



ADVANCING FULL SPECTRUM HOUSING

Designing for Adults with Autism Spectrum Disorders

Produced by

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Step Up on Second & Step Up on Fifth

Stoney Pine Villa

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The inability to get consistent meaning through my senses meant I developed an ability to respond not to meaning but to patterns. Donna Williams [4]

*Many descriptions of autism and Asperger's describe people like me as "not wanting contact with others" or "preferring to play alone" ... but I'd like to be very clear about my own feelings: I did not ever **want** to be alone. I played by myself because I was a failure at playing with others. I was alone as a result of my own limitations, and being alone was one of the bitterest disappointments of my young life.*

John Elder Robison [3]



People are always looking for the single magic bullet that will totally change everything. There is no single magic bullet.

Temple Grandin [1]



Our brains are wired differently. We take in many sounds and conversations at once. I take over a thousand pictures of a person's face when I look at them. That's why we have a hard time looking at people.

Carly Fleishmann [2]

... the research, the grant money, the treatments [are] relentlessly toward the children..... For adult autistics, much is just as it was 50 years ago. State institutions for the developmentally disabled. Group homes run by those of varying qualifications. Living at home with aging parents. Karl Taro Greenfield [5]



INTRODUCTION

For many people, their initial and sometimes only exposure to adults with autism is the main character portrayed by Dustin Hoffman in the 1989 film *Rainman*. The character, Raymond Babbit, whom Hoffman portrayed, appeared to be mentally disabled yet impressed others with his prodigious memory and amazing dexterity in calculating numbers. He was extremely naïve and had no idea that his brother was scheming to take advantage of him. He did not realize how difficult his rigid behavioral routines were for others. He unflinchingly carried out their ridiculous requests—like reading the phone book—without question [6].

While *Rainman* may have exposed the world of an adult with autism to the larger population, it was only a small peek into that world. Less than ten percent of individuals with autism spectrum disorders (ASDs) have the savant-like gifts of Hoffman's character [7]. Some are difficult to live with; many have additional physical and intellectual problems. Most have very limited financial resources. Many are challenged by the physical and social worlds in which they live. Adults with autism are, however, becoming more visible in our communities. Because of growing advocacy for community-living options for adults with neurobiological conditions and because of the aging of their parents in whose homes they live, adults with ASDs, their parents and advocacy groups are seeking residential opportunities

outside traditional institutions and the parental home. Architects, housing providers, and developers will be called upon to plan, design, retrofit, and develop homes and residential developments that best fit the needs and aspirations of this new housing consumer. But many in the housing and real estate development industries are stuck with the image of Dustin Hoffman's character when they envision an adult with an ASD.

This report introduces housing providers, architects, developers, planners, public officials, and others involved in the residential development industry to conditions and aspirations of adults with ASDs that demand a new approach to how we provide, design, and develop homes in which they live.

This report is an initial effort to formulate evidence-based design goals and guidelines to direct future housing design and development. As research continues and new sites of housing appear on our residential landscapes, we hope these guidelines are reassessed, evaluated, refined, and expanded. There is no singular perfect residential model, just as there is no singular prototype of autism. We advocate here a diversity of residential accommodations that collectively respond to the spectrum of individuals with ASDs.



CURRENT CONDITIONS, EMERGING TRENDS

More than 60 years ago, American psychiatrist Leo Kanner described a group of children with difficulties in speech, communication, and emotional contact, who displayed stringent repetitive behavior and routines. At about the same time, Austrian pediatrician Hans Asperger identified similar problems but among individuals with higher levels of language ability. Over the years, specialists recognized that these two accounts were describing variations of the same phenomenon. Since then there has been worldwide attention to autism. Today the disorder is explained in the International Classification of Diseases (ICD10) by the World Health Organization and the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) of the American Psychiatric Association.

Autism is a complex neurobiological disorder. Researchers now believe that it is many diseases with multiple distinct causes. Research undertaken by the Centers for Disease Control demonstrates that it occurs in all racial, ethnic, and social groups and is four times more likely to strike boys than girls [8]. To complicate matters further, individuals with autism often have other health issues as well. Once thought to be mainly a disease of the cerebellum, autism is increasingly seen as a pervasive problem with the way the brain is wired. More commonly used today is the term Autism Spectrum Disorders or ASDs.

Many classic symptoms of autism—for example, spinning, endlessly repeating phrases—appear to be coping mechanisms rather than hard-wired behaviors. Other symptoms, such as lack of emotional expression, are now largely seen as artifacts of impaired communication. [6]

While the signs of ASDs vary enormously among individuals—and why the term spectrum is used to reflect the wide range of occurrence and severity of these difficulties—three core features characterize ASDs [8, 9].

1. DIFFICULTIES IN SOCIAL INTERACTION

This goes beyond being a loner or acting clumsy or awkward in social situations. Most children with ASDs have difficulty learning to engage in everyday interaction with peers and family. They avoid eye contact, seem indifferent to others, and often appear to prefer being left alone. Children with ASDs are slower in learning to interpret what others are thinking and feeling, and they may have difficulty seeing things from another person's perspective. Some individuals with ASDs also have problems controlling their emotions, being disruptive and physically aggressive at times, making it further difficult to cultivate social relationships.

2. DIFFICULTIES IN VERBAL AND NONVERBAL COMMUNICATION

Some individuals with ASDs remain nonverbal throughout their lives; others may develop language later than their peers, at ages five to nine. Some may communicate using pictures or sign language. Those who do speak often use language in unusual ways. They may not be able to combine words into meaningful sentences. Some may speak only single words, while others repeat the same phrase over and over. Conversation may be impossible to negotiate, while a monologue on a favorite subject may persist indefinitely. It can be difficult to understand their body language as facial expressions, movements, and gestures often do not match what they are saying. Without meaningful gestures or the language to ask for things, they often are at a loss to let others know what they need or want.

3. RESTRICTED, REPETITIVE PATTERNS OF BEHAVIORS, INTERESTS AND ACTIVITIES

Odd repetitive motions often distinguish individuals with ASDs from other children or adults. Some children and older individuals repeatedly flap their arms or walk on their toes. Some suddenly freeze in position. There is strong resistance to change and aversion to novelty. Doing the same thing—watching the same video, eating the same food, rocking in the same manner in the same place on the floor—day after day, is the kind of excessive pattern that can be found in children with ASDs. Children with ASDs often need and demand absolute consistency in their environment. This may be less noticeable in adults with ASDs where the behavioral repertoire may have widened through learning and experience.

In addition, many individuals with ASDs may be painfully sensitive to sensory experiences. Many are highly attuned to certain sounds, textures, tastes, and smells. Some find

the feel of clothes touching their skin almost unbearable. A vacuum cleaner or a ringing telephone may disturb them enough to cover their ears and scream. Emotional and behavioral patterns also may accompany autism, such as strong impulses, compulsions, or excessive anxiety. Many children with ASDs have some degree of mental impairment. One in four children with ASDs develops seizures by puberty [10]. This can produce a temporary loss of consciousness, body convulsion, unusual movements, or staring spells.



There is a wide range in the severity of these symptoms, from profound impairment to milder, high-functioning forms.

For many high-functioning individuals, such as those with Asperger's syndrome, diagnosis may come at a much later age. The Centers for Disease Control identifies three different types of ASDs; the American Psychiatric Association describes a class of five types. For the purposes here, it is only important to recognize that there are differences among individuals when the symptoms start, how severe or mild they are, and what is their particular nature. The ability of adults with ASDs to take care of themselves, to manage a job and home, or to take care of financial obligations is contingent upon not only the severity and nature of the disorder but also the need-based education they received as children. Paying bills, cooking, washing dishes, and other independent behaviors can sometimes be taught. Other times, special services may be required to help individuals live more productive lives. Some adults with ASDs have families, careers, and social lives and live in their own homes [11].

Derived from numerous epidemiological reports, current estimates of the U.S. population under 20 years of age with ASDs range between 486,000 and 567,000 [12]. According to studies conducted by the Centers for Disease Control and Prevention in 2000, about one in 150 American children born today will fall somewhere on the autistic spectrum [8] [An updated prevalence report by the CDC is currently in press]. That is double the rate of ten years ago and ten times the estimate of a generation ago. There is much speculation about the rapid rise in these numbers: the expansion of the diagnostic range such that autism is now recognized as a spectrum disorder, the increased prevalence of services, and a heightened awareness of the condition by parents and professionals play major roles in explaining this increase in diagnoses. Children now diagnosed with ASDs might have been given a different diagnosis (such as mental retarda-



tion or language disorder) in the past. Children with mild symptoms may not have been diagnosed with any disability. Also there is continuing research and speculation that other factors, such as environmental, may be contributing to an increase in the incident of ASDs [13].

There are no reliable, wide-scale epidemiological surveys of the prevalence of adults with ASDs as there have been with children.

A proxy portrait of living conditions and arrangements of these adults may be derived from Census figures of adults with mental disabilities, which would include those with ASDs [14]. Of the U.S. population 15 years and older, approximately 16 million, or 7 percent, have mental disabilities, representing people with learning disability, mental retardation, or another developmental disability; attention deficit hyperactivity disorder; autism; senility; dementia or Alzheimer's disease; or other mental or emotional condition that seriously interferes with everyday activities or difficulties managing money and bills. Clearly this is a much



DD—did not differ significantly in lifespan from the general population [16].

Together, these numbers and trends suggest the rising demand for appropriate and effective services, including residential accommodation and support, for adults with ASDs as well as those with other I/DD.

