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Research Article

Intergenerational Facility Alternatives: Transitioning Care Options for Aging Parents and Children with Autism

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Abstract

Purpose: The objective was twofold: 1) summarize research-informed environmental characteristics into Mostafa's seven ASPECTSS™ criteria for people who are aging, and for children who have autism, and 2) apply those characteristics within the context of a Green House planned intergenerational facility providing support to adult child with autism, and their parent(s).

Background: The rate of Autism Spectrum Disorder (ASD) diagnoses is increasing, making it important to design spaces for people with ASD. Approximately 85% of children with ASD live with their parents (Mykyta, 2012). Ahrentzen & Steele (2010) identified the need to develop housing options for people with ASD.

Method: Design considerations from a literature review were organized into two tables: 1) aging adults and 2) people who have ASD. Shared characteristics were placed into a third table using Mostafa's seven ASPECTSS™ criteria, and then applied to the intergenerational facility plan to demonstrate the effectiveness of intentional planning by caregivers and the design community.

Results: When integrating Mostafa's ASPECTSS™ framework, and the intergenerational Green House Model, the application of design choices within housing demonstrates that appropriately designed space can positively impact persons and families with autism, regardless of age.

Conclusion: Findings show numerous overlapping design criteria for people with autism and aging adults that can lead to effective environmental solutions for both. This facility type has the potential to minimize family fracture since aging parents are supported in their ability to care for their child with autism.

Key Words: Autism; assisted living; aging; intergenerational; care; ADA

Introduction

Autism

In the U.S. today, **1 in every 54 children are diagnosed with Autism Spectrum Disorder** (ASD) and the Center for Disease Control and Prevention (CDC) estimates that there are currently 5.4 million adults with autism in the U.S. This societal trend shows the need to identify sooner rather than later, solutions that provide housing for families that address the needs of persons with ASD so they are prepared to provide for transitions in housing across the lifespan (C.D.C., 2020; Maenner, M.J., Shaw, K.A., Baio, J., et al., 2016).

Autism is considered a broad spectrum disorder that affects individuals in varying ways. Autism's core symptoms include social communication challenges, e.g., verbal and nonverbal, and restricted repetitive behaviors. For example, they may not understand or appropriately use: spoken language (⅓ are nonverbal), gestures, eye contact, facial expressions, tone of voice, or expressions not meant to be taken literally. Additional social challenges include recognition of emotions/intentions in others, recognition of one's own emotions, expressing emotions, seeking emotional comfort from others, feeling overwhelmed in social situations, or taking turns in conversations. Restricted and repetitive behaviors vary greatly across the spectrum and may include repetitive body movements, repetitive motions with objects, or ritualistic behaviors such as lining up objects. These differences make it difficult to design one solution for all people with autism knowing that a solution that supports one individual may be a barrier for another. However, the characteristics identified in the literature as being most relevant to people with autism are often also effective universal design choices for people who are neurotypical, e.g., views to the outdoors, levered hardware, and safe spaces (CDC, 2020).

People with ASD are highly sensory and can become overwhelmed by artificial lights, loud noises, and overstimulation. When experiencing unfitting stimulation levels, children with ASD can exhibit violent outbursts in response to difficulty in processing the sensory environment, showing a direct link between wellbeing and the built environment. General agreement in the literature review shows that the sensory environment, with its colors, textures, patterns, lights, shapes and spatial qualities, plays a role in the disorder. It is possible to address these behaviors through planning (Maenner, M.J., Shaw, K.A., Baio, J., et al., 2016). One thing that is clear is that **persons with ASD experience built environments very differently from most users, and that increased knowledge in this area can impact them across their entire life**.

As a general rule, most children with autism live in the home of a parent or other family member, with parents most often functioning as their caregiver (Ahrentzen, 2016), with as high as 85% reported living with parents (Mykyta, 2012). As caregivers age and need additional support, they often wonder how they will provide care for themselves, let alone providing care for someone on the spectrum. As a result of this aging process, the demand for housing accommodation for people with ASD who reside with aging caregivers is projected to rise considerably (Ahrentzen & Steel, 2009). Traditional alternative solutions have often involved the addition of in-home staffing or placement of their children in group home care settings (Gaines et al., 2016), developmental centers, nursing homes or intermediate care facilities. Only recently have families and design professionals begun to advocate for new designs in the development of alternative residential options for adults with ASD (Ahrentzen, 2016; Ahrentzen & Steel, 2009). Although the authors recognize that there cannot be one perfect residential solution to meet the differing needs of people on the spectrum, the intergenerational solution presented below is one accommodation that addresses a unique niche.

One architect who has worked to develop effective characteristics for educational and living environments for people with autism is Mostafa (2014). After looking at common sensory environment problems, she developed the Autism ASPECTSS™ Index and seven principles – **A**coustics, **SP**atial sequencing, **E**scape space, **C**ompartmentalization, **T**ransition zone, **S**ensory zoning, and **S**afety – as a design tool to enhance the built environment for people with autism (Mostafa, 2014). **When the ASPECTSS™ framework is applied within the environment, spaces are not only more sensitive to their needs, but also can be more enjoyable, multifunctional, and accessible for everyone**.

Providing a Solution

Most design information available to designers and architects focus on the physical needs of people with disabilities and a typical aging population, with growing advocacy for adults with neurobiological conditions (Ahrentzen & Steele, 2009). Although studies have examined characteristics of effective environments for aging adults (van Hoof, Kort, van Waarde & Blom, 2010; Wood-Nartker et al., 2019), and of children with autism, few studies have examined effective housing and living environments for adults with autism (Ahrentzen & Steele, 2009; Gaines et al., 2016). Ahrentzen & Steele relate the housing needs for adults with autism to the development of residential care over the last five decades to that of designing for eldercare. Initially, it was difficult to locate an option that was not a nursing home or residence in homes of their adult children. Today, the options for aging adults are vast, clarifying the need to forge a similar path for people on the spectrum. What is clear for both older adults and people with ASD is that it can be difficult for the person to easily adapt to the environment, and so the environment must adapt to their specific needs. This makes it important to connect the requirements of aging adults (in this case, people who are also caregivers for their children with autism) and people with autism (in this case, people who have been provided care by their parents) to specific design solutions. Within this article, this has been done in two ways. The first is to summarize research-informed environmental characteristics using Mostafa's seven ASPECTSS™ principles for people who are aging, and for children who have autism. The second is to apply those characteristics within the context of a Green House planned intergenerational facility that provides support to adult child with autism, and their parent(s).

The development of a housing approach that looks to intergenerational care could positively impact the lives of families who have members with autism. Traditionally, we think of children growing up and moving away from their parents, although this is not often how life plays out for many children with autism. As their parents age and require assistance themselves, for individuals with ASD who still require daily assistance, this would mean a separation from the family unit and the destabilization of previously established care routines. For the child who has autism, an optimal and focused design that they become familiar with early in life can assist in minimizing problems later that could result from the need to move, which could debilitate these residents who need stability and consistency in their lives. Effective and intentional design is also important for their caregivers (parents) since their quality of care can be supported by the environment. The more that the environment (and on-site caregivers) can serve as a support for parents, by providing opportunities for respite and restoration, the more likely they will be able to continue to provide stability and supported care for their adult children with autism (Ahrentzen & Steele, 2009).

Therefore, as the family itself ages, it is necessary to consider long-term housing options that support a range of needs. **The creation of a Green House planned intergenerational facility that allows people with ASD to attend a childcare center as children, live independently in assisted living in the same facility as their aging parents when their parents need assistance with care, and then age in place as they become elderly and require even more assistance with daily living (ADLs), is a care concept worth exploring**. This idea can provide crucial supports while maintaining strong relationships with friends, family, and staff. When considering children with autism, the intergenerational model becomes particularly important as it offers opportunities for children to become accustomed to the facility at a young age where they can be introduced to a sense of structure and routine. This improved familiarity with the facility could minimize difficulties involving transition to the facility should future residency within the intergenerational facility become a viable option.

Green House Model

The Green House planning concept, developed by Dr. Bill Thomas, is a newer approach to designing effective housing for older adults. In this housing approach, residents live in small-scale, self-contained home-like environments termed Green Houses that are designed for 10 or fewer individuals, as shown in Figure 1.

