhouses (1-2 residents per townhouse), group living (2+ residents sharing common spaces), single-family (detached house), apartment style (studio or 1 bedroom))

**Response 1:**
1. townhouses
2. group living
3. single-family
4. apartment style

**Question 2:** Do you believe individuals with ASD would benefit from having roommates? Why or why not?

**Response 2:** Yes--most of the young adults with ASD who I know are very social and long the sort of casual interactions that can happen living together.

**Question 3:** Do you believe an on-site caretaker/nurse would be necessary in the case of group housing for ASD individuals?

**Response 3:** No, it would not be necessary.

**Question 4:** What sort of spaces do individuals with ASD generally seem to prefer? (options: open, closed-off or enclosed, naturally daylit, bright, dark or shaded, large, small)

**Response 4:** naturally daylit

**Question 5:** What resources and/or programming would likely help adult ASD individuals feel more connected to their community (especially for young adults leaving home for the first time)?
Response 5: I have visited very appealing group settings (clustered apartment complexes) in Florida designed for adults with IDD. There were activities daily (often led by volunteers from the community and the atmosphere was inclusive and fun and drew outsiders into the community (Arc of Jacksonville and Noah's Ark are two examples.) Other examples of innovative housing for people with ASD is First Place in AZ, and Sweetwater Spectrum in CA.

Question 6: Do you believe that independent individuals with ASD would be likely to visit a community center dedicated to helping them connect to their community? Why or why not? If so, what would type of programming would be the most helpful?

Response 6: I've seen these community centers work beautifully! In our area ICC (Inclusive Community Center which houses Whole Children and Milestones is a great example. Lots of college volunteers, retirees who teach classes, etc.)

Question 7: What aspect(s) of the built environment seem(s) to be the most burdensome for individuals with ASD? (options: loud spaces, transitional spaces (ex. hallways), stairs or steps, common or public spaces, bright or intrusive lighting, reflective surfaces)

Response 7: loud spaces

Question 8: There has been some research suggesting that practicing mindfulness may benefit adults with ASD, as well as their families. Do you think providing a space for such practice would be beneficial? Why or why not?

Response 8: My guess is that this varies a lot from one individual to the next. In designing spaces, I would say having MULTI-PURPOSE shared space is the way to go. It might hold a yoga class one hour, a gaming group another night, a pizza party the next.
**Question 9:** What type of outdoor/green spaces would likely be used by individuals with ASD? (options: park-like spaces, walking paths, gardens, private backyard, other (ex. beaches, lakes, etc.))

**Response 9:** walking paths

**Question 10:** What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD? What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD?

**Response 10:** Private spaces for individuals seems as important as shared "community space" that doesn't get too, too loud or busy. Both seem to hold the secret for balanced opportunities to socialize and also re-group.

**Question 11:** If you have worked or are currently working directly with an organization that provides services to adults with ASD, what have you found to be the most successful part your work/project? What have you found to be the most difficult?

**Response 11:** My son benefits enormously from Prospect Meadow Farm, BHMA, and recreation classes at Milestones (esp. Theater and Joyful Chorus). They all offer something different and greatly enrich his life.

**Question 12:** Is there anything that this study has not asked that you feel is important to consider in designing housing for adults with ASD?

**Response 12:** If you don't already know about Desiree Kameka and Madison Housing Project (which maintains a listing of all housing projects for people with ASD that already exist or are under construction) you should really check it out. She's also very approachable for interviewing and no one in the country knows more about this field than she does (I've spoken with her extensively about financing and organizing parents
for developing residential options, but she could also talk about the places with the most innovative design projects going.) As far as designing specialized spaces, I know First Place in Phoenix has an interesting video about the architects who designed their autism-friendly spaces. Chapel Haven in New Haven CT is just completing a huge project specifically for the aging population with IDD that I visited and their design was very cool—private apartments but more shared spaces—like a kitchen on every floor, and TV lounge—than most assisted living places.
Participant: Architect

**Question 1:** What housing type do you believe is best for adults with ASD?
(ranking townhouses (1-2 residents per townhouse), group living (2+ residents sharing common spaces), single-family (detached house), apartment style (studio or 1 bedroom))

**Response 1:**
1. townhouses
2. group living
3. single-family
4. apartment style

**Question 2:** Do you believe individuals with ASD would benefit from having roommates? Why or why not?

**Response 2:** Depending on their place on the spectrum, many residents might benefit from the socialization afforded by a roommate; however, in more severe situations, the privacy and ability to move away from over stimulating situations may suggest single room bedroom occupancy. Within a group home setting, privacy within the bedroom can be augmented with social interaction within the common spaces

**Question 3:** Do you believe an on-site caretaker/nurse would be necessary in the case of group housing for ASD individuals?