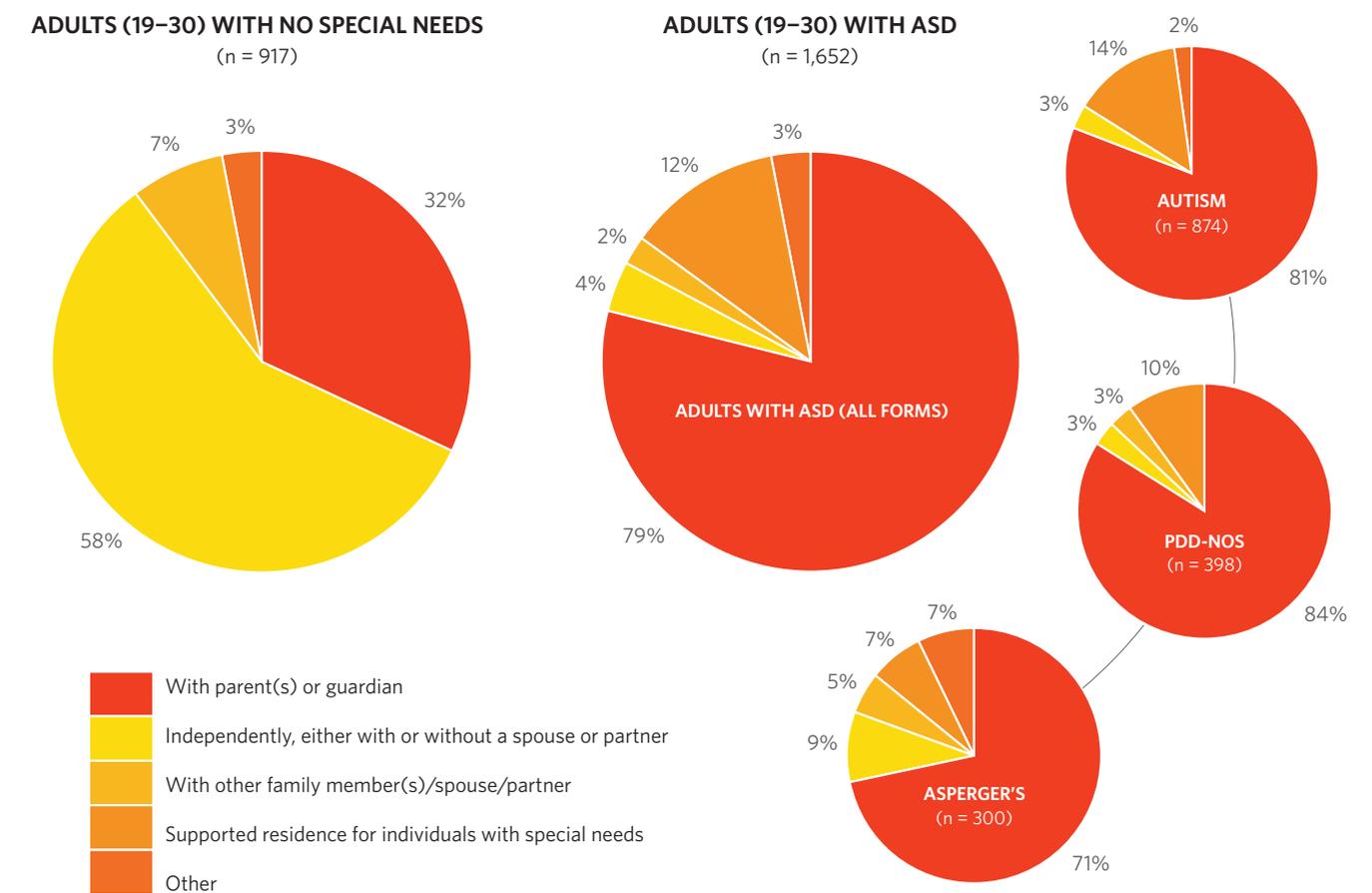
While researchers, psychiatrists, and counselors continue to learn more about ASDs, a large gap in our knowledge is what happens to individuals with autism as they age. Some adults with ASDs, especially those with high-functioning autism or with Asperger’s syndrome, are able to work successfully in mainstream jobs. Many others are employed in sheltered workshops under the supervision of managers trained in working with persons with disabilities [9]. One critical point in the lives of most adults with ASDs is “aging out” of the service care system available in all states to persons under the age of 22 when the public schools’ responsibility for providing service ends. Advocates, parents, and service providers are beginning to develop programs, practices, and strategies that attend to the living situations of these adults with ASDs.

broader classification than simply ASDs. But of those with a mental disability between the ages of 21 and 64, approximately 38 percent were employed, with median monthly earnings of \$1,516 and median family income of \$2,165. The low-income nature of these adults is also evident in the poverty figures. An analysis of the 1994/1995 National Health Interview Survey shows that nearly 32 percent of noninstitutionalized persons 19 years and older with intellectual or developmental disabilities (I/DD) were at or below poverty level [15]. This compares to approximately 11 percent of adults without I/DD at the time. A 2003 study concluded that life expectancy for persons with mild and moderate degrees of impairment—the vast majority of persons with I/

RESIDENTIAL LIVING ARRANGEMENTS

As mentioned previously, there is very little research showing the prevalence of adults with autism, including a lack of systematic information of where and how they live as adults. One exception is a study undertaken by Easter Seals in 2008 that included questions about young adults (less than 30 years of age but having finished high school) [17]. As Figure 1 reveals, most young adults with ASDs live with their parents, more than double that of young adults without special needs. Nearly three times as many of those with Asperger’s than those with autism or PDD-NOS (i.e.

FIGURE 1 – CURRENT LIVING ARRANGEMENTS OF YOUNG ADULTS WITH ASDS AND THOSE WITHOUT SPECIAL NEEDS: 2008



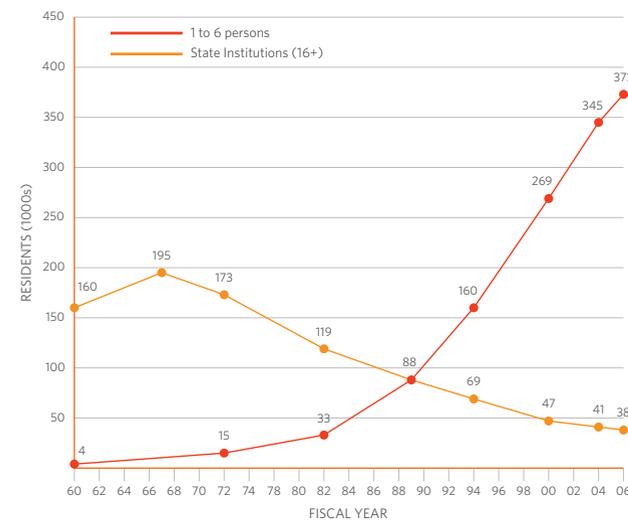
source: Harris Interactive [17]

pervasive development disorder-not otherwise specified) live independently, albeit still a small number. Of those adults living in supported residences¹ for individuals with special needs, 84 percent have round-the-clock care while 16 percent have less than 24/7 care.

What happens after age 30? What is the scale and scope of nonfamily living arrangements or supported residences? With virtually no systematic, larger-scale research on adults with ASDs, documentation of living accommodations for adults with I/DD may provide the best clues at this time of possible residential living arrangements for

adults with ASDs. In general, over the last couple decades, the nation has moved from large-scale institutional facilities to community residential services as shown in Figure 2 [18]. Approximately 26 percent of persons receiving I/DD residential services live in their own homes that they own or lease. Over 45 percent of those receiving HCBS² (Home and Community Based Services) waivers live with their parents or other family members. Indeed, during the past decade, the estimated number of HCBS recipients living in their family home increased by 285 percent, more than twice the increase in the number of all HCBS recipients during the same period. In 2006, total residential placements outside one's home or parental home included 532,830 persons in various settings, as indicated in Figure 3³. Most of these individuals live in small, one- to six-person residences [19].

FIGURE 2 – RESIDENCY TRENDS FOR PERSONS WITH I/DD RESIDING IN SMALL AND LARGE SETTINGS



source: Braddock, Hemp & Rizzolo [19]

Demand for services or new residential accommodations for people with intellectual or developmental disabilities who reside with aging family caregivers is projected to increase significantly.

2006, for example, approximately 2.8 million of the 4.7 million persons of all ages with I/DD in the U.S. were receiving residential support from family caregivers. As shown in Figure 4, an estimated 717,000 persons, or 15 percent of all individuals with I/DD, were residing with caregivers age 60 and older and may be expected to require out-of-home residential support in the very near future [19].

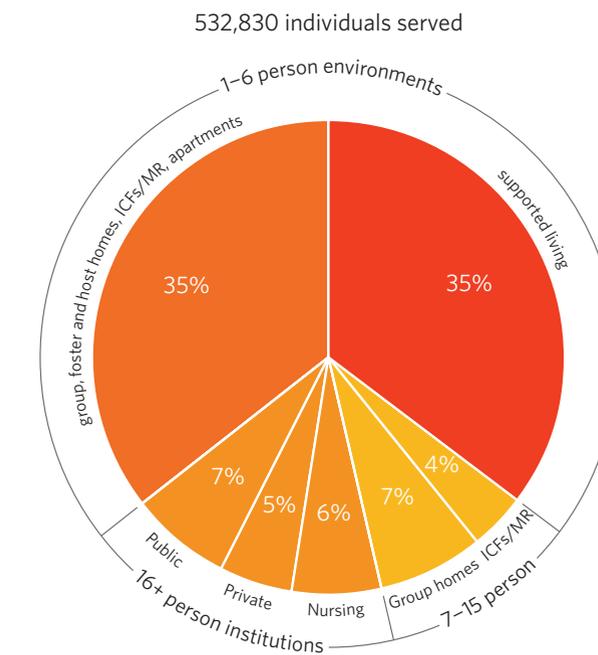
SOCIETAL COSTS OF AUTISM

According to research from Harvard School of Public Health and Abt Associates, lifetime per capita incremental societal cost of autism is \$3.2 million [20]. This includes direct medical costs to the individual, direct nonmedical costs (e.g. child care, adult residential placement, and home and vehicle modifications), and indirect costs (i.e. value of lost or impaired work time and income, benefits, and household services of individuals with autism and their caregivers because of missed time at work, reduced work hours, etc.).

Lost productivity and adult care are the largest components of costs.