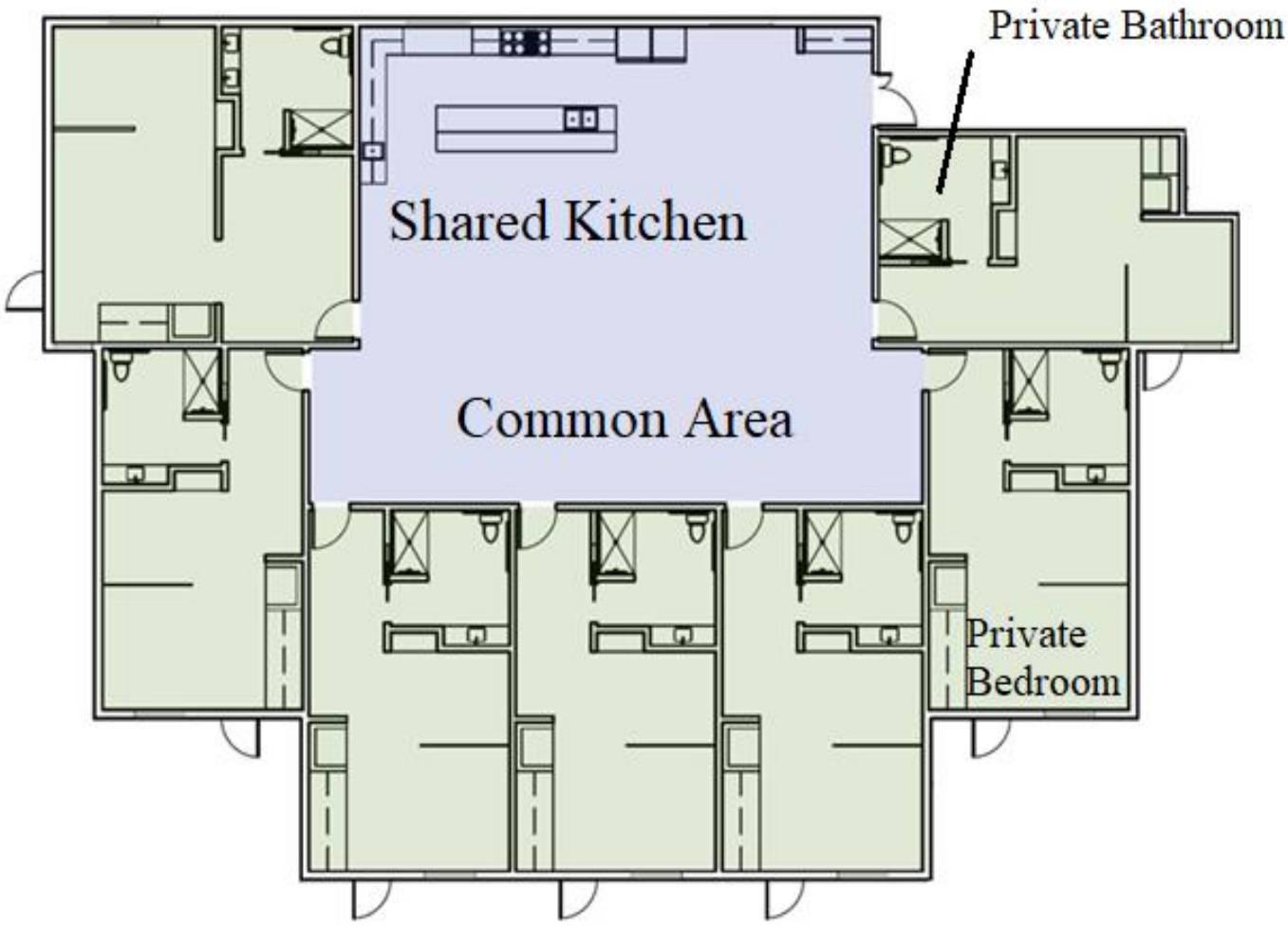

Figure 1: *Green House Model Example.*

This plan, developed by one of the authors, integrated characteristics particular to the Green House model. For example, each home contains private bedrooms with attached baths, as well as communal space including a kitchen, dining room, and living room. The Green House concept also seeks to change the administrative functions of elder living which now would take place in an off-site or remote location. Visible aspects of institutional care, such as nursing stations or medical carts, are taboo. Instead, staff members serve more holistic roles, taking on cooking, housework, and general socialization positions alongside typical nursing care. The main goal of the Green House model is to improve the quality of life for residents through environmental changes, increased family and staff involvement, and personalization methods such as using the residents' own furnishings and belongings within the design (Cohen et al., 2016). To adapt this intergenerational space to the needs of people with ASD and neurotypical aging adults, there was a conscious choice to create a non-institutional environment that incorporated residential characteristics in the commercial grade furnishings, finishes, accessories and lighting selections.

Routine and predictability are not typical behaviors of people with ASD, although they are needs the children have. Therefore, it would be beneficial to provide environments that promote these behaviors across the age continuum. When childcare and assisted living areas are integrated within a singular facility, routine and normalcy can be established in one environment which transitions with the individual (and parents) as they age.

Merging principles from Thomas' Green House model and Mostafa's ASPECTSS™ model created the foundation from which this new housing norm and effective environments were planned to meet the needs of individuals with autism, both as children, and as young/aging adults. Research-informed recommendations were gathered from a literature review in order to create effective environments for their special needs at all stages of life.

ASPECTSS™ Framework

Acoustics

Mostafa's ASPECTSS™ framework highlights the characteristics that should be focused on when designing centers for people with ASD. Due to the potential of hyperstimulation in individuals with ASD, the acoustical environment should be planned in such a way to minimize background noise, echo, and reverberation (Mostafa, 2014). The degree of acoustical control depends on the specific individuals who will be using the space, and this can vary greatly depending on factors such as planned activities in the space, skill level, and the severity of ASD. Acoustic baffles and reverberation mitigate ambient sound level and echo. Addition of industrial grade drywall, with three layers up to six feet high (kickable range) helps to minimize construction costs associated with replacement due to aggressive behaviors, and also to reduce sound

transmission between spaces (Warman, 2019). In addition to acoustic considerations, research suggests that all senses should be considered when designing for people with autism (Clouse et al., 2019; Gaines et al., 2016). As such, design implementations that relate to any of the senses will be categorized under Acoustics (senses) for the sake of applying this model. Selections such as neutral and soft colors help to minimize over-stimulation within the environment. To reduce glare, indirect and diffuse lighting can be specified along with matte, non-reflective finish surfaces to minimize visual simulation. Individually controlled climate control systems and operable windows cater to individuals with hyper- and hypo-sensitivity to temperature. Additionally, higher ceilings in public areas help encourage people with autism to look up to break their habit of looking down and focusing on minute objects, promoting socialization (Mostafa, 2014).

SPatial Sequencing

SPatial sequencing proposes that areas are organized in a logical order to promote one-way circulation whenever possible. This is proposed due to the nature of ASD and a desire for routine and predictability, which can be improved by seamless transitions between spaces with different functions. Spacious areas promote socialization among people with ASD, while circulation spaces replace corridors to allow for adequate personal space. Rooms and spaces should be designed to have clear identity and purpose, while loud and quiet spaces should be remote from one another. Walls and visual partitions can aid in dividing rooms to promote organization of activities and events. Moveable furniture that can be regrouped according to the needs of a planned activity allow flexible modifications that cater to the needs of specific individuals (Mostafa, 2014).

Escape Space

Escape spaces can provide a place of retreat and respite for users experiencing overstimulation in the environment. Escape spaces can either take the form of a designated area in a room or entire rooms within larger buildings, as shown in Figure 2.

Figure 2: *Corridor Escape Space*

Note: Public corridor space located in the Faison Center in Richmond, VA.

In both cases, the escape space should allow for the proper customized sensory input needed by each user (Mostafa, 2014).

Compartmentalization

Compartmentalization is the process of dividing a room into areas, each intended for a specific task. The task should be clearly defined and have the proper stimulus qualities to best facilitate that activity, as shown in Figure 3.

Figure 3: *Spatially Sequenced Furnishings within a Classroom.*

Note: Classroom space located in the Faison Center in Richmond, VA.