**Response 3:** It may be necessary.

**Question 4:** What sort of spaces do individuals with ASD generally seem to prefer? (options: open, closed-off or enclosed, naturally daylit, bright, dark or shaded, large, small)

**Response 4:** closed-off or enclosed, naturally daylit, small
Question 5: What resources and/or programming would likely help adult ASD individuals feel more connected to their community (especially for young adults leaving home for the first time)?

Response 5: (no response)

Question 6: Do you believe that independent individuals with ASD would be likely to visit a community center dedicated to helping them connect to their community? Why or why not? If so, what would type of programming would be the most helpful?

Response 6: I believe this would be a beneficial experience for active social and recreational activities that could occur outside of the residents' home. At Cape Cod Village, we incorporated a separate community resource center for the residents, families, the community at large and special programming to help raise awareness of the varying degrees of autism.

Question 7: What aspect(s) of the built environment seem(s) to be the most burdensome for individuals with ASD? (options: loud spaces, transitional spaces (ex. hallways), stairs or steps, common or public spaces, bright or intrusive lighting, reflective surfaces)

Response 7: loud spaces, common or public spaces, bright or intrusive lighting, reflective surfaces

Question 8: There has been some research suggesting that practicing mindfulness may benefit adults with ASD, as well as their families. Do you think providing a space for such practice would be beneficial? Why or why not?
**Response 8:** Yes- this type of space could have multiple functions. It could serve as a quiet, meditative type space but could also be used to aid with calming during an acting-out scenario.

**Question 9:** What type of outdoor/green spaces would likely be used by individuals with ASD? (options: park-like spaces, walking paths, gardens, private backyard, other (ex. beaches, lakes, etc.))

**Response 9:** walking paths, gardens, other (ex. beaches, lakes, etc.)

**Question 10:** What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD? What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD?

**Response 10:** Creating contained quiet spaces with simple materials, natural and simple artificial lighting and furniture and reducing opportunities for negative sensory reactions. Giving residents choices to engage within a space or time to stand back, size up the situation and then engage (ie. transition spaces are good). Also providing small pocket spaces for individual or small group activities is a good design technique.

**Question 11:** If you have worked or are currently working directly with an organization that provides services to adults with ASD, what have you found to be the most successful part your work/project? What have you found to be the most difficult?

**Response 11:** As the architects for a recently completed new model for congregate living among autistic adults, we have had to make many assumptions on the resident profile ranging from moderate to severe on the spectrum so gauging individual resident needs is difficult. We worked very closely with the daily service provider and
tried to learn what has worked well and not so well at other group homes. We intend to
do a "Lesson Learned" next spring after the one year occupancy period is reached.

**Question 12:** Is there anything that this study has not asked that you feel is
important to consider in designing housing for adults with ASD?

**Response 12:** We read and constantly referred to the book "At Home with
Autism" by Kim Steele and Sherry Ahrentzen. If you haven't yet read this book, it is an
excellent source of information about autism in general and designing residential settings
for this special population
Participant: Social worker

Question 1: What housing type do you believe is best for adults with ASD? (ranking townhouses (1-2 residents per townhouse), group living (2+ residents sharing common spaces), single-family (detached house), apartment style (studio or 1 bedroom))

Response 1:

1. townhouses
2. group living
3. single-family
4. apartment style

Question 2: Do you believe individuals with ASD would benefit from having roommates? Why or why not?

Response 2: It depends on the individual’s preference and personality. People with ASD are as varied in personality as those without it. Some people would prefer having roommates while some would not. Some can live independently with minimal support while others need 1:1 support at all times. It’s really a matter of personality, preference and skill level. I couldn’t pick one living environment in the previous question because any or all would be best depending on the person.

Question 3: Do you believe an on-site caretaker/nurse would be necessary in the case of group housing for ASD individuals?

Response 3: It may be necessary.

Question 4: What sort of spaces do individuals with ASD generally seem to prefer? (options: open, closed-off or enclosed, naturally daylit, bright, dark or shaded, large, small)
Response 4: open, closed-off or enclosed, naturally daylit, bright, dark or shaded, large, small

Question 5: What resources and/or programming would likely help adult ASD individuals feel more connected to their community (especially for young adults leaving home for the first time)?