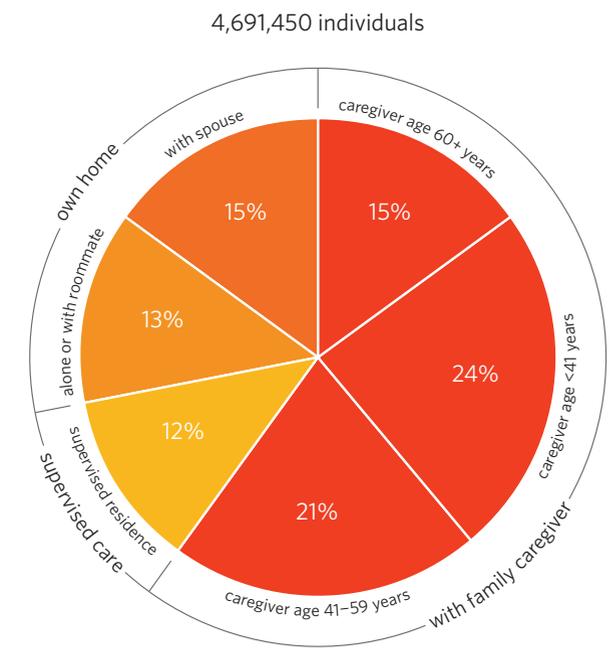
Total lifetime costs (ages 23 through 66) of adult care for an individual with an ASD are \$662,192. Adult care includes that of day programs, home and community services, institutional services, and residential placement services.

FIGURE 3 – OUT-OF-HOME RESIDENTIAL PLACEMENTS OF INDIVIDUALS WITH I/DD: 2006



source: Braddock, Hemp & Rizzolo [19]

FIGURE 4 – ESTIMATED LIVING ARRANGEMENT OF INDIVIDUALS WITH I/DD (ALL AGES)



source: Braddock, Hemp & Rizzolo [19], Fujiura [30]

Chapter Footnotes

1 Supported living typically includes housing in which individuals choose where and with whom they live, ownership is by someone other than the support provider, and the resident has a personalized support and care plan that changes as her or his needs and abilities change [19].

2 Authorized by Congress in 1981 as an alternative to ICF/MR program, HCBS is the principal Medicaid program underwriting I/DD long-term care. It includes federal reimbursement for

a wide range of community services and supports including supported living and other types of assistance in homelike, community-based services. HCBS waiver is the principal funding source for services that support individuals living in the family home [19].

3 These figures include both children and adults, but since most children would still live at home with their parents, it is likely they are minimally represented in these figures.

or with agency/provider-chosen roommates), (3) degree of occupancy mix in the residential complex (if larger than independent single-family home), and (4) types of residential and care support (which often corresponded with whether office and residence of support staff were colocated in the resident’s home or housing complex). We term this “residential accommodation” instead of simply “housing” to reflect the nature of both the residential structure and the occupancy of the dwelling and development. (More detailed description, including definition of terms, is located at http://stardust.asu.edu/research_resources/detail.php?id=60.)

RESIDENTIAL BUILDING TYPE

- Independent detached home
- Independent attached home (e.g. townhome)
- Cluster of detached homes (e.g. planned residential development)
- Attached home, 2-5 units (e.g. duplex)
- Attached home, 6+ units (e.g. apartment, condominium), no common/shared spaces
- Attached home, 6+ units (e.g. assisted living complex), with common/shared spaces
- Attached efficiency units or guest rooms (e.g. single-room occupancy housing)

RESIDENT OCCUPANCY OF DWELLING UNIT

- With family only
- With self-selected friends or roommates (or alone)
- With agency/provider-selected roommates

RESIDENT OCCUPANCY OF RESIDENTIAL COMPLEX

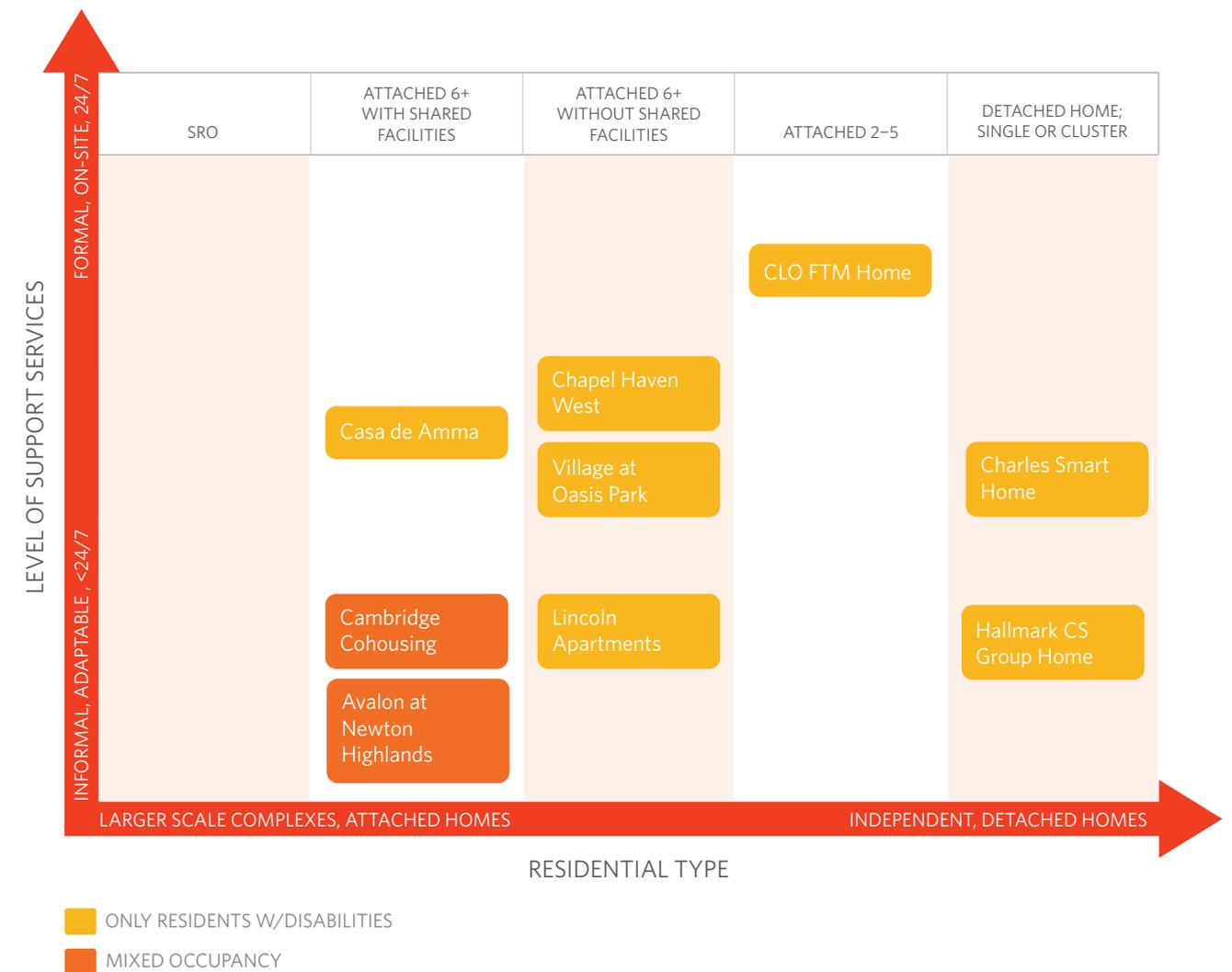
- Mixed
- Exclusionary

TYPES OF RESIDENTIAL AND CARE SUPPORT

- Supported and personal assistance (support staff/caregivers living off-site)
- Supervised (support staff/caregivers living on-site or working office is on-site)
- Long-term institutional (constant) care (extensive offices/service spaces on-site, some staff may be live-in, staff present during sleeping hours)
- Transitional training (supervised but only temporary)

Using these characteristics, we identified nine sites (in California, Arizona, Colorado, Massachusetts, and Kansas) that together demonstrate a range of the residential accommodations considered “best practices” (see Figure 5). Our profiles of these case studies are provided in a separate document located at: http://stardust.asu.edu/research_resources/detail.php?id=60.

FIGURE 5
RESIDENTIAL TYPE AND SUPPORT SERVICES FOR CASE STUDY PROJECTS



RESIDENT-BASED DESIGN GOALS

The homes and neighborhoods where adults with ASDs live may significantly impact the quality of their lives. Yet many housing providers, developers, and architects are unfamiliar with how residential design factors and neighborhood amenities affect these residents' well-being.

For adults with ASDs, dealing with the world and its people can be challenging and can dissolve into misunderstanding, stress, anxiety, and what appears to many as eccentric reactions. Housing providers and architects need to know how best to create autism-friendly environments and how residents can be helped to manage in their homes and their wider communities. Optimal design and neighborhood selection at the outset can help avoid later problems that may necessitate a subsequent move, which could prove debilitating for these residents who need stability and consistency in their lives.

Good design and community access is also critical for caregivers since the quality of their care, and their desire to continue their service, can be supported in part by the environment and resources in which they work. Not only does turnover of care providers result in considerable financial costs, it can trigger behavioral and emotional crises among residents as well [22]. The more that care providers feel the environment supports them in their work and also al-

lows them opportunity for respite and restoration, the more likely they will be to stay in their positions [23].

Since most architects and housing providers have little familiarity in how design can best accommodate and ameliorate the challenges and conditions faced by adults with autism, the design goals below and accompanying design guidelines in the next section can act as guideposts when developing new or renovated homes for adults with ASDs. What follows will not apply to everyone, however. Responses to particular features can be very individual. Clearly there is no one perfect model. There must be a range of options so that individual circumstances, needs, and inclinations can be accommodated.

The aim of these design goals and guidelines is to provide a robust platform that architects, housing providers, family, and residents can use to identify and select design features that best respond to specific needs and aspirations of the residents.

To establish a basis for the design guidelines that follow in the next section, the following ten design goals were crafted from a synthesis of the available research literature as well as our case study research (see Appendix A for



further information). These goal statements reflect general ways in which the design can enhance and optimize residents' needs. In some instances goals may overlap or even conflict with one another. Nevertheless, an understanding of such goals can sensitize housing providers to some of the higher-level priorities to which any environment for adults with ASDs should respond.

They should also be key considerations when quality control or cut-backs in construction, design, or materials are being debated to better recognize the behavioral and health consequences of such decisions on residents.