It is not necessary that the separation of space be defined by architectural characteristics such as permanent walls, but instead can be introduced via furniture arrangement, dividers, or variations of lighting and floorcovering. This, in turn, allows the spaces to be flexible and tailored to the specific needs of diverse users (Mostafa, 2014).

Transition Zones

Transition zones aid in the effectiveness of both Spatial Sequencing and Sensory Zoning (to be defined). The purpose of a transition zone is to allow the user to recalibrate their sensory stimulation level when moving between areas of differing stimulus levels. These transition zones are also safe spaces to facilitate socialization, as shown in Figure 4 (Mostafa, 2014).

Figure 4: *Example of Transition Zone.*

Note: Public corridor space located in the Faison Center in Richmond, VA.

Wide entryways with full-sized doors and operable sidelight windows reduce restrictiveness in transitioning between spaces and act as space for socialization. Reception areas allow for transition between exterior and interior areas. Awnings can achieve the same effect for outdoor building entrances (Gaines et al., 2016).

Sensory Zones

Zones within an interior environment should be organized according to their sensory quality as opposed to the neurotypical approach of functional zoning. For example, noisier spaces or “high-stimulus" zones include areas where physical activity might occur such as a corridor or playground. “Low-stimulus” zones include quieter areas geared towards activities such as reading and working on a computer (Mostafa, 2014). When spaces are organized according to sensory needs instead of function, they should focus on the desired activity and sensory levels and be clearly defined , e.g., carpet squares, colored floor tape, or screens, as shown in Figure 5 (Gaines et al., 2016). Figure 5 shows how quiet teaching/learning spaces have been separated from larger, noisier play spaces.

Figure 5: *Classroom with Diverse Work Areas and Stimuli.*

Note: Classroom space located in the Faison Center in Richmond, VA.

Safety

Research shows that injury and mortality rates are higher in individuals with autism. As such, safety is essential when designing environments for people with ASD (Svend, 2013). As shown in Figure 4, design suggestions for furniture, finishes and equipment, such as use of robust materials, lack of sharp edges and corners, and choking hazards, as well as proper management of hot water via safety fittings should be considered. Windows should be specified and installed with child-proof controls (Mostafa, 2014). Larger furniture and fixtures can be secured to floor or walls (Gaines et al., 2016). Multiple layers of drywall increase

durability in case of aggression. Perimeter fences for courtyard use also ensure safety outdoors (Warman, 2019). Designing spaces using this proposed framework can help to create safe, suitable environments for people with ASD.

Beyond the design suggestions specifically targeting educational environments in Mostafa's ASPECTSS™ framework (2014), additional research provides insight into home environments for users with autism (Gaines et al., 2016). As such, these suggestions have also been incorporated into the intergenerational facility.

Environments Serving Children with ASD

In this intergenerational facility, the educational child daycare serves as a transition zone for individuals with autism to become familiar with the facility at a young age. As these individuals gain familiarity, the potential stress that could occur when there is a need to transition to permanent residence in the facility as a family unit may be eased. The literature review provided design characteristics that were beneficial to children with ASD, as shown in Table 1. For example, within the daycare, it was important to develop appropriate instructional, independent, recreation and leisure areas in each structured environment. In a classroom setting, these areas may include a small group work area, an independent work area, a 1:1 work area, a play/recreation/ leisure area, sensory motor area and a crash/quiet area (Kanakri et al., 2017). Modifying the design of a classroom for students has been shown to improve learning performance, reduce negative behaviors, and increase attention span (Gaines et al., 2016). Creating a learning environment that regulates sound, light, and provides a structured environment with limited or well-controlled sensory stimuli helps students learn and remain focused. Some environmental factors that cause distraction and lead to sensory triggers are background noise, glare, open storage systems, clutter, and large numbers of students and teachers. Environments that only have artificial illumination and lack natural light increase stress and discomfort (Shabha & Gaines, 2013).

Author	Design Consideration
Mostafa, 2014	Space plan to minimize background noise, echo, and reverberation.
	Organize areas in logical order, promoting one-way circulation
	Use light and neutral color selections to minimize over-stimulation
	Incorporate indirect and diffuse lighting
	Select matte and non-reflective finish surfaces
	Use walls and visual partitions as an aid for division and organization of rooms
	Specify movable furniture which can be regrouped according to the needs of the activity
	Give rooms and spaces clear identity and purpose
	Designate specific areas in a room or entire rooms as escape space
	Include reception areas between indoor and outdoor areas
	Allow for customization within these spaces according to the needs of the user
	Use covered awnings in outdoor spaces
	Clearly define zones through carpet squares, colored floor tape, or screens
	Provide wide entryways with full sized doors and operable sidelight windows
	Avoid sharp edges and corners
	Consider proper management of hot water via safety fittings which are child-proof
	Organize "high stimulus" and "low stimulus" zones
	Separate loud and quiet spaces

Author	**Design Consideration**
Warman, 2019	Specify multiple layers of drywall
	Specify movable and adaptable furniture to create boundary-defined areas
	Specify sound absorbing panels
	Stagger doorways within corridors to eliminate direct pathways for sound travel
	Cover light fixtures and sprinkler systems for safety
	Specify hard surfaces for easy maintainence
	Replace corridors with circulation spaces
	Include perimeter fences outdoors
	Add acoustic baffles and industrial grade drywall (3 layers up to 6ft high)
	Design Consideration
Gaines et al., 2016	Specify robust materials with a lack of choking hazards for furniture, finishes, and equipment
	Use carpet to minimize acoustical reverberation
	Provide fixed furniture for predictability in bedrooms
	Have spatial sequencing to promote predictability and routine patterns
	Specify individual climate controls and operable windows within rooms
	Design Consideration
Ahrentzen et al., 2009	Provide predictability in the environment, demonstrated through transparency in special sequencing
	Provide smooth transitions between rooms and uses
	Provide clear visual access into and between rooms
	Specify a change of material to indicate change of use
	Separate high stimulus areas with low—input transition zones
	Include escape spaces
	Include active and quiet spaces within common areas
	Design hallways wide to accommodate people in wheelchairs

Ahrentzen et al., 2009	Keep hallways and flights of stairs short
	Specify individual climate control and ventilation fans in bedrooms
	Specify durable finishes according to the intended use
	Include a fence to inhibit wandering or access from unwanted visitors
	Use color coding to indicate location, function, or activity
	Use color palettes avoiding bright, primary colors
	Avoid using high-heat, fluorescent, and halogen lightbulbs
	Use indirect lighting to reduce glare
	Avoid carpet with a strong weave or pile to avoid trip hazards
	Choose quiet HVAC systems and other appliances
Author	**Design Consideration**
Kanakri et al., 2017	Develop appropriate instructional, independent, recreation, and leisure areas
	Specify perimeter fences outdoors
	Lower ceilings to decrease acoustics
	Design Consideration
Shabha & Gaines, 2013	Incorporate indirect and diffuse lighting
	Design Consideration
Kinnaer et al., 2016	Display order and definition in planning of rooms

Table 1. *ASPECTSS™ Framework: Design Considerations Relating to Autism*

In all spaces, it is important to provide durable finishes. For example, light fixtures should be covered so that an object thrown at the light source will not break it. A sprinkler system should be concealed or covered with a wire cage to minimize damage or activation due to blunt force. Hard surface flooring can be easily maintained by clients and guests who may urinate or defecate on it, while adding tennis balls on the legs of chairs and tables can minimize the damage to hard surface floors from moveable furniture. Mobile and adaptable furniture facilitate flexible, boundary-defined areas within a larger classroom environment (Warman, 2019).

The structure of walls around an environment can greatly affect the sound qualities within the space. In the children's spaces, there were several suggestions to address acoustics within the environment. For example, sound-absorbing panels can be installed over drywall or suspended from the ceiling (Warman, 2019). Using carpet instead of vinyl composite tile decreases sound reverberation (Gaines et al., 2016). Use of two layered staggered studs within walls with one-layer housing sound-absorbing insulation, and two sheets of drywall outside each stud enhance sound insulation. In addition, staggering doorways within the corridor can eliminate direct routes for sound (Gaines et al., 2016). The use of lowered ceilings creates the most ideal acoustical conditions (Kanakri et al., 2017).