Response 5: Access to the community and to local services like libraries, the Y or gym, parks, etc would be helpful. Programming to help develop living and coping skills like cooking, financial management, housekeeping, self care, etc would provide the support young adults need to feel confident and grow into the people they’re meant to be. I feel that access to a garden and gardening is also beneficial In so many ways! 😊

Question 6: Do you believe that independent individuals with ASD would be likely to visit a community center dedicated to helping them connect to their community? Why or why not? If so, what would type of programming would be the most helpful?

Response 6: Yes, many people would probably enjoy this.. it would be wonderful for the center to be designed to serve people without ASD too, to broaden the experience and promote full integration into the community.

Question 7: What aspect(s) of the built environment seem(s) to be the most burdensome for individuals with ASD? (options: loud spaces, transitional spaces (ex. hallways), stairs or steps, common or public spaces, bright or intrusive lighting, reflective surfaces)

Response 7: loud spaces, transitional spaces (ex. hallways), bright or intrusive lighting
Question 8: There has been some research suggesting that practicing mindfulness may benefit adults with ASD, as well as their families. Do you think providing a space for such practice would be beneficial? Why or why not?

Response 8: Yes, definitely! I feel that a space dedicating to the practice of mindfulness and relaxation would increase the residence’s focus on assisting and encouraging individuals to develop their skills and coping options.

Question 9: What type of outdoor/green spaces would likely be used by individuals with ASD? (options: park-like spaces, walking paths, gardens, private backyard, other (ex. beaches, lakes, etc.))

Response 9: walking paths, gardens, private backyard

Question 10: What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD? What do you believe is the most critical element in creating a home and sanctuary for individuals with ASD?

Response 10: I feel that offering options is very important. A variety of living spaces that meet a range of preferences and can be easily personalized to be comfortable for the persons living in or sharing the space would create a therapeutic environment where people could change and grow in comfort.

Question 11: If you have worked or are currently working directly with an organization that provides services to adults with ASD, what have you found to be the most successful part your work/project? What have you found to be the most difficult?

Response 11: I think the most successful-enjoyable part of working with adults with ASD is watching them develop skills and confidence to reach beyond the potential that they and their supporters expected. I believe that this happens when individuals are
met “where they are” treated with dignity and respect. The biggest challenge is conveying this idea to other people who are supporting them.

**Question 12:** Is there anything that this study has not asked that you feel is important to consider in designing housing for adults with ASD?

**Response 12:** I would consider studying the effects that specific finishes, surface and colors have on people would be important. As I mentioned above, I’ve seen the benefits of gardening and experiencing the outdoors countless times.
HOUSING FOR ADULTS WITH AUTISM SPECTRUM DISORDER (ASD):
Creating an Integrated Living Community in Salem, MA

By Tara Pearce

Why It Matters:

• ASD is steadily increasing in prevalence
• There are insufficient housing options available for individuals with ASD
• There is insufficient government funding for housing for individuals with ASD
• Problem of aging parents

Thesis Objective:

Design a community that promotes independence, alleviates co-morbid symptoms, and enhances connections within families and the community at large
WHAT IS AUTISM SPECTRUM DISORDER (ASD)?

Autism spectrum disorder (ASD) refers to a broad range of conditions characterized by challenges with social skills, repetitive behaviors, speech and nonverbal communication.

**SYMPTOMS**
- **Impairments in Social Interaction:** Difficulty understanding others, seeking attention, and shaping behaviors around social situations.
- **Impairments in Communication:** Difficulty with verbal and nonverbal communication, including language processing.
- **Impairments in Imagination:** Resistance to change, difficulty in social gaming, and reduced skills in understanding social contexts.
- **Sensory Dysfunction:** Difficulty in managing sensory processing, affecting learning and behavior.
- **Safety Behavior:** Unpredictable or dangerous behaviors, often involving physical elements and aggression.

**STRATEGIES**
- **Social Skills:** Teach social skills, develop strategies for communication and interaction.
- **Sensory Strategies:** Use sensory tools, manage sensory processing, and create a safe environment.
- **Behavioral Management:** Implement behavior modification strategies, use positive reinforcement, and address triggers.
- **Environmental Modifications:** Create a structured environment, reduce sensory overload, and enhance learning opportunities.

**BIOMARKERS**
- Use biomarkers to identify early signs of ASD, including genetic markers.
- Conduct comprehensive assessments to identify specific needs and develop personalized interventions.