ENSURE SAFETY & SECURITY

Ensuring that residents sustain no harm is the first priority of any safe living environment. Although concerns of safety and security are often reflected in building codes and standards, these codes primarily address basic life safety issues (e.g. fire

retardant construction) with very little attention on unique circumstances of special populations such as adults with ASDs. Yet as a consequence of their social, sensory, and learning impairments as well as limited experience of living outside the parental home, adults with ASDs can be more susceptible and vulnerable to environmental, social, and physical conditions that threaten their security and safety. If residents have balance control difficulties or visual impairments, accidents and movement in the home becomes particularly problematic. If residents need assistance with basic self care, attention to appliances and fixtures need to be carefully considered. Controlling access to the home or yard may be necessary for those residents who tend to wander off and are unaware of potentially dangerous situations on public streets. Supervision and ease of observation are other elements of managing the environment to ensure safety. In addition, toxic substances are increasingly important in explaining possible causes of certain disorders as well as exacerbation of particular conditions and behaviors. Designers and contractors need to pay particular attention to specifying products and materials that reduce exposure to toxic chemicals.



MAXIMIZE FAMILIARITY, STABILITY & CLARITY

A major characteristic of autism is difficulty with transitions. For those leaving homes they have lived in for many years, moving into a new residence and neighborhood can be a very disorienting experience. Adults with ASDs can become confused and frightened with changes in place and organization. Creating continuity and connection with the past is reassuring and facilitates the transition. The design of homes and support services should all work to maximize the awareness and orientation of these adults to their physical and social environment, assisting them in "knowing where they are" in terms of time, place, and

social situation. Regular daily occurrence of activities, such as meals—where and when it takes place—can provide both the structure and predictability residents need. Residents take cues from the environment. When it is designed to accommodate familiar events and patterns, when the layouts and design features are clear and simple, it is more predictable and understandable [24]. Dedicated spaces for particular activities are consistent with residents' adherence to routines. It is important to maintain ties to that which is healthy, familiar, and comfortable. The creation of a familiar-looking environment provides the sense of "soft transition" needed for what can be a rather traumatic experience. Links to the past can also be maintained by regular visits of family and friends, fostering therapeutic benefits and personal services for residents.



MINIMIZE SENSORY OVERLOAD



Persons suffering from sensory overload may react adversely to what may seem ordinary sensory stimulation such as striped wallpaper in primary colors, the hum of a refrigerator, or the flicker of a fluorescent lamp. Sen-

sory stimulation can involve aromas from the kitchen or garden, colors and patterns from furnishings, laughter from conversations, even texture of certain fabrics. Many adults with ASDs cannot process what neurotypicals would consider moderate levels of light, noise, color, smells, and textures without experiencing sensory overload and distress. Researchers have found that many children with ASDs see colors with greater intensity than others. Sounds commonly identified as causing stress to the hypersensitive are those associated with heating systems, domestic appliances, and ventilation fans. Use of artificial light and various fabrics and colors may have similar effects [25].

Given these conditions, simplifying the sensory environment is critical. A building that has a sense of clarity and order has a calming effect for residents. Yet settings devoid of sensory stimulation may not be therapeutic and may even exacerbate some ASD-related symptoms. A certain level of stimulation helps keep people alert and engaged. Natural light, for example, can have positive health effects. A neutral sensory environment can be designed so that elements and features can be added to accommodate the sensory sensitivity of individual residents. It is easier to add stimulation from a moveable nonpermanent source, like a painting or iPod, than to remove stimulation from a fixture that is relatively permanent or structurally embedded.

Individuals with ASDs may identify the architectural environment around them in accordance to sensory zoning

rather than conventional functional zoning. As such, spatial groupings should be logical and involve sensorial compatible functions. Such zoning in the home, for example, might entail certain colors to communicate to residents the character or function of various zones and spaces. Visually distinctive landmarks (for example, an overstuffed chair) may be used as environmental cues. Compartmentalization of rooms may help the hypervisual and even hyperauditory individual remain focused and not be distracted from sounds or objects in one’s peripheral vision [26].



ALLOW OPPORTUNITIES FOR CONTROLLING SOCIAL INTERACTION & PRIVACY

Social interaction is a significant therapeutic activity but can be a major challenge for adults with ASDs. Connections with relatives, health personnel, caregivers, and roommates need to be robust. Given the difficulties of responding to social presence, homes should have a variety of spaces where different types of social interaction can occur, allowing for resident choice, need, and ability. Former schools often provided structured socialized activities (e.g. dances) so that adults who have not developed social alternatives after they leave school may suffer. This can be a very serious problem for adults with Asperger’s Syndrome and is related to a greater incidence of depression in some individuals [27]. For those who have speech and language limitations, technological assistive devices and picture-based communication systems can help residents communicate.

Adults with ASDs vary in the amount of personal space needed to feel comfortable. What the adult with ASDs perceives as crowded may not be what architects and designers typically perceive [21]. If there are to be roommates, a total of two or three individuals seems to be optimal in

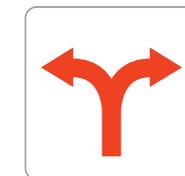
terms of sharing space and minimizing disruption. More than six adults in the same living unit may appear crowded, and residents may begin to be disturbed by competing stimuli and lack of space [27]. When small, rooms should be designed to give the illusion of additional space, and for many residents it is desirable to have more than one room to the dwelling [27]. If a building can be designed to allow for both common areas where people can mix and separate places where individuals can withdraw, then residents have the opportunity to manage social discomfort more easily. Providing opportunities for privacy allows the resident to control desired and undesired social interaction. Clearly defined boundaries between shared and private spaces reduce ambiguity in knowing which spaces are shared and where social interaction is expected to oc-



cur and those that are private and belong to an individual. Knowing that one has access to a private or “escape” space can also make social interaction more comfortable for autistic individuals [26].

Not only residents, but caregivers and health personnel need spaces where they can effectively interact with residents as well as spaces for personal retreat and privacy. The ability to visually monitor residents without invading their personal space can help reduce stress among care providers [28].

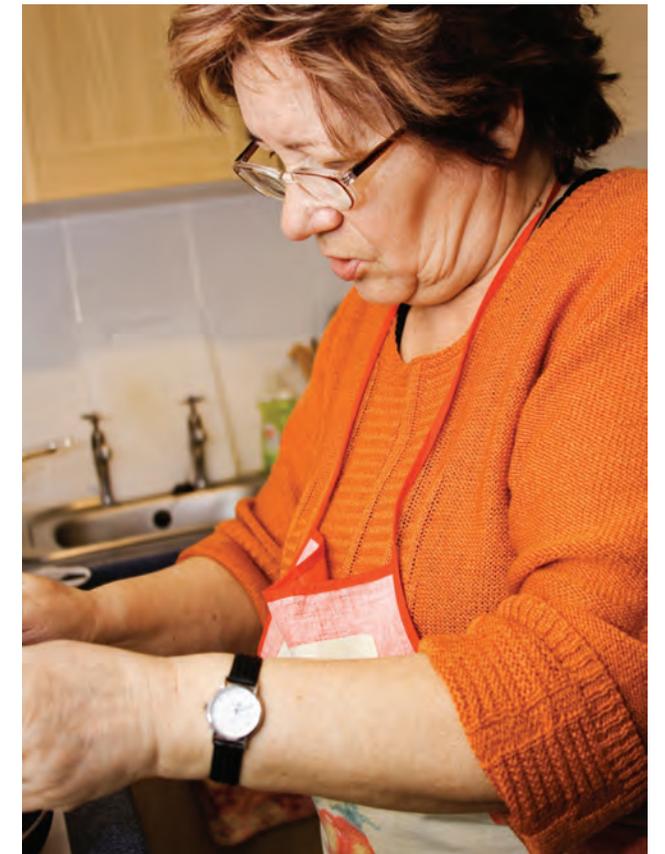
PROVIDE ADEQUATE CHOICE & INDEPENDENCE



Our sense of independence and self-worth is often shaped by our ability and opportunity to make choices, control events, and be autonomous. Yet choice can be a potential minefield for many adults with ASDs who may view multiple options with uncertainty and subsequently threatening. Offering options can work effectively when residents are guided to understand the consequences of decisions and when the number of options is limited. The physical environment should be designed so that options are available but few and flexible and so that it can be adapted to changes in residents’ needs over time.

Having one’s own apartment is viewed as a hallmark of independence by many young adults with autism and developmental disabilities [29]. The ability of these adults to take care of themselves is often directly related to the need-based education they received as children [11]. Being able to maintain a home can be challenging yet also important in reinforcing one’s sense of independence. Preparing meals can seem overwhelming for residents who have low levels of frustration or when they are depressed. Maintain-

ing one’s home or personal hygiene can also be challenging for residents with intellectual and mental health difficulties. For these reasons, how bathrooms and kitchens are designed, what finishes are specified, and the amount of storage space available, can make such daily living tasks more manageable. Assistive technology is increasingly being developed for the home that supports adults with ASDs to live more independently. Devices can minimize risk and provide assistance and greater qualitative support rather than intensive care.



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FOSTER HEALTH & WELLNESS

Many adults with ASDs have co-occurring health problems. Brain seizures, mental retardation, diarrhea and

constipation, sleep disorders, and other ailments inflict a number of these adults. The core characteristics of ASD—routinized behavior patterns, impaired social skills, poor or lack of communication—can create a series of secondary emotional problems: inability to cope without help, fear and frustration in everyday living, and social difficulties of isolation and loneliness. Physical features, materials, and layout should be designed and selected so as to reduce provoking added stress that may be elicited from what residents perceive as noise and crowding. Residents with ASDs often require ample space both with respect of room and corridor sizes—and even at times ceiling height—to accommodate gross movement activity without inflicting bruising or injury [25]. Residents may also be prone to physical ailments and susceptible to chemicals and substances found in many building materials and furnishings. Because of this increased vulnerability to ongoing health problems, designers and contractors need to be particularly attentive to not specifying residential features

and materials that may exacerbate chronic afflictions such as asthma, allergies, lead poisoning, chemical sensitivity, injuries, and depression.



ENHANCE ONE'S DIGNITY

Autism and other developmental disabilities are stigmatizing conditions in American society. A sense of dignity for residents with ASDs can be

enhanced by the manner in which the homes blend in with neighboring residences. Dignity also is enhanced by recognizing one's individuality. Opportunities should be provided to allow the resident to make his or her space personal and "mark" it as one's own. Personal items used for display and decorations are often very important and salient to residents as they grow older. These items can animate a room by triggering memories and reinforcing one's sense of self and life history [24].