Within the children's play space, low-level dividers can be used to set spaces apart within the classroom or, when possible, access should be made to external environments for recreation, physical education, social development, and academic learning. A universally designed playground should provide access to at least 70% of all play equipment by children who have sensory or developmental disabilities.

A portion of the facility was designed for long-term residence of users with ASD. This environment would suit either lower functioning residents with ASD or higher functioning individuals who wish to remain connected with parents or other equivalent caregivers who themselves require assistance with daily living within the facility. Giving residents an opportunity to decide when, where, and how much they want to mix with

others in their group living situation is one way to respond to their need for control. This ensures that individuals have a quiet space for sleeping, doing homework, etc. to help them to remain focused (Gaines et al., 2016). Within the bedroom, it was suggested to provide fixed furniture in defined configurations, such as built-in cabinetry, to assure occupants that some aspect of a setting is predictable and not going to change (Gaines et al., 2016).

Designing for Aging Adults

In the U.S., it is estimated that ~70% of people with early-to-moderate dementia live at home, and that this percentage remains high (64%) for

those with advancing dementia. Many of these adults living at home endure more pain, higher levels of anxiety, have higher fall rates, and have more complex or unaddressed medical needs than their counterparts living in residential care or nursing homes. People with dementia benefit from consistent and predictable environments and caregivers (Harrison et al., 2019) and could benefit from the care provided in an assisted living facility. The importance of the environment as a provision for care and support of aging adults was recognized at least five decades ago by Pastalan et al. (1973). Pastalan's et al.(1977) work is pivotal in that it is perhaps the first behavioral research technique to focus on bridging the gap between research and practice, e.g., the designer/architect's need for anecdotal experiences linking the physical environment to human responses and abilities vs. the rigors needed for the science of research. This established an important framework for use by interior designers and architects referred to as empathic modeling (Clouse, Wood-Nartker & Rice, 2019).

In the Empathic Model, researchers modified their senses and developed recommendations for visual characteristics based on their experiences that architects, designers, and caregivers should consider when creating environments for older adults as shown in Table 2. Aging adults are sensitive to blues, greens and violets and need to avoid some color combinations. Glare was the single most difficulty encountered and there was a decreased ability to adapt quickly to light and dark, creating a need to avoid extremes in contrast. When intense colors were adjacent to one another, they became visually unstable creating a hazard when negotiating stairs or when distinguishing floors from wall surfaces (Pastalan et al., 1973).

Author	**Environment Should:**
MCSS/Zgola, 1990	Be structured & stable
	Provide environmental routines (association of activities with certain locations)
	Serve as a (memory) cue
	Facilitate orientation
	Provide security
	Promote recollection
	Environment Should:
Pynoos et al, 1989	Promote dignity and independent functioning
	Provide appropriate sensory stimulation
	Provide security and safety
	Provide appropriate level of activity/task
	Provide a home-like and familiar atmosphere
	Provide for individual control and privacy
	Create opportunity for socializing
	Be flexible and adaptable in supporting the person's behavioral and physical needs
	Emphasize wellness and maintain connection with the healthy and the familiar

Author	**Environment Should:**
Schiff, 1990	Be clear and well structured
	Be stable and familiar
	Serve as a cue to behavior
	Serve as a cue to memory
	Support reality orientation
	Therapeutic goals for good design:
Cohen and Weisman, 1995	Ensure safety and security
	Support functional ability through meaningful activity to help maintain competence and enhance self-esteem
	Maximize awareness and orientation
	Provide (carefully regulated) opportunities for (sensory) stimulation and change, avoiding either deprivation or overload
	Maximize autonomy and control
	Adapt to changing needs
	Establish links to the healthy and familiar, for instance, maintain as many connections as possible with past lives
	Provide opportunities for socialization
	Protect the need for privacy
	A functional environment should:
Brawley, 1992	Enable communication and appropriate exercise
	Minimize agitation
	Minimize hazard and risks of fall and injury
	Provide nurturing, comfort, and security
	Anticipate potential cognitive deficits
	Provide cues and assistance for wayfinding

Author	**Design should:**
Marshall, 1998	Compensate for disability
	Maximize independence
	Enhance self-esteem and confidence
	Demonstrate care for staff
	Be orientating and understandable
	Reinforce personal identity
	Welcome relatives and the community
	Allow control of stimuli
	Special care units should:
Fleming et al., 2003	Ensure safety and security
	Reduce the size of the group and be small
	Make the environment simple and provide good visual access
	Reduce unwanted and unnecessary stimulation
	Highlight helpful stimuli
	Provide for planned wandering
	Make the environment as familiar as possible
	Provide opportunities for both privacy and community
	Provide connections to the community, e.g., encourage and accommodate visitors
	Make the environment as domestic as possible
Author	**Day care settings should:**
Diaz Moore et al., 2006	Provide safety and security
	Facilitate functional independence
	Promote orientation
	Provide sensory stimulation

Diaz Moore et al., 2006	Facilitate meaningful activity
	Promote social interaction
	Encourage privacy
	Encourage personal control
	Promote continuity of the self
	Encourage spirituality
	Create architectural delight
Author	**Dementia-friendly design should:**
Burton and Torrington, 2007	Be familiar
	Be legible
	Be distinctive
	Be accessible
	Feel comfortable
	Be safe
	Criteria of a therapeutic environment should:
Marquardt and Schmieg, 2009	Be legible (logical room syntax, furnishing, fixtures, and fittings)
	Be familiar (biographical reference, homogeneous and small groups, noninstitutional character)
	Promote social interaction (privacy, belonging, communication)
	Create autonomy (barrier-free, compensating environment, safety and security, orientational cues)
	Control sensory stimulation (encouragement, avoidance of overstimulation, access to the outdoors)
	Aging Adult design should:
Herdman & Kamitsuru, 2014;	Promote stability and balance through specification of firm seating with arms, easy to grip handrails, anti-slip flooring, use of grab bars, and non-use of area rugs.
	Maximize safety through close placement of the restroom to the living space, limiting exposure to inclement weather and omitting clutter.

Author	Aging Adult design should:
Romli et al., 2018	Promote stability and balance through specification of firm seating with arms, easy to grip handrails, anti-slip flooring, use of grab bars, and non-use of area rugs.
	Maximize safety through close placement of the restroom to living spaces and by limiting exposure to inclement weather.
	Minimize glare by selecting window treatments that allow adjustment of natural light.
	Minimize trip hazards by incorporating clear circulation paths, corridor handrails, and minimizing clutter.
	Aging Adult design should:
Delcampo-Carda et al., 2019	Reduce glare by minimizing use of matte finishes, minimizing placement of dark surfaces adjacent to a window that emits uncontrolled light source, selecting non-glare window glazing.
	Minimize glare by selecting window treatments that allow adjustment of natural light.
	Provide transitional lighting for extreme lighting contrasts.
	Provide adaptable and adequate lighting levels.
	Provide clear wayfinding through clear, noteworthy and safe signage/artwork.
	Aging Adult design should:
Pynoose et al., 2012	Minimize tripping by creating flush flooring surfaces and avoiding trailing wires.
	Maintain clear planar definition through clear definition of the floors from the walls.
	Aging Adult design should:
Delcampo-Carda et al., 2019	Minimize vibrating boundaries through non-use of small-scale striped patterns and large-scale flooring prints
	Avoid placing complimentary colors next to one another.
	Organize space for mastery through spatial scale and personal space.
	Promote easy access to the environment through use of levered hardware on doors and plumbing fixtures.
	Aging Adult design should:
Canham et al., 2017	Increase socialization opportunities through strategic furniture placement and planning spaces for clear use.
	Maximize socialization opportunities through sensitivity to surrounding noise levels.
	Aging Adult design should:
Campbell, 2015	Increase socialization opportunities through strategic furniture placements.
	Plan spaces so that the intended use is clear
	Maximize socialization opportunities through sensitivity to surrounding noise levels.
	Aging Adult design should:
Clouse, Wood-Nartker & Guerin, 2019; van Hoof et al., 2010	Mitigate hearing loss by considering background noises, sound reflectance from hard surfaces, and high frequency tones.
	Avoid using hard to turn knobs and subtle textures/textures that can affect tactile response

Table 2. *Overview of Design Principles or Design Goals for Living Environments for Persons with Dementia and Aging Adults*

Adapted Table 1 from Environment and the Design of Homes for Older Adults with Dementia: An Overview, 2010. Used with permission by van Hoof, Kort, van Waarde & Blom.