**RESEARCHED DESIGN STRATEGIES**

*Further details on research strategies and interventions can be found in the associated literature and resources.*
RESEARCHED DESIGN STRATEGIES

Dr. Magda Mostafa’s Autism
ASPECTSS™ Design Index:

Acoustics: minimize background noise, echo and reverberation
Spatial Sequencing: organize areas in accordance with user routine
Escape Spaces: provide respite from over-stimulation
Compartmentalization: create compartments with clearly defined functions
Transitions: recalibrate user senses from one stimulus level to another
Sensory Zoning: organize areas according to sensory quality
Safety: ex. avoid sharp corners and increase overall security

*Biophilia: connect user to site-responsive natural elements

PRECEDECE NTS

Sweetwater Spectrum Community
Sonoma, CA
ARCHITECTS: Leedy Mayrum Stacy Architects
YEAR: 2013
RELEVANCE:
- Programming (urban farm, community kitchen, exercise/activity spaces)
- Close to public transit and bicycle trails
- Promotes engagement with the neighborhood and community through volunteer activities and outreach projects
- Draws on evidence-based design guidelines (ex. legibility, predictability, sense spaces)

First Place Apartments
Phoenix, AZ
ARCHITECTS: RSP Architects
YEAR: 2015
RELEVANCE:
- Special program areas are carved into the circulation spaces to create connection
- Programming (community garden, apartments, and classrooms are included to promote independence)
- It is a tenant-oriented development that leverages the benefits of a supportive urban area
THE SITE: SALEM, MA

Features:
- Waterfront views of Collins Cove
- Non-busy street located close to downtown Salem (5-10 min. walk)
- Relatively quiet location
- Multiple public transportation options are available (bus, train, ferry)
- Adjacent to bike and walking paths, parks, and the harbor/Collins Cove
- Day programs for adults with ASD are easily accessible from the site

PROGRAM ANALYSIS

Program sequencing diagram

<table>
<thead>
<tr>
<th>Space</th>
<th>Square Feet (sf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Apartments (1012 Bedroom)</td>
<td>30,000</td>
</tr>
<tr>
<td>Development Apartment</td>
<td>800</td>
</tr>
<tr>
<td>Nurse's Office</td>
<td>600</td>
</tr>
<tr>
<td>Community Center</td>
<td>5,000</td>
</tr>
<tr>
<td>Gallery, Lobby, &amp; Recreation</td>
<td>1,000</td>
</tr>
<tr>
<td>Cafe + Kitchen</td>
<td>1,000</td>
</tr>
<tr>
<td>Executive Director's Office</td>
<td>150</td>
</tr>
<tr>
<td>Development Manager's Office</td>
<td>150</td>
</tr>
<tr>
<td>Maintenance Manager's Office</td>
<td>150</td>
</tr>
<tr>
<td>Community Programming Office</td>
<td>150</td>
</tr>
<tr>
<td>Front office space (sf)</td>
<td>800</td>
</tr>
<tr>
<td>Farmstand</td>
<td>800</td>
</tr>
<tr>
<td>Retail</td>
<td>40,700 – Construction &amp; Building Systems</td>
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<table>
<thead>
<tr>
<th>Unit Type</th>
<th># Units</th>
<th># Residents</th>
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<tbody>
<tr>
<td>4 Bedroom</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>3 Bedroom</td>
<td>4</td>
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<td>2 Bedroom</td>
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<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>104</td>
</tr>
</tbody>
</table>

52,000 sf - 10,000 sf = 42,000 sf * 120% = 50,400 sf (floor space) + 15,000 sf (public space) = 65,400 sf

41,300 sf - 8,000 sf = 33,300 sf (per person) + 40 residents = 1,330 sf (per resident)
PROGRAM ANALYSIS

Pathways to independence diagram

CONCEPTUAL DESIGN

Biophilic Design

Organic

Includes forms, shapes, colors, textures, and patterns found in natural materials. Also includes natural lighting and ventilation and the presence of water and vegetation.

Vernacular

Connection to a particular place, either culturally, historically, or ecologically. Incorporates geological and landscape features, local building materials, and historic and cultural traditions.

Interior Details

Exxamples: Visual connection to water and garden, imagery of local flora and fauna, lots of vegetation and natural light, etc.

Exterior Form and Materials

Reference to Salem's coast, use of brick and timber construction
GARDEN TYPE: FARM

Characteristics:
Wood, raised beds
Vegetables (carrots, cucumber, kale, squash, tomato, etc.)

GARDEN TYPE: SENSORY

Characteristics:
Vivid colors
Variety of scents
Variety of textures
Pollinator-friendly, native plants
GARDEN TYPE: THERAPY

Characteristics:
- Calming place of rest and retreat
- Sheltered
- Shade plants

GARDEN TYPE: BIOSWALE

Characteristics:
- Flood control
- Bridge for viewing
- Mix of sun and shade plants
APARTMENTS: 2 BEDROOM

Spaces are organized in accordance with routine. One can proceed from their room to rest, to their bathroom to rejuvenate, to the kitchen to nourish, and finally through the front door to then participate in the community’s programs.