Enhancing a person's dignity in place means anticipating that some adults with ASDs will want to live as a couple. Much of the research on adult living arrangements has focused on single or group living. Providing options for living as a couple or family acknowledges these individuals' self-determining desires to seek a living environment most compatible with their life course.



ENSURE DURABILITY

Some residents may be deliberately or unintentionally hard on materials, appliances, fixtures, and furnishings.

Outbursts of repetitive or stereotyped movements, such as jumping, pacing, running and banging against surfaces, and other such actions can threaten not only the resident but also the durability of the home itself. Specifying materials and equipment that are durable and

easily maintained is essential not for the resident's safety and well being but also for minimizing long-term maintenance costs of the home. The challenge is finding the right balance between using hard-wearing materials and equipment and the more typical domestic fixtures and specifications that do not have the institutional or commercial appearance often found in some of the more durable materials. The physical environment needs to be robust, ensuring that the risk of injury to the residents and caregivers and damage to the property is kept to a minimum.



ACHIEVE AFFORDABILITY

In any city there can be thousands of people who need affordable, safe living options in the community. Yet many cities lack ample supply of such

affordable homes. While affordability can, in part, be addressed by financing options and arrangements, careful attention to the physical design and layout can help reduce construction and development costs, thereby bringing down mortgage or rental prices. Building shape, appearance, layout, and density—as well as that of parking and outdoor space—can be designed in such a manner to not only reduce construction and operational costs but also do so in a manner that produces pleasing and well-designed homes. Green building practices can help increase energy and water efficiencies, leading to reduced operational costs in the long run. Efforts to trim construction costs by cutting corners in design, specifications, and construction can have long-range negative impacts on residents if what is cut is essential to their health and well-being.



ENSURE ACCESSIBILITY & SUPPORT IN THE SURROUNDING NEIGHBORHOOD

Locating one's home in a neighborhood with easy, convenient, and safe accessibility to public transportation and community services such as shopping, banking, and the like, promotes the opportunity to take advantage of community resources and amenities. Many residents will not drive or cannot afford automobiles. With the right location, more independent individuals may be able to access many community services without care provider assistance. Yet the everyday world outside one's door can seem threatening: the noise, traffic, people, colors. Clear routes and target locations need to be identified, even mapped. In some cases, technology can assist residents in mapping out and "testing" what could be a potentially difficult excursion and converting it into something more predictable, clear, and manageable [21]. Effective transportation use means access to work sites as well as all community activities, including leisure activities, domestic errands, continuing education, and religious and spiritual life. Because adults with ASDs find relationships difficult, thought needs to be given to what constitutes an individual's community and how access to social networks might be developed. The use of mainstream services in the community is one avenue in which such social inclusion and networking can occur. As parents age, it may become necessary for the adult son or daughter with an ASD to travel to them rather than vice versa.

DESIGN GUIDELINES

INTRODUCTION

When designing for adults with ASDs, a series of modifications to standard building strategies may be employed to increase the livability of the home and outdoor environment. To assist architects and builders in deciding what modifications help create an autism-friendly environment, the following recommendations have been developed.

These recommendations should serve as a guide during the design process with the understanding that not all of the elements must be included for a home to be successful.

Since autism is a heterogeneous disorder, finding design solutions is not a “one-size-fits-all endeavor”; what is mandatory for one individual with an ASD might be irrelevant to another. Designing for a range of needs, with a focus on accommodating the issues that occur most frequently such as sensitivity to noise, demand for personal space, and the tendency toward physical exuberance, may be sufficient for most residents. The following recommendations are intended to cover all potential areas where appropriate design could make a significant difference in the well-being of a resident with an ASD.

The design guidelines are organized to reflect the ten resident-based design goals profiled in the previous section. Specific recommendations indicate the particular icon of the goal it addresses. Linking each design recommendation to one of the resident-based design goals articulates how the modification may aid and support the individual with an ASD to live independently in the home environment.

The design guidelines grew out of the case study research into current housing models for people with autism and other developmental disabilities as well as extensive research in therapeutic interventions for autism and findings in the sciences that address autism and the environment. See Appendix A for further explanation of the methodology.

NEIGHBORHOOD

Selecting the right neighborhood and site is a critical first step in developing housing for people with ASDs. Issues to consider include access to amenities and transportation and the potential for residents to be integrated into existing community.



NEIGHBORHOOD ACCESSIBILITY & SUPPORT

- Select a site that provides the most opportunities for residents such as proximity to the following:
 - family, support groups, and service agencies
 - public transportation (many residents do not drive)
 - grocery stores and pharmacies
 - employment opportunities
 - day programs
 - medical facilities
 - entertainment and social options
 - open space, parks, and other recreational opportunities
- Selecting a site that has the appropriate zoning at the outset will diminish the possibility for neighborhood opposition: NIMBYism or the tendency among some to assert “Not in My Backyard.”



Neighborhood amenities

- Neighborhoods that are established and stable suggest the best outcomes for new residents: less confusion, stress, and disruption.
- The scale of the proposed housing should be appropriate to the context: potential for acceptability increases

FLOOR PLAN STRATEGIES

Space planning should encourage choice, autonomy and independence for residents. Attention to connectivity within the floor plan and its impact on wayfinding will lead to a more effective use of all household spaces.



FAMILIARITY & CLARITY

- Predictability in the environment, demonstrated through transparency in spatial sequencing, smooth transitions between rooms and uses, and the potential to establish routines, assists in keeping arousal levels low and minimizing resident stress.
- The spatial layout should be easily understood by providing clear visual access into and between rooms. Use half-walls, vestibules, and cutouts to allow residents to preview a space before entering it. People will be more apt to use common rooms if they can assess the space and potential social interactions before entering them. Minimize the unknown.
- Spaces and rooms should be clearly defined with specific uses and functions, identified legibly (e.g. kitchen is for food preparation, dining room is for eating, etc.).
- A change of material (e.g. wall color or flooring material) could be used to indicate change of use (e.g. active living area vs. quiet area on the periphery).
- To accommodate the preoccupation with order that is common with autism, the design should utilize clean lines, eliminating visual and physical clutter. Avoid overembellishing or overfurnishing.



SENSORY SENSITIVITY

- Ample storage should be provided to create a clutter-free, less stimulating environment.
- Storage should be available in shared spaces as well as individual rooms.
- Separate high stimulus areas (e.g. TV room, exercise room) with low-input transition zones to allow for sensory recalibration.
- Every residence should include “escape” spaces: spaces that are activity free, calming, low-arousal.



HEALTH & WELLNESS

- Design of all spaces should accommodate and encourage physical movement. Spontaneous gross motor activity is common among people with autism and the living environment must support that. Common areas, hallways, bedrooms, and outdoor spaces should be designed to permit jumping, pacing, bouncing, and so on.
- Private areas away from residents should be provided for staff to complete paperwork and take breaks.

OUTDOOR SPACES

Secure, shaded outdoor areas offer opportunities for residents to tend gardens and socialize.



SAFETY & SECURITY

- Provide adequate lighting on timers (not motion detectors).
- All doors connecting to the outside should have zero-step thresholds for accessibility.



FAMILIARITY & CLARITY

- Include a covered walkway or porch at unit entrance to shield residents from inclement weather and to offer opportunity for neighborhood interaction.
- Courtyards are a good option since they are legible, private, safe, and accessible.
- Treat secured outdoor spaces as extensions of the home.
- A mix of hardscape and softscape provides residents a range of options for using various yard areas.
- Include raised planters for accessibility and to protect plants from trampling.



SOCIAL INTERACTION & PRIVACY

- Facilitate social interaction by planting flower or vegetable gardens for the residents to tend.



HEALTH & WELLNESS

- Install low maintenance landscaping that offers residents the opportunity to care for it.
- Provide adequate shade control in outdoor spaces and awnings over windows and doors.
- Include recreational opportunities on-site.
- Healing gardens positively effect people and should be included when possible.
 - Homelike imagery
 - Places for privacy
 - Settings to stimulate mental alertness
 - Opportunities for social exchange
 - Family gathering spaces
 - Areas for activities
 - Comfortable seating
 - Sense of security
 - Accessible

MATERIALS AND RESOURCES

Clare Cooper Marcus and Marni Barnes, editors. 1999. *Healing Gardens: Therapeutic Benefits and Design Recommendations*. New York: Wiley.

LIVING/COMMUNITY ROOMS

Living rooms should provide residents with a variety of options.



SOCIAL INTERACTION & PRIVACY

- Provide a range of communal areas for different types of interaction.
- Provide space for residents to meet with their family that is separate from central living area: the presence of unfamiliar people may inhibit other residents.
- Create a central shared space for mailboxes, message board, bill paying, etc: encourages the least social to interact at least once a day.
- Locate common areas in proximity to one another to offer more opportunities to interact (e.g. kitchen, dining room, laundry, courtyard, living room all share a high degree of connectivity to one another).
- A common area should include active and quiet spaces within one contiguous larger space: people with autism often do not prefer to be alone, seeking instead proximity to others rather than active engagement. Window seats and nooks offer opportunities to participate from the periphery.



Comfortable living areas



HEALTH & WELLNESS

- Locate a bathroom in close proximity to common areas.

MATERIALS AND RESOURCES

Sources for low-VOC furniture: http://www.greenhomeguide.com/index.php/main/product_detail/335/C124 and <http://www.greenyour.com/home/furnishings/couch/tips/opt-for-a-low-voc-couch>

KITCHENS

Providing ample counter space to accommodate multiple users and independent living aides (e.g. computers) facilitates residents success and satisfaction.



SAFETY & SECURITY

- Food storage areas should be placed away from the cooking surface to reduce accidents related to reaching and crowding.



DURABILITY

- Kitchen countertops need to be extremely durable, fire and heat resistant, and easily cleaned and disinfected.
- Solid surface countertops with an integral backsplash such as Silestone, Corian, granite, or concrete are durable choices for kitchen and bath.
- Butcher block is a good surface for cutting but must be disinfected properly.
- Avoid tiled countertops because of dirt buildup in the grout and because they are easily broken
- Avoid laminate countertops as they are easily scratched and burned and pooling water causes delamination.
- Mix countertop materials according to use (e.g. surfaces dedicated to cutting).
- Select solid wood cabinets over veneers as veneers delaminate and do not wear as well. Avoid particle board substrates because of susceptibility to water damage.