Findings showed that hearing losses were impacted by three main things: background noises, sound reflectance from hard surfaces, and high frequency tones (Clouse, Wood-Nartker & Guerin, 2019; van Hoof et al., 2010). Table 2 shows recommendations related to auditory considerations within the environment.

Research showed that hard to turn knobs and subtle textures affected tactile responses, as shown in Table 2 (Clouse, Wood-Nartker & Guerin, 2029; van Hoof et al., 2010).

Research by Joseph (2006) suggests that the physical environment of long-term care settings impacts residents, families, and staff through improved quality of life, resident safety, and reduced staff stress. Layout, specialized surfaces and finishes, and wayfinding methods also improve safety. Joseph suggests that wall murals on exit walls; two-dimensional grid patterns on boundary areas; and restricting visibility through immediate exit areas, have been shown to mitigate wandering and escape-driven tendencies for residents with dementia or Alzheimer's. Similar studies by other authors provided additional design recommendations. For example, bright, white light can reduce aggressive behaviors in memory care patients (Hanford & Figueiro, 2013). Non-institutional dining rooms improve food intake among dementia residents and locating communal spaces with immediate access to residential rooms promotes socialization (Cohen et al., 2016).

Public Spaces (ASD + Aging Adults Crossover)

In this intergenerational facility, public spaces act as a large-scale transition zone between the childcare and adult resident spaces. As such, these more communal spaces were designed as a bridge between the two communities, allowing users with ASD to learn life skills, provide interaction opportunities with family and friends, and simultaneously create recreation and enrichment opportunities for aging adults. Research-informed design characteristics that mutually benefit adult children with ASD and their aging parents were integrated into Table 3. These characteristics were organized using Mostafa's ASPECTSS™ framework. The overarching categories included Acoustics (all senses), SPatial Sequencing, Escape Space, Compartmentalization, Transition Spaces, Sensory Zoning, and Safety. For example, the ability to control sensory stimulation and access to the outdoors were two design characteristics shown to affect aging adults and people with ASD. Attention to acoustic control can reduce overstimulation in users with ASD alongside reducing aggression in memory care patients through the thoughtful selection of quiet HVAC systems and other climate controls, to minimize background noise and sound reverberation. Use of strategic building materials, use of neutral and soft colors, and the incorporation of indirect and diffuse lighting (Ahrentzen et al., 2009, Diaz Moore et al., 2006; Gaines et al., 2016; Kanakri et al., 2017; Marquardt & Schmieg, 2009; Mostafa, 2014; Shabha & Gaines, 2013; van Hoof et al., 2010; Warman, 2019) were all shown to have an impact on aging adults as well as people with ASD and so were considerations in the design decisions made within the intergenerational center.

When planning the interior of rooms, it is important to display order, definition (Kinnaer et al., 2016) and promote routine (Mostafa, 2014). Spatial sequencing was used to promote routine (Mostafa, 2014) by dividing rooms into different zones with each zone having only one function or activity. This allows individuals to begin associating an activity with a specific area, which eases transition between activities, protects routine patterns, and promotes predictability. Rooms that are clearly divided and organized, clear wayfinding, mobile furniture, and a variety of public and private spaces that support socialization support people who are aging and who have ASD and were considerations in planning (Cohen & Wesman, 1995; Diaz Moore et al., 2006; Gaines et al., 2016; Kinnaer et al., 2016; Marshall, 1998; Marquardt & Schmieg, 2009; Mostafa, 2014; Sánchez et al., 2011; Schiff, 1990; Warman, 2019; van Hoof et al., 2010)

The term **escape space** is more typically associated with children with autism, but the idea is also relevant to aging adults. Rooms designed as distinct zones can flexibly accommodate varying levels of stimuli to allow users to select spaces most suitable to their own desired privacy or socialization level (Mostafa, 2014). For example, the inclusion of reception areas between indoor and outdoor spaces (Mostafa, 2014), the availability of active and quiet spaces in common areas (Ahrentzen et al., 2009), and the availability of specific areas in rooms or entire rooms as a place to retreat to regroup (Ahrentzen et al., 2009; Kanakri et al., 2017; Mostafa, 2014) are beneficial to both.

Compartmentalization supports the needs of children with autism and aging adults when the division or organization of a room aids in clarifying specific tasks along with the inclusion of the proper stimulus qualities to best facilitate that activity (Mostafa, 2014). Spaces were effectively designed to be flexible so they could be tailored to the specific needs of the parents and children with ASD.

Transition zones are safe spaces that facilitate socialization, which is critical since aging adults in assisted living facilities often suffer from loneliness and children on the spectrum are challenged socially and often desire friendships (Cohen et al., 2016; CDC, 2020). The literature highlighted the use of wide entryways and sidelights (Mostafa, 2014), or the inclusion of circulation spaces (Ahrentzen et al., 2009) to seamlessly transition from one space to the next and were carefully considered in the design of the intergenerational center public spaces.

Sensory zones within an interior environment should be organized according to their sensory quality and Table 3 shows that areas that provide flexibility in regulating hyper- and hyposensory stimulation (Cohen & Weisman, 1995; Fleming et al., 2003; Marquardt & Schmieg, 2009; Pynoos et al., 1989) benefit aging adults and people with autism. Sensory zoning played an important role in the decision making for location of spaces throughout the intergenerational center.

Safety is essential when designing any environment but is a priority for residents in the assisted living facility. Multiple safety issues were mutually beneficial and supported the need to: minimize fall risk hazards (Brawley, 1992), provide autonomy (Marquardt & Schmieg, 2009), specify accessible spaces (Ahrentzen et al., 2009) and minimize the potential for burns (Mostafa, 2014).

ASPECTSS	Design Consideration	Author
Acoustics (All senses)	Space plan to minimize background noise, echo, and reverberation.	Mostafa, 2014; Van Hoof et al., 2010; Gaines et al., 2016; Warman, 2019; Kanakri et al., 2017.
	Organize areas in logical order, promoting one-way circulation	Mostafa, 2014.
	Select soft and neutral color to minimize over-stimulation	Mostafa, 2014; Ahrentzen et al., 2009.
	Incorporate indirect and diffuse lighting	Ahrentzen et al., 2009; Mostafa, 2014; Shabha & Gaines, 2013.
	Use matte and non-reflective finish surfaces	Mostafa, 2014.