Lower sensory rooms, like bedrooms, are grouped together and then separated from higher sensory rooms, such as the kitchen and living room.

Each resident has an ADA-compliant bathroom. Slip-resistant tile floors, hot water safety fillings, and wall-hung toilets are recommended.

Closets and storage spaces act as acoustic buffers.

Recommendation: Insulate walls and floors with soundproofing material (ex. spray foam)

Built-in furniture and storage make the use of space clear and reduce clutter contributing to sensory overload.

Built-in furniture by windows creates individualized places of escape.

Important views look onto natural elements.

Natural materials such as neutral-toned wood floors are used throughout.

Dining and living spaces are clearly separated from each other.

Escape space in hallway is lit from lightwell above and the hallway receives natural light through a curtain wall.

Wider, central hallway allows flexibility when moving from one space to another.

Intimately-scale escape space in the hallway provides a space to retreat and recalibrate in the case of overstimulation.

Recreation room has clearly defined function by including a game table and built-in media center.

Wider hallways and generous spatial standards allow for safer, more comfortable movement.

APARTMENTS: 3 BEDROOM

Spaces are organized in accordance with routine. One can proceed from their room to rest, to their bathroom to rejuvenate, to the kitchen to nourish, and finally through the front door to then participate in the community’s programs.

Lower sensory rooms, like bedrooms, are grouped together and then separated from higher sensory rooms, such as the kitchen and living room.

Each resident has an ADA-compliant bathroom. Slip-resistant tile floors, hot water safety fillings, and wall-hung toilets are recommended.

Closets and storage spaces act as acoustic buffers.

Recommendation: Insulate walls and floors with soundproofing material (ex. spray foam)

Built-in furniture and storage make the use of space clear and reduce clutter contributing to sensory overload.

Built-in furniture by windows creates individualized places of escape.

Important views look onto natural elements.

Natural materials such as neutral-toned wood floors are used throughout.

Dining and living spaces are clearly separated from each other.

Hallway receives diffused light from the lightwell and direct light through a curtain wall.

Wider, central hallway allows flexibility when moving from one space to another.

Balcony off of the hallway provides a space to retreat and recalibrate in the case of overstimulation.

Wider hallways and generous spatial standards allow for safer, more comfortable movement.
Spaces are organized in accordance with routine. One can proceed from their room to rest, to their bathroom to rejuvenate, to the kitchen to nourish, and finally through the front door to then participate in the community’s programs.

Lower sensory rooms like bedrooms are grouped together and then separated from higher sensory rooms, such as the kitchen and living room. Each resident has an ADA-compliant bathroom. Slip-resistant tile floors, hot water safety fittings, and non-slip toilets are recommended.

Closets and storage areas act as acoustic buffers.

Recommendation: Insulate walls and floors with soundproofing material (ex. spray foam).

Built-in furniture and storage make the use of space clean and reduce clutter contributing to sensory overload.

Built-in furniture by windows creates individualized places of escape.

Important views look toward natural elements.

Natural materials such as neutral-toned wood floors are used throughout.

Dining and living spaces are clearly separated from each other.

Escape spaces in hallway lie hidden below and the hallway receives natural light through a curtain wall.

Wide, central hallway allows flexibility when moving from one space to another.

Intimately-scaled escape space in the hallway provides a space to retreat and recalibrate in the case of overstimulation.

Recreation room has clearly defined function by including a game table and built-in media center.

Wide hallways and generous spatial standards allow for safer, more comfortable movement.

Level 1
- Acoustics
- Compartmentalization
- Safety
- Biophilia

Level 2
- Acoustics
- Compartmentalization
- Safety
- Biophilia
APARTMENTS: 4 BEDROOM

Front Elevation

Rear Elevation

APARTMENTS

Exterior Perspective

Interior Perspectives
COMMUNITY CENTER: THIRD FLOOR

High-stimulus spaces (computer lab, gym, and recreation room) are grouped together and low-stimulus rooms like the library and therapy rooms are grouped together. Enclosed checkout space provides a node for circulation routing from higher sensory areas to lower sensory areas.

Interior void and retain walls on north and south elevations fill interior spaces with natural light.

Sunroom, balconies, and upper deck allow access to natural light, views, and elements.

Elevators and stairs to this level require a key card.

COMMUNITY CENTER

Section
SITE CONTEXT
BIBLIOGRAPHY