Kitchen with multiple work areas



CHOICE & INDEPENDENCE

- Kitchens should have adequate space including multiple stations and ample counter space for several people to work simultaneously.
- Sufficient storage should be provided such that individuals may have their own cupboards.

HALLWAYS, STAIRS & RAMPS

Treat these as opportunities for socializing; provide seating space.



FAMILIARITY & CLARITY

- Hallways should be wide to accommodate people in wheelchairs.
- Each floor should be accessible to all residents. Including a ramp as well as an elevator is preferable: it facilitates social interaction and also eases resident anxiety in the event of a power outage.
- Keep hallways and flights of stairs short.
- Minimize “blind” corners since they introduce unpredictability.
- Provide seating at landings to facilitate socialization and to offer opportunity to preview common areas.



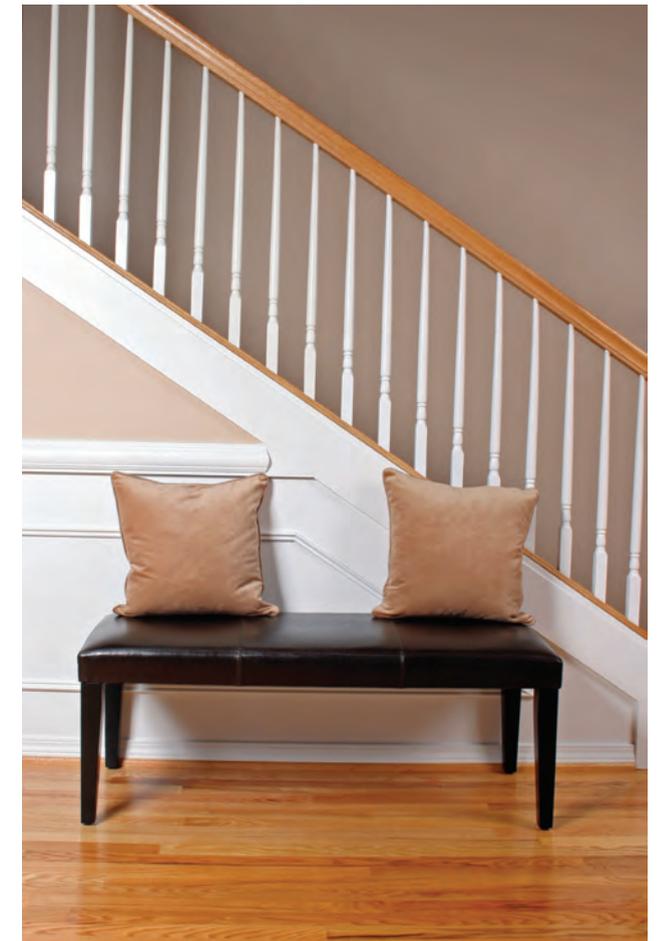
HEALTH & WELLNESS

- Opt for single-loaded corridors opening onto shared spaces or a courtyard: allows for cross-ventilation and natural light and provides more opportunities for social interaction.



DURABILITY

- Install well-secured carpet runners on stairs to reduce noise; carpet runners are economical to replace or clean when soiled.



Seating at stair landings

BEDROOMS

Individual bedrooms with en-suite bathrooms, adequate storage, and a desk provide residents with privacy and dignity.



CHOICE & INDEPENDENCE

- Include a desk area with task lighting.
- Closets should be internally lit and outfitted with a built-in organization system to assist residents with their daily dressing and grooming tasks.



HEALTH & WELLNESS

- Each bedroom should have individual climate control and a ventilation fan.



DIGNITY

- Residents should have their own bedrooms with en-suite accessible bathrooms for privacy and dignity.



Bedroom storage

SENSORY ROOMS

Providing a separate room that allows residents to control the atmosphere leads to decreased stress and anxiety.



SENSORY SENSITIVITY

- A room that allows residents to modify the sensory inputs such as lighting and music helps people with autism relax, process the larger environment, and modify behaviors.
- Sensory rooms should be painted white or soft colors to produce a calming effect.
- Texture can be introduced for added sensory engagement.
- The room should have a defined sense of enclosure, to promote feelings of safety and security for the residents.
- The room should be designed to be acoustically contained: do not allow outside noises in and prevent noise from within from escaping.
- Snoezelen Rooms (Dutch for “sniff” and “doze”) are an established sensory room model that can be referenced.



image source: Wikipedia Commons

Snoezelen sensory room

MATERIALS AND RESOURCES

See “Materials” and “Appliances & Fixtures” section for more information

MATERIALS AND RESOURCES

Snoezelen rooms: http://www.worldwidesnoezelen.com/component/option,com_frontpage/Itemid,1/
 Image above is a file from the Wikimedia Commons, made available by Ciell at <http://en.wikipedia.org/wiki/File:Snoezelruimte.JPG>. This file is licensed under the Creative Commons Attribution ShareAlike 2.5, info at <http://creativecommons.org/licenses/by-sa/2.5/>

BATHROOMS

At least one bathroom per unit should be fully accessible to accommodate residents with varying levels of mobility.



SAFETY & SECURITY

- Install nonslip tile flooring.



HEALTH & WELLNESS

- In units with multiple residents, there should be one or more bathrooms for general use.
- In multistory units include a main floor bathroom for accessibility.
- Bathrooms should have ample room for staff to assist residents.
- Sinks should be wall hung for accessibility.
- Grab bars should be installed by the toilet and in the shower and bath.



DURABILITY

- Toilets should have concealed cisterns and use a push panel flush system for durability and ease of use.
- Install tile or waterproof panels on all walls to minimize possible water damage.



Wall-mounted sink

MATERIALS AND RESOURCES

See “Materials” and “Appliances & Fixtures” section for more information

LAUNDRY ROOM

Each unit should include a bright laundry room with a large folding area and accessible appliances.



FAMILIARITY & CLARITY

- Include ample counter space to accommodate sorting, stain prep, and folding.
- Provide storage for laundry supplies.



SENSORY SENSITIVITY

- Provide adequate ventilation through inclusion of operable windows and ducted fans.
- Provide adequate acoustic insulation to contain noise.



HEALTH & WELLNESS

- Include a laundry sink or commercial hopper to contend with heavily soiled items.
- Install frontload washers and dryers for ease of accessibility; if necessary, raise the appliances to accommodate wheelchair riders.



Laundry room with storage and folding area



DURABILITY

- Install a floor drain to accommodate spills.
- Flooring should be a continuous, durable surface.

MATERIALS AND RESOURCES

Information on accessible washers & dryers: <http://www.afb.org/afbpress/Pub.asp?DocID=aw080303>
 Shake absorber pads for washing machines: http://www.kellettent.com/vib_isol.html

TECHNOLOGY Technology should be unobtrusive, easy to use and modify, and fail-safe; it should enhance resident independence and support staff. Privacy issues must be considered before selecting any monitoring technology. In-unit security support systems must also be available for staff.



SAFETY & SECURITY

- Install detectors for smoke, carbon monoxide, natural gas, radon, propane.
- Select talking smoke and carbon monoxide detector to minimize stress response and clarify the situation.
- Bed occupancy sensors alert caregivers to resident activity and possible accidents.
- Install lockable fuse boxes to avoid tampering.
- Install window stops to prevent inadvertently leaving window open at night or when away from the home.
- A security fence should be included to inhibit wandering or access from uninvited visitors.
- Appropriate fire safety systems should be installed: select alarms with visual explanations and talking alarms for smoke detectors.
- Install property exit sensors on exterior doors and windows. Select systems that provide an audible warning when any doors or windows are opened.

- Select an entry/exit system that is easy for residents to operate. Options may include keyless locks: radio frequency identification (RFID), biometric, digital keypads, and proximity systems.
- Select door buzzers and intercom systems that feature a visual display.
- Install automatic locks on external doors to eliminate possibility of residents forgetting to lock doors.
- Install emergency call buttons in all rooms or specify wearable call buttons for residents.
- Minimize possibility for furniture to block room access.
- Locks on internal doors must have the ability to be opened externally.
- Electrical sockets and appliances should have an automatic shut-off feature.
- Provide a “Staff Attack” alarm system to allow staff members to call for assistance in the event of an emergency.

- Include an in-unit intercom system to facilitate communication between residents and staff.
- Install fall sensors to monitor residents prone to seizures or with epilepsy.
- RFID (radio frequency identification) location sensors unobtrusively monitor people and also are suitable for use on items that are easily misplaced.
- Bed occupancy and motion sensors detect resident activity.



CHOICE & INDEPENDENCE

- Select a range of daily activity monitors to assist residents in completing tasks and to alert caregivers when an activity is not completed properly (e.g. too long in the bathroom, meal preparation stalled, altered sleeping patterns, and so on).
- Include task prompting systems for daily independent living tasks such as dressing and grooming, cooking, cleaning.



Security system

MATERIALS AND RESOURCES

Extensive overview of home technologies with links to manufacturers: <http://www.toolbase.org>
 Voice Annunciator by Sensorium: http://www.sensorium.co.uk/product/assistive/voice_annunciator.htm
 For audible alarm products: Cobolt Systems, Ltd: <http://www.cobolt.co.uk/Default.aspx?pageId=1>

MATERIALS AND RESOURCES

QuietCare Lifestyle Monitors: <http://www.chubbcommunitycare.co.uk/products/C88/>
 CAMP: Context Aware Medication Prompting by Intel and Oregon State University: <http://www.intel.com/healthcare/research/portfolio.htm>

TECHNOLOGY CONTINUED



HEALTH & WELLNESS

- Install high-efficiency, whole-house air filtration system: attached directly to the HVAC system, air filtration systems remove over 90 percent of pollutants. Examples include:
 - Trane CleanEffects
 - Aprilaire Whole House Air Cleaner
 - Fantech Whole House HEPA Filtration
- Enuresis sensors alert caregivers of enuresis incidents—protects against skin breakdown and preserves resident dignity; use in bedding and furniture; alert is communicated through wireless connection to caregiver.
- Include a medication tracking and prompting system to remind residents to take their medications.