Acoustics (All senses)	Provide appropriate sensory stimulation	Pynoos et al, 1989.
	Facilitate orientation	MCSS/Zgola, 1990.
	Provide (carefully regulated) opportunities for (sensory) stimulation and change, avoiding either deprivation or overload	Cohen and Weisman, 1995.
	Allow control of stimuli	Marshall, 1998.
	Reduce unwanted and unnecessary stimulation	Fleming et al, 2003.
	Allow for individual climate control and ventilation fan in each bedroom	Ahrentzen et al., 2009.
	Avoid using high-heat, fluorescent, and halogen lightbulbs	Ahrentzen et al., 2009.
	Choose quiet HVAC systems and other appliances	Ahrentzen et al., 2009.
	Use durable finishes specified according to the intended use	Ahrentzen et al., 2009.
	Provide individual climate controls and operable windows within rooms	Gaines et al., 2016.
	Add acoustic baffles and industrial grade drywall (3 layers up to 6ft high)	Warman, 2019.
	Provide ability to control sensory stimulation (encouragement, avoidance of overstimulation, access to the outdoors)	Diaz Moore et al., 2006; Marquardt and Schmieg, 2009.
ASPECTSS	**Design Consideration**	**Author**
SPatial Sequencing	Specify movable furniture which can be regrouped according to the needs of the activity	Mostafa, 2014; Warman, 2019.
	Give rooms and spaces clear identity and purpose	Burton and Torrington, 2007; Mostafa, 2014; Gaines et al., 2016.
	Provide predictability in the environment, demonstrated through transparency in spatial sequencing and orientation as well as logical room syntax, furnishings, fixtures, and fittings.	Ahrentzen et al., 2009; Cohen and Weisman, 1995; Diaz Moore et al., 2006; Marquardt and Schmieg, 2009; Gaines et al., 2016.
	Plan smooth transitions between rooms and uses	Ahrentzen et al., 2009; Gaines et al., 2016.
	Provide environmental routines (association of activities with certain locations)	MCSS/Zgola, 1990; Mostafa, 2014.
	Facilitate orientation	MCSS/Zgola, 1990.
	Promote recollection	MCSS/Zgola, 1990.
	Promote dignity and independent functioning	Pynoos et al, 1989.
	Provide appropriate level of activity/task	Pynoos et al, 1989.
	Create opportunity for socialization (privacy, belonging, communication)	Cohen and Weisman, 1995; Diaz Moore et al., 2006; Marquardt and Schmieg, 2009; Pynoos et al, 1989.
	Be flexible and adaptable in supporting the person's behavioral and physical needs	Pynoos et al, 1989.
	Be stable and familiar	Schiff, 1990.
	Provide cues that clarify desired behaviors	Schiff, 1990.
	Serve as a cue to memory	Schiff, 1990.
	Provide (carefully regulated) opportunities for (sensory) stimulation and change, avoiding either deprivation or overload	Cohen and Weisman, 1995.
	Maximize autonomy and control	Cohen and Weisman, 1995.
	Adapt to changing needs	Cohen and Weisman, 1995.
	Enable communication and appropriate exercise	Brawley, 1992.
	Minimize agitation	Brawley, 1992.
	Minimize group sizes when planning	Fleming et al, 2003; Kanakri et al., 2017; Marquardt and Schmieg, 2009.
	Provide accessible spaces	Burton and Torrington, 2007.
	Plan sequencing of space to promote wayfinding	Gaines et al., 2016; Mostafa, 2018; Sanchez et al., 2011; van Hoof et al., 2010.
	Develop appropriate instructional, independent, recreation, and leisure areas	Kanakri et al., 2017.
	Display order and definition in planning of rooms	Kinnaer et al., 2016.
	Provide familiarity (biographical reference, noninstitutional character)	Marquardt and Schmieg, 2009.

ASPECTSS	Design Consideration	Author
Escape Space	Designate specific areas in a room or entire rooms as escape space	Ahrentzen et al., 2009; Kanakri et al., 2017; Mostafa, 2014.
	Provide reception areas between indoor and outdoor areas	Mostafa, 2014.
	Allow for customization within these spaces according to the needs of the user	Mostafa, 2014.
	Provide covered awnings in outdoor spaces	Mostafa, 2014.
	Select matte and non-reflective finish surfaces	Mostafa, 2014.
	Include active and quiet spaces in common areas	Ahrentzen et al., 2009.
	Provide for individual control and privacy	Cohen and Weisman, 1995; Diaz Moore et al., 2006; Pynoos et al, 1989.
ASPECTSS	**Design Consideration**	**Author**
Compartmentalization	Clearly define zones through carpet squares, colored floor tape, or screens	Mostafa, 2014.
	Use a change of material to indicate change of use	Ahrentzen et al., 2009; Mostafa, 2014.
	Specify indirect and diffuse lighting	Mostafa, 2014.
	Select matte and non-reflective finish surfaces	Mostafa, 2014.
	Facilitate orientation	MCSS/Zgola, 1990.
	Allow control of unwanted and unnecessary stimulation	Fleming et al, 2003; Marshall, 1998.
	Incorporate individual climate control and ventilation fan into bedrooms	Ahrentzen et al., 2009.
ASPECTSS	**Design Consideration**	**Author**
Transition Zone	Incorporate wide entryways with full-sized doors and operable sidelight windows	Mostafa, 2014.
	Replace corridors with circulation spaces	Ahrentzen et al., 2009.
	Promote clear visual access into and between rooms	Ahrentzen et al., 2009.
	Provide opportunities for socialization	Cohen and Weisman, 1995.
	Provide cues and assistance for wayfinding	Brawley, 1992.
	Make the environment simple and provide good visual access	Fleming et al, 2003.
	Provide (carefully regulated) opportunities for (sensory) stimulation and change, avoiding either deprivation or overload	Cohen and Weisman, 1995; Marshall, 1998.
ASPECTSS	**Design Consideration**	**Author**
Sensory Zoning	Organize “high stimulus” and “low stimulus” zones	Mostafa, 2014.
	Separate loud and quiet spaces	Mostafa, 2014.
	Provide (carefully regulated) opportunities for (sensory) stimulation and change, avoiding either deprivation or overload	Cohen and Weisman, 1995; Fleming et al, 2003; Marquardt and Schmieg, 2009; Pynoos et al, 1989.
	Provide opportunities for socialization	Cohen and Weisman, 1995.
	Provide cues and assistance for wayfinding	Brawley, 1992.
	Make the environment simple and provide good visual access	Fleming et al, 2003.
ASPECTSS	**Design Consideration**	**Author**
Safety	Avoid sharp edges and corners	Mostafa, 2014.
	Consider proper management of hot water via safety fittings which are child-proof	Mostafa, 2014.
	Include perimeter fences outdoors	Warman, 2019; Kanakri et al., 2017.
	Specify robust materials with a lack of choking hazards for furniture, finishes, and equipment	Gaines et al., 2016.
	Specify wide hallways to accommodate people in wheelchairs	Ahrentzen et al., 2009.
	Keep hallways and flights of stairs short	Ahrentzen et al., 2009.
	Inhibit wandering or access from unwanted visitors, e.g., fence	Ahrentzen et al., 2009.
	Avoid carpet with a strong weave or pile to avoid trip hazards	Ahrentzen et al., 2009.
	Provide security and safety	Burton and Torrington, 2007; MCSS/Zgola, 1990; Pynoos et al, 1989.
	Cover light fixtures and sprinkler systems for safety	Warman, 2019.
	Minimize hazard and risks of fall and injury	Brawley, 1992.
	Provide for planned wandering	Brawley, 1992.
	Provide autonomy (barrier-free, compensating environment, safety and security, orientational cues)	Marquardt and Schmieg, 2009.

Table 3. *Design Considerations which are both for Dementia and Autism*

Methods

Autism affects whole families. Developing an intergenerational facility for aging parents and children with autism allows children to become familiar with the facility while they attend the childcare center when they are young and living at home with their parents. As these parents age and themselves need assistance, the assisted living section of the facility can provide residential support to both the parent and child (who now may also be an adult) to minimize the effects of familial fracture. To address this need, the Green House model was applied as a framework for facility planning.

To prioritize design characteristics to be implemented in the planning process, the information from the literature review was organized into three categories. The first category organized characteristics that are effectively incorporated into the environment for people who have autism, as shown in Table 1. The second category organized characteristics that are effective to incorporate into the environment for neurotypical aging adults, as shown in Table 2. Features common to both Table 1 and Table 2 were combined together to form Table 3. Mostafa's seven ASPECTSS™ was used as a basis for organizing the information.

This plan is not meant to be a "one solution fits all", but is meant to expand designers' and architects' thoughts toward the development of a new residential housing and childcare solution for parents who have a child with autism. Design, construction, furniture and finishes, and building technology can be a support or a hindrance to autonomy (van Hoof et al., 2010). These environmental recommendations focus on research-informed characteristics that can facilitate support for the diverse needs of aging adults and people who are on the autism spectrum.

Results

Research suggests that there are shared design characteristics that can benefit aging adults and persons with ASD, as shown in Table 3. These characteristics were organized using Mostafa's ASPECTSS™ framework and then applied to one example of a shared communal space for this intergenerational facility, as shown in Figure 6. This communal space shows the design and architectural community one approach for creatively developing a new housing solution that is safe, flexible, well-defined and accessible for children with ASD and their parents. Although there are other environments that could meet these needs, the authors felt that it would be helpful to show one plan that identified research-informed design characteristics that could easily be applied to other facilities, as shown in Figure 6.