FAMILIARITY & CLARITY

- Include temperature and power alert monitors since residents may not be cognizant of temperature shifts or power outages in appliances, etc.
- Install a silent, battery-powered backup system to maintain seamless power during electrical outages.
- Occupancy sensors connected to lighting—turning lights on and off automatically in bathrooms, hallways, kitchens, laundry rooms, and closets.
- Use timers on exterior lighting rather than motion sensors—less startling.
- Include an information exchange system for staff and residents.
- Include dressing aids such as a closet system with compartments for daily clothes

VISUAL CUES

Individuals with ASDs often experience attention difficulties and stimulus overselectivity. Ameliorate this by keeping visually distracting elements to a minimum. Opt instead to employ appropriate visual cues that assist residents with daily activities.



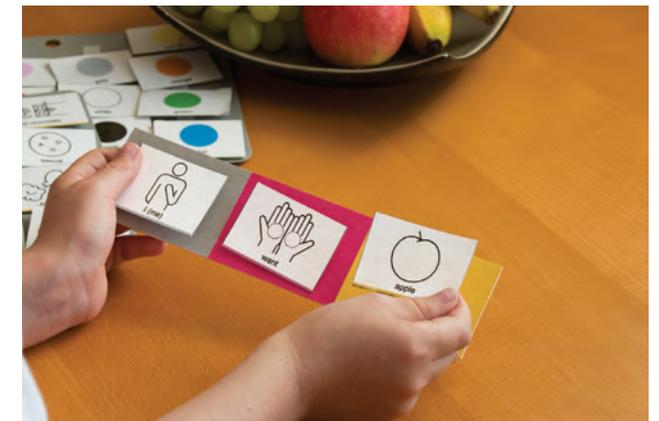
SAFETY & SECURITY

- Incorporate visual signs into the home environment to assist with safe use of features such as appliances, electrical outlets, windows, doors, and on the like. These may be in the form of pictures, words, or warning colors that are understood by all residents.



FAMILIARITY & CLARITY

- Picture schedules can assist residents with daily activities.
- Use color coding to indicate location, room function, activity area.
- Color palettes should avoid using bright, primary colors in favor of softer tones. Bright hues may cause agitation in certain individuals with autism.
- Written or pictorial signage also may be used to denote functions within the home such as an individual's bedroom, bathroom, storage areas, and so on.



Picture exchange communication system



SENSORY SENSITIVITY

- Minimize detail since visual clutter may lead to stimulus overselectivity causing an individual to fixate on a particular object or aspect in the environment.

MATERIALS AND RESOURCES

SmartHome, the Home Automation Superstore, has a wide range of suitable products: http://www.smarthome.com/_/_/index.aspx
 Architectural Products for Barrier Free Living is a good source for ADA compliant products: www.barrierfree.org

MATERIALS AND RESOURCES

Visual schedules: <http://autism.healingthresholds.com/therapy/visual-schedules>

VENTILATION

Adequate ventilation reduces unwanted smells that can negatively affect individuals with hyperreactive (extremely sensitive) sensory processing.



SENSORY SENSITIVITY

- Use silent, ducted exhaust fans in bathroom and kitchen such as Ultra Silent NuTone ventilation fans.



HEALTH & WELLNESS

- Install high-quality air filters such as HEPA filters.
- Include operable windows in all living areas.
- Selecting blinds enclosed between window panes rather than curtains will reduce dirt and odor buildup and minimize wear and tear thereby increasing the longevity of product.
- Moisture-proof fabrics should be used to minimize opportunities for mold growth.



AFFORDABILITY

- Install dual-glazed windows for increased energy efficiency, temperature control, and minimization of condensation.
- Wire bath exhaust fan to light switch and timer to improve effectiveness and efficiency.



Operable window

LIGHTING

People with autism often experience visual perceptual problems that are exacerbated by lighting conditions. A range of lighting options should be provided with the optimal environment featuring nonglare surfaces, no-flicker bulbs, and lots of natural light controlled by window blinds or other coverings.



SAFETY & SECURITY

- Avoid using high-heat tungsten and halogen lightbulbs.
- Use wet-area fittings on all portable lighting and wall outlets.
- Halls, stairs, and landings should be well-lit.
- Install day/night activated exterior lighting at doors and in yard; motion activated lighting may be startling to some individuals.



FAMILIARITY & CLARITY

- Use indirect lighting to reduce glare.
- Bathrooms should have bright, uniform, shadow-free light and include mirror and shaving lights.
- Rooms should have overhead, recessed lighting as well as task lighting.
- Include light fixtures in closets for accessibility and to minimize resident frustration.
- In kitchens, provide lighting under cabinets and overhead recessed lighting.



DIGNITY

- In living/community rooms, avoid institutional atmosphere by using recessed and task lighting.



SENSORY SENSITIVITY

- Natural light should be available in all rooms.
- Use nonfluorescent, no-flicker bulbs.
- Provide opportunity to maintain even lighting levels through dimmer switches, easy-to-adjust window blinds, etc.
- Reduce glare through use of indirect lighting, clerestory windows, and awnings.
- Use buzz-free dimmer switches on all recessed and wall-mounted lighting.



CHOICE & INDEPENDENCE

- Provide flexibility by including portable task lighting.



DURABILITY

- Wet-areas require water-proof electrical fittings.
- Recessed lighting minimizes opportunities for breakage.
- Include ample electrical outlets in all rooms to accommodate portable task lighting needs and to avoid outlet overloading.

MATERIALS

People with autism often have underlying health issues that are exacerbated by environmental chemicals. Prevent chronic exposure to indoor air pollutants by selecting durable, nontoxic building materials and finishes. Durability is also a concern.



SAFETY & SECURITY

- Install nonslip flooring in bathrooms, kitchens, and laundry rooms, such as textured ceramic tile.
- Avoid carpet with strong weave or pile as it may be a trip hazard.
- Create smooth, flush flooring transitions between rooms.



SENSORY SENSITIVITY

- Use nonslip area rugs and wall hangings to dampen room noise.
- Avoid materials and finishes with distracting patterns or excessive embellishing: for people coping with stimulus overselectivity, patterns and embellishes may cause them to fixate unnecessarily.
- Choose paint in soft colors rather than bright, primary colors.



HEALTH & WELLNESS

- Use zero- or low-VOC (volatile organic compound) materials including paints, adhesives, caulking, carpets, vinyl tile, linoleum, particle board, plywood, and engineered wood products.
- Use hypoallergenic materials such as marmoleum for floors and wainscoting.
- Use nontoxic, fragrance-free, biodegradable cleaners.
- Avoid using pesticides and insecticides both indoors and outdoors since these persist in the environment long after application.
- Seal or paint all MDF (medium-density fiberboard) and plywood to minimize off-gassing
- Use zero-VOC eggshell finish paint such as Benjamin Moore Natura or AFM Safecoat for durability, cleaning ease, and a low-glare surface.
- Select non-pressure treated wood for exterior use such as Radiance Thermally Modified Wood, a sustainable, chemical-free option.



FAMILIARITY & CLARITY

- Use contrast (tonal value vs. bright color) to indicate light switches, electrical outlets, and other pertinent features.
- Select materials that create a warm home environment rather than an institutional atmosphere.



Muted color palette

MATERIALS AND RESOURCES

Radiance Thermally Modified Wood: <http://www.radiancewood.com>
 Marmoleum Click is certified asthma and allergy friendly by the Asthma and Allergy Foundation of America: <http://www.forboflooringna.com>

MATERIALS AND RESOURCES

Carpet & Rug Institute—"Green Label" testing program identifying low-VOC products: <http://www.carpet-rug.com>
 California recycled materials product directory: <http://www.ciwmb.ca.gov/rcp>
 Green Resource Center: www.greenresourcecenter.org

MATERIALS CONTINUED



DURABILITY

- Select hard, continuous surface flooring such as bamboo, wood, tile, natural linoleum, or marmoleum.
- Use carpet tiles rather than rolled carpet for easy replacement. Carpet is not as durable as other flooring options and is best restricted to use as area rugs or runners.
- Durable flooring materials to consider include:
 - Flor by Interface www.Flor.com
 - Flotex, www.flotex.co.uk
 - Skatelite Pro and Hemplite: <http://www.skatelite.com>
- Install wainscoting, corner guards, tall baseboards or chair rails in high traffic areas to protect, walls: marmoleum, wood, tile, stone are all durable choices.
- Kitchen countertops need to be extremely durable, fire and heat resistant, and easily cleaned and disinfected.
- Solid surface countertops with an integral backsplash such as Silestone, Corian, granite or concrete are ideal for kitchen and bath.
- Butcher block is a good surface for cutting but must be disinfected properly.
- Avoid tiled countertops because of dirt buildup in the grout and because the tiles are easily broken.
- Avoid laminate countertops as they are easily scratched and burned and pooling water causes delamination.
- Mix countertop materials according to use (e.g. surfaces dedicated to cutting).
- Select solid wood cabinets over veneers as veneers delaminate and do not wear as well. Avoid particle board substrates because of susceptibility to water damage.

MATERIALS AND RESOURCES

Healthy House Institute: <http://www.Healthyhouseinstitute.com>
National Center for Healthy Housing: <http://www.nchh.org>

ACOUSTICS

To accommodate aural sensitiveness, ambient noise levels should be reduced as much as possible. Building systems and appliances designed for quietness should be selected and sound-proofing insulation in ceiling and walls should be increased.



SENSORY SENSITIVITY

- Choose quiet systems to minimize ambient noise: HVAC, ventilation, appliances.
- With exposed brick, etc, use deeply raked masonry joints to break up sound waves.
- Soundproofing options include the following:
 - Acoustic panels such as Acoustiblok or AcoustiFence
 - Quiet Batt Acoustic Insulation—cotton insulation has superior soundproofing qualities compared to fiberglass insulation
- Dishwashers, models such as:
 - Bosch 800 Plus quiet series
 - Maytag Quiet Series Sound Package
 - GE Quiet Partner
- Refrigerators, models such as:
 - LG LoDecibel quiet operation with door alarm if left open
 - Kitchen Aid with Whisper Quiet compressor system
 - GE with quiet package
 - Amana with SofSound II package
- HVAC:
 - Ductless HVAC systems
 - Insulate conventional HVAC system with internal acoustical duct board which is more effective at sound mitigation than wrapping sheet metal ducts with batt insulation
- Ventilation fans, models such as:
 - Ultra silent NuTone ventilation fans in bedrooms and bathrooms
 - Bosch kitchen ventilation systems feature whisper quiet volume
- Washer and dryer:
 - Mount on sturdy, level surfaces to minimize bouncing
 - Use additional insulation in laundry room walls to help contain noise
- Appliance downdrafts and hoods:
 - Locate blower outside of kitchen using a remote blower

MATERIALS AND RESOURCES

Acoustiblok: <http://www.acoustiblok.com/index.html>
Quiet Batt: <http://www.soundprooffoam.com/quiet-batt-insulation.html>
Ductless HVAC Systems: <http://hvacquest.com/ductlessvac.php>

APPLIANCES & FIXTURES

Safety controls on appliances are essential since people with autism often experience inattentiveness, high pain thresholds, and the inability to recognize problems. Durability, quietness, and ease of use also are important.