Figure 6: Intergenerational Facility Plan

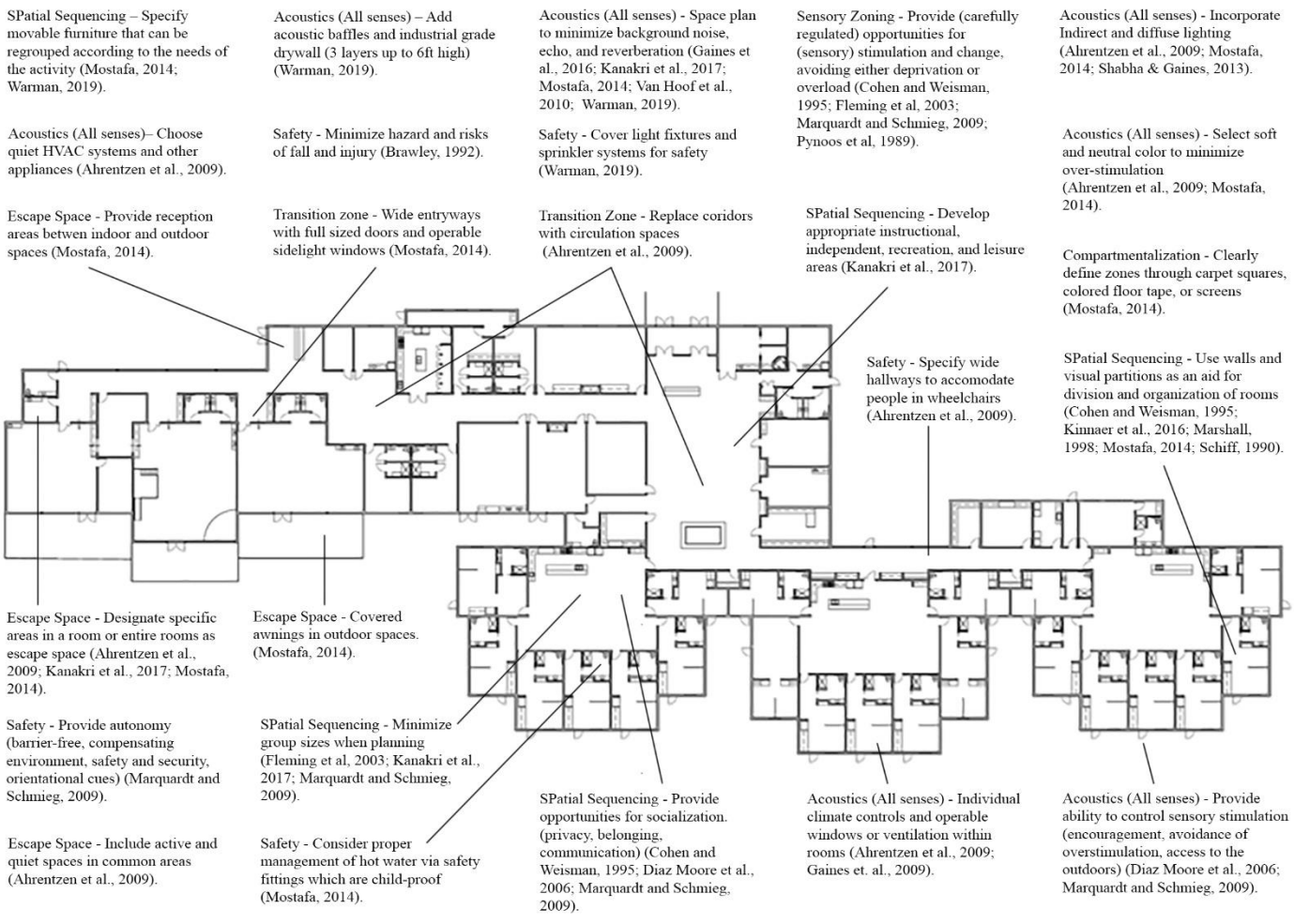

Figure 6: *Intergenerational Facility Plan.*

This figure includes a plan view of this intergenerational facility in which design characteristics were applied. In a general sense, the childcare for children with autism is to the left, shared spaces including recreational and group activity areas are centralized, and the living pods catering to aging adults, both with autism and neurotypical residents are to the right. Mostafa's ASPECTSS™ principles were considered in a more overarching sense on the plan as well. For example, SPatial sequencing was used in locating communal spaces between childcare and resident areas, allowing for an easier transition from either end.

Discussion

Implications to Practice

As 79% of adults with ASD age 18-30 live with their parents (Ahrentzen & Steele, 2009), there is an emerging need to consider housing solutions that not only provide for the specific needs of individuals with ASD and aging adults but to do so in a way that creates a symbiotic relationship between these two groups in a singular facility. This paper described how best design practices (largely informed by the Green House model and Mostafa's ASPECTSS™ framework) were applied to the design of an intergenerational center. There is a clear need for such investigation, as the number of people in our society who are affected by ASD and who are aging is on the rise. Table 1 shows research-informed design characteristics for people on the spectrum while Table 2 shows principles for people who are aging. There is some overlap between the two lists, which was presented in Table 3. This criterion was applied to the intergenerational facility plan, as shown in Figure 6. The importance of developing a housing solution that looks to the needs of aging parents of children with autism is crucial in offering more opportunities to families affected by ASD. Combining design decisions that provide the necessary care to both while allowing families to stay together could be one unique solution.

One limitation of this work is that many of the characteristics that were identified in the literature review include design features that were recommended for aging adults and/or people with ASD. However, applied and systematic testing is scarce, due to the cost of building and retrofitting to better accommodate needs. Often, recommendations that are presented in source materials were shared with researchers from practical experiences by housing and service providers (Ahrentzen & Steele, 2009).

In addition to being different from standard assisted living facilities, this Green House planned intergenerational facility incorporates guidelines from Mostafa's (2014) ASPECTSS™ (Acoustics, **SP**atial sequencing, **E**scape space, **C**ompartmentalization, **T**ransition zones, **S**ensory zoning, and **S**afety) **which are beneficial to neurotypical users and those on the spectrum for creating flexible, safe, and specialized spaces.**

One contribution to the body of knowledge was expanding the definition of ASPECTSS™ Acoustics to include all senses, and to identify environmental characteristics that are consistent across facilities for people who are aging and who are on the spectrum within Thomas' Green House model. We created a residential scale housing solution for 6-10 people per unit that promotes stable and supportive family relationships. Acoustics do not only affect those on the spectrum who have sensitivities to sensory stimuli, but also benefit neurotypical aging adults since older adults in large spaces frequently struggle with sensory issues related to vision, sound and touch (as shown in Table 2). With regards to furniture and finishes, it is clear that designers and architects must remain mindful of the sensory impact of texture, color, etc. in material and finish selections and the impact of these decisions on neurotypical people and those with ASD.

SPatial sequencing arranges spaces in logical order, usually one-way circulation, and utilizes movable furniture to arrange spaces according to the desired use. While this can provide routine and predictability for individuals with ASD, it can also do the same for neurotypical aging adults. Escape spaces provide a break from overstimulation for individuals with autism and can also act as a calming room for others. Even neurotypical individuals can experience overstimulation throughout the day and can benefit from having a place to retreat to compose themselves.

Compartmentalization of spaces provides specific purposes to each space which can be further customized for each user. This also can benefit neurotypical aging adults because having clearly defined areas for different activities, marked by arrangement of furniture or use of materials, can clarify the intent of each space, which aids in orientation. Transition zones can aid people moving from high stimulation to low stimulation areas and are beneficial in creating opportunities for recalibration, such as social spaces between bedrooms and classrooms. Sensory zones can also aid neurotypical aging adults in the same way, since compartmentalization has specific areas with different purposes. Safety is the final component of ASPECTSS™ which is universal to all users, regardless of age or ability. This is particularly important when considering both people with ASD as well as aging residents who often have declining physical health and increased sensory needs.

An intergenerational facility would allow a child with ASD to grow comfortable within a childcare setting, then transition across spaces as they age. This could allow for them to eventually reside in the assisted living facility themselves when their parents are in need of supportive care, simultaneously maintaining close family relationships.

Future research needs to look at the evidence-based effects of these design characteristics to determine to what extent these are applicable to the changing and diverse needs of aging adults and people with autism. Both have cognitive impairments and sensory impairments, and the ability to measure the impacts of these characteristics experientially will be beneficial. Despite the limited scientific evidence of the effectiveness of these characteristics, many hold promise.

Conclusion

Findings show numerous overlapping design criteria for people with autism and aging adults that can lead to effective environmental solutions for both. When integrating Mostafa's ASPECTSS™ framework into the Green House Model, the application of design choices within this housing solution demonstrates that appropriately designed spaces can positively impact persons and families with autism, regardless of age. It is the goal of the authors that these guidelines be utilized as a design tool by families and design professionals for assessing design characteristics that can enhance aging adults' ability to maneuver within the built environment, while simultaneously supporting the diverse needs of their children with autism spectrum disorder. This facility type has the potential to minimize family fracture since aging parents are supported in their ability to care for their child with autism. This design is unique in that it takes a lifespan approach, considering the changing abilities and needs of diverse users across time. Enhanced knowledge can serve to support the family unit while providing an environment that is safe and suitably designed.

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References

1. Ahrentzen, S., & Steele, K. (2016). How do you design a home for someone with autism?
2. Ahrentzen, S. & Steele, K. (2009). Advancing full spectrum housing: Designing for adults with autism spectrum disorders.
3. Brawley, E. (1992). Alzheimer's disease: Designing the physical environment. *American Journal of Alzheimer's Care and Related Disorders & Research, 7*(1), 3-8.
4. Burton, E. & Torrington, J. (2007). Designing environments suitable for older people. CME Journal of Geriatric Medicine. 9, 39-45.
5. Center for Disease Control and Prevention (CDC) (2020). Prevalence of Autism Spectrum Disorder among children aged 8 Years - Autism and Developmental Disabilities Monitoring Network l, 11 Sites, United States, 2016. *CDC Morbidity and Mortality Weekly Report (MMWR), 69*(4), 1-12.
6. Clouse, J. R., Wood-Nartker, J., & Rice, F. A. (2019) Designing beyond the Americans with disabilities act (ADA): Creating an autism-friendly vocational center. *Health Environments Research & Design Journal,* 1-15;
7. Cohen, U., & Weisman, G.D. (1995). Holding on to home: Designing environments for people with dementia. Baltimore, MD: The Johns Hopkins University Press.
8. Cohen, L.W., Zimmerman, S., Reed, D., Brown, P., Bowers, B. J., Nolet, K., Hudak, S., & Horn, S. (2016). The Green House Model of nursing home care in design and implementation. *Health Services Research, 51*(Special Issue), 352-377.
9. Delcampo-Carda, A., Torres-Barchino, A., & Serra-Lluch, J. (2019). Chromatic interior environments for the elderly: A literature review. *Color Research & Application,* 44(3), 381-395.
10. Diaz Moore, K., Geboy, L.D., Weisman, G.D. (2006) Designing a better day. Guidelines for adults and dementia day services centers. Baltimore, MD: The Johns Hopkins University Press.
11. Fleming, R., Forbes, I. Bennett, K., New South Wales Department of Health & Hammond Care Group (2003). Adapting the ward: for people with dementia. Sydney: NSW Health,
12. Gaines, K., Bourne, A., Pearson, M., & Kleibrink, M. (2016). *Designing for Autism Spectrum Disorder: Design Considerations for ASD*. New York, NY: Routledge.
13. Harrison, K., Ritchie, C., Patel, K., Hunt, L., Covinsky, K., Yaffe, K., & Smith, A. (2019). Care settings and clinical characteristics of older adults with moderately severe dementia. *Journal of the American Geriatrics Society. 67*(9), 1907-1912.
14. Herdman, T., & Kamitsuru, S. (2014). NANDA International nursing diagnoses: Definitions & classification, 2015–2017. Oxford: Wiley Blackwell.
15. Joseph, A. (2006). *Health Promotion by Design in Long-Term Care Settings*. California HealthCare Foundation.
16. Kanakri, S. M., Shepley, M., Tassinary, L. G., Varni, J. W., & Fawaz, H. M. (2017). An Observational Study of Classroom Acoustical Design and Repetitive Behaviors in Children With Autism. *Environment and Behavior, 49*(8), 847–873.
17. Kinnaer, M., Baumers, S., & Heylighen, A. (2016). Autism-friendly architecture from the outside in and the inside out: An explorative study based on autobiographies of autistic people. *Journal of Housing and the Built Environment, 31*(2), 179-195.
18. Maenner, M.J., Shaw, K.A., Baio, J., et al. (2016). Prevalence of autism spectrum disorder among children aged 8 years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2016. MMWR Surveillance Summary 2020. No. SS-4), 69, 1-12.
19. Marquardt, G., & Schmieg, P. (2009). Dementia-friendly architecture: Environments that facilitate wayfinding in nursing homes. *American Journal of Alzheimer's Disease & Other Dementias, 24*(4), 333-340.
20. Marshall, M., (1998). Therapeutic buildings for people with dementia. *Design for dementia. London: Hawker Publications*, 11-4.
21. Ministry of Community and Social Services. (1990). *Dementia and activities of daily living. A report on technologies and environmental design that can assist people with Alzheimer disease and related dementias.* Toronto, ON: Ministry of Community and Social Services.
22. Mostafa, M. (2018). Designing for autism: An ASPECTSS™ post-occupancy evaluation of learning environments. *International Journal of Architectural Research: ArchNet-IJAR, 12*(3), 308-326.
23. Mostafa, M. (2014). Architecture for autism: Autism ASPECTSS in school design. *International Journal of Architectural Research: ArchNet-IJAR, 8*(1), 143-158. https://archnet.org/publications/9101
24. Mykyta L. (2012). Economic downturns and the failure to launch: The living arrangements of young adults in the U.S. 1995-2011. U.S. Census Bureau. http://www.census.gov/hhes/www/poverty/publications/WP2012-24.pdf. Table A2 Number of Young Adults and Percent of Young Adults In Living Arrangement, By Age 1995-2011
25. Pastalan, L. A. (1977). The Empathic Model a methodological bridge between research and design. *Journal of Architectural Education, 31*(1), 14-15.
26. Pastalan, L. A., Mautz, R.K., Merrill, J. (1973). The simulation of age-related sensory losses: A new approach to the study of environmental barriers. *Environmental Design Research,* 1, 383-391.
27. Pynoos, J., Steinman, B. A., Do Nguyen, A. Q., Bressette, M. (2012). Assessing and adapting the home environment to reduce falls and meet the changing capacity of older adults. *Journal of Housing for the Elderly, 26*(1-3), 137-155.
28. Romli, M.H., Tan, M.P., Mackenzie, L., Lovarini, M., Kamaruzzaman, S.B., Clemson, L. (2018). Factors associated with home hazards: Findings from the Malaysian Elders Longitudinal Research study. *Geriatrics & Gerontology International, 18*(3), 387-395.
29. Sánchez, P. A., Vázquez, F. S., & Serrano, L. A. (2011). Autism and the built environment. In Autism Spectrum Disorders—From Genes to Environment, edited by Tim Williams, 363–80. Rijeka, Croatia: InTech.
30. Schiff, M. R. (1990). Designing environments for individuals with Alzheimer's disease: Some general principles. *American Journal of Alzheimer's Care and Related Disorders & Research, 5*(3), 4-8. doi:10.1177/153331759000500303
31. Shabha, G., & Gaines, K. (2013). A comparative analysis of transatlantic design interventions for therapeutically enhanced learning environments-Texas vs West Midlands. *Facilities, 31*(13/14), 634-658.
32. Svend, E. M. (2013). Mortality and factors associated with death is autism spectrum disorders. *American Journal of Autism,* 1, 17-25. doi:10.7726/aja.2013.1002
33. J van Hoof, J., Kort, H., van Waarde, H., & Blom, M. (2010). Environmental interventions and the design of homes for older

adults with dementia: An overview. *American Journal of Alzheimer's Disease & Other Dementias, 25(3), 202-232.*
34. Warman, A. (2019). Personal interview conducted by Dr. Wood-Nartker in 2019.
35. Wood-Nartker, J., Beuschel, E., & Guerin, D. (2019). Design guidelines to reduce extrinsic fall risks in the built environment. *OBM*, *3*(4), 21; doi: 10.21926/obm.geriatr.1904095. Special Issue: Mobility and Aging: Falls Prevention Among the Elderly.
36. Zgola, J. (1990). Alzheimer's disease and the home: Issues in environmental design. *American Journal of Alzheimer's Care and Related Disorders & Research*, *5*(3), 15-22. doi:10.1177/153331759000500305

DOI: 10.31579/2767-7370/020