SAFETY & SECURITY

- Induction cooktops transfer heat only to magnetic materials eliminating risk of burns to users; the stovetop stays cool. Residents with cardiac pacemakers should consult their doctors regarding use of induction cooking.
- Specify cool-touch small appliances in which surfaces do not become exceedingly hot.
- Install lock-out or override feature on appliances to prevent inadvertent use or to keep appliance door from opening.
- Use auto shut-off safety outlets for small appliances: toasters, coffee makers, etc.
- Select appliances with front or side controls: enhances ease of use and eliminates reaching across hot surfaces.
- Select appliances that have automatic shut-off feature or install a motion detector to automatically turn appliance off after a period of inactivity.



DURABILITY

- Install a drain trap instead of a garbage disposal.
- All sinks should use a drain trap and have captive plugs.
- Equip sinks and toilets with intake alarms: shuts water off in event of leak or overflow.
- Install a flood detector on sinks, baths, washing machines.
- Faucets should be single lever, mixing hot and cold water.
- Select concealed cistern toilets with push panel flush systems.
- Bathtubs constructed of heavy gauge porcelain on steel are longer lasting than those of fiberglass.



FAMILIARITY & CLARITY

- Appliances should be easy to operate and not require excessive instruction.
- Appliance handles should allow use of whole hand for doors, drawers.
- Controls should be easy to read: large numbers/letters, nonglare and nonreflective.
- Controls should be easy to see: use color contrast to distinguish knobs/buttons from background surface.
- Controls should be easy to use: easy to turn, click in place.
- Install nightlights in kitchens and bathrooms.
- Select dual signaling appliances with visual and audible alerts.
- Sufficient lighting within all appliances is necessary.
- Laundry rooms should include a sink, folding area, fold-down ironing board.



HEALTH & WELLNESS

- Appliances should be easy to clean: racks and drawers should be removable.
- Accessible appliances and fixtures allow for more flexibility over life of resident:
 - Wall-hung sinks
 - Frontload washer and dryer
 - Adjustable countertops
 - Wall ovens that open sideways
 - Counter-mounted cooktops with under-counter knee space
 - Cabinets with pullout shelves or drawers
 - Roll-in shower
 - Lever door handles rather than knobs



SENSORY SENSITIVITY

- Appliances should be as quiet as possible (see "Acoustics" for specific recommendations).

MATERIALS AND RESOURCES

Auto shut-off safety outlet: http://www.goldviolin.com/Auto_Shut_Off_Safety_Outlet_p/91574.htm

MATERIALS AND RESOURCES

GE Universal Design: http://www.geappliances.com/design_center/universal_design/

APPENDIX A: METHODOLOGY

DEVELOPMENT OF INVENTORY

A systematic and comprehensive search was conducted to identify residences for adults with ASDs, intellectual/developmental disabilities, or other special needs that were considered as exemplary models. To sift through the thousands of such residential developments, we solicited recommendations from staff in relevant organizations and agencies of residential models or programs that they considered exemplary. From recommendations of Southwest Autism Research and Resource Center and from web searches, 54 service-based organizations were identified from which to solicit this information. These organizations were:

- Accessible Housing Society
- Adaptive Environments Center
- Alzheimer’s Association Senior Housing Finder
- American Association of Homes and Services for the Aging
- American Association of People with Disabilities
- American Seniors Housing Association
- Arizona Bridge to Independent Living
- Arizona Statewide Independent Living Council
- ASSIST- Community Design Center
- Assisted Living Consumer Alliance
- Assisted Living Online
- ASU Center for Inclusive Communities

- Autism Society of America
- Canadian Centre on Disability Studies
- The Center for an Accessible Society (U.S.)
- Center for Excellence in Assisted Living
- Center for Health Care Strategies
- Center for Housing and New Community Economics
- Center for Persons with Disabilities
- Center for Universal Design
- Center on Community Living and Careers
- Centre for Accessible Environments
- Community Living Exchange Collaborative Clearinghouse
- Concrete Change
- Consumer Consortium on Assisted Living
- DIRECT Center for Independence
- EIDD Design for All Europe
- Eldercare Locator
- The EQUAL Research Network
- Illinois Network of Centers for Independent Living
- Independent Living Research Utilization
- Institute for Recovery and Community Integration
- Institute on Community Integration, Adult Services and Community Living Center, U of Minnesota
- Liberty Resources
- MAAP Services for Autism and Asperger Spectrum
- Minnesota Association of Centers for Independent Living
- National Alliance for the Mentally Ill (NAMI-Arizona)

- National Autism Association
- National Center for Assisted Living (NCAL)
- National Council on Independent Living
- National Down Syndrome Society
- National Resource Center on Supportive Housing and Home Modification (NRCSHHM)
- NCB Capital Impact
- New Horizons
- Pioneer Network
- Research and Training Center on Community Living, University of Minnesota
- Research and Training Center on Independent Living, University of Kansas
- RISE, Inc.
- Seniors for Living (search assistance for various types of homes)
- SMILE Services Maximizing Independent Living Empowerment
- SNAP for Seniors
- SocialWorks Inc, (Arizona based)
- Total Living Choices
- Upenn Collaborative on Community Integration

In addition to these organizations, all 23 State Associations of Independent Living were identified. Each organization was sent an email with follow-up phone contact when determined necessary.

In addition to the recommendations from these organizations, we also conducted a search of electronic documents that identified exemplary developments or “best practices” of housing for adults with autism, I/DD, or other special needs.

CLASSIFICATIONS

Our search resulted in the identification of 101 projects that had sufficient information about the program or residential complex. For each development, we gathered and classified the following information.

1. NAME OF RESIDENCE

2. CITY AND STATE

3. PRIMARY RESIDENTS

- A: Only adults with ASDs
- O: Other populations (can include ASDs)

4. NUMBER OF RESIDENTS

5. RESIDENTIAL BUILDING TYPE

- D: Independent detached home
- A: Independent attached home (e.g. townhome)
- C: Cluster of detached homes (as planned residential development)
- AH: Attached home, 2-5 units (e.g. duplex)
- AN: Attached home, 6+ units (e.g. apartment complex, condominium), with no common/shared areas
- AC: Attached home, 6+ units (e.g. assisted-living complex), with common/shared areas
- E: Attached efficiency units or guest rooms (e.g. single-room occupancy housing)

5. DEVELOPMENT TYPE

- G: Government agency
- N: Nonprofit organization/developer
- P: Private development

6. CONSTRUCTION TYPE

- E: Existing and not rehabbed
- N: New construction
- R: Rehabbed

7. TYPES OF RESIDENTIAL AND SERVICE SUPPORT

- O: Supported and personal assistance (service staff living off-site)
- S: Supervised (staff living on-site or working office is on-site)
- I: Long-term institutional (constant) care (extensive offices/service spaces on-site; some staff may be live-in, staff there during sleeping hours)
- T: Transitional training (supervised but only temporary)

8. INNOVATION TYPE

- B: Business model (e.g. homeownership, special on-site facilities produce external revenue used to cover operational expenses of housing)
- I: Fosters functional independence (can be at the level of site, of building complex, interior/outdoor/technological features of dwelling unit)
- Q: Quality of life enrichment (e.g. opportunity to attend community college classes)
- S: Facilitates opportunity for socializing
- X: Support services on site

9. SOURCE OF INFORMATION

The list of the 101 residential developments is available at: http://stardust.asu.edu/research_resources/detail.php?id=60

CASE STUDIES OF EXEMPLARY RESIDENTIAL DEVELOPMENTS

From the 101 cases in the inventory, we selected places to visit that were relatively close to the researchers at ASU and that would together represent a diversity of residential types, amenities, resident populations, and development types. A data collection form was developed to gather consistent information across the various site visits. The following sites were visited in September and October 2008:

Bristol Place & Sand Beach, San Jose, California
 Casa de Amma, San Juan Capistrano, California
 Chapel Haven West, Tucson, Arizona
 Garden Villas, North Hollywood, California
 Home Safe II, San Jose, California
 Laguna Senior Apartments, Los Angeles, California
 Lincoln Oaks, Fremont, California
 Milagros Independent Living, San Jose, California
 Mission Creek Senior Housing, San Francisco, California

Step Up on Second & Step Up on Fifth, Santa Monica, California
 Stoney Pine Villas, Sunnyvale, California
 The Mark, Pasadena, California
 Vista Nueva, Los Angeles, California

The following sites were visited in May and October 2008:

Charles SmartHome, Boulder, Colorado
 Community Living Options Family Teaching Model Homes, Lenexa, Kansas

While not visited, phone interviews were conducted with staff at:

CHAI Community Services, of Jewish Family & Children's Services in Boston, Massachusetts. I

Interviews were conducted with staff and plans analyzed of an innovative multigenerational development using Sections 202 and 811 fundis, currently in development phase:

Village at Oasis Park - currently in development in Mesa, Arizona, sponsored by Marc Center.

Profiles of some of these case studies are available at: http://stardust.asu.edu/research_resources/detail.php?id=60

DEVELOPMENT OF DESIGN GOALS AND GUIDELINES

In addition to the information derived from the case study visits and interviews, we consulted a number of research and design sources in deriving the design goals and design guidelines. Some of the design features and goals had been systematically tested with populations of individuals with ASDs or other special needs. Yet empirical, systematic testing was rare. In most cases, the recommendations in the source material were developed from practical experience by housing and service providers, and in a few cases, architects. The resources used are listed in a separate bibliography, available at: http://stardust.asu.edu/research_resources/detail.php?id=60.

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