Erratum

Enhancing quality of life through Universal Design

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Abstract. Objectives: To inform clinicians, caregivers and researchers involved with assessing and treating individuals with neurological disabilities of the benefits of universal design in enhancing quality of life. The improvement of quality of life has the potential to benefit the individuals with neurological disabilities and those whose lives overlap and intersect with those individuals.

Methods: Literature and design reviews are used as a foundation for a model for incorporating and leveraging universal design to the benefit of the patient’s social sphere, which includes caregivers, family members and medical staff. By matching patients’ varied abilities with universal design solutions, the model of universal design benefitting the patients’ social sphere will be demonstrated.

Recommendations: Recommendations are made for clinicians and researchers that they may use in their practices and investigations in three areas: 1) educating patients about the benefits of universal design, 2) helping inform patients how to leverage universally designed products and approaches in their lives and living spaces and 3) understanding how to incorporate universal design principles into research and clinical spaces as demonstration pieces for patients.

Keywords: Universal Design, neurological disabilities, inclusive design, design for all, stroke, spinal cord injury

1. Introduction

The breadth of the conditions and number of individuals with neurological disorders is staggering. There is an estimated prevalence of 5.8 for autism spectrum disorder and 2.4 for cerebral palsy per 1000 children. A 1-year prevalence for migraine was 121, 7.1 for epilepsy, and 0.9 for multiple sclerosis per 1,000 in the general population. The prevalence of Alzheimer disease was 67 and Parkinsons was 9.5 among the elderly. 183 strokes, 101 major traumatic brain injuries, 4.5 spinal cord injuries, and 1.6 diagnosis of ALS are reported for every 100,000 individuals [25]. Behind each of these numbers, incidence and prevalence, are individuals struggling with the debilitating symptoms and changes in ability or functionality as a result of the condition with which they are afflicted.

By focusing on challenges in the residence, this article will inform readers how rewriting problems and supporting solutions guided by the principles of universal design will enable individuals to complete more tasks. Although the individual’s capabilities do not change as a result of the design, his/her abilities do. By redefining problems, changing environments, and selecting different products, the quality of life of the individual may be enhanced. While not competing with the benefits of rehabilitation design, universal designs focus on solutions that benefit multiple members of the social sphere. The effected individual’s family
Potential changes in capabilities with a neurological disorder
- mobility (paralysis, balance, gait)
- memory (short term, long term, recall, and learning)
- mental processing
- strength (decrements, paralysis, numbness in extremity, sidedness, endurance)
- precision and accuracy of motions (tremors, seizures, tics)
- senses (numbness, pain, speech, vision, appetite)

Changes in capability may lead to changes in abilities
These changes in capability manifest themselves as changes in an individual's ability to perform activities of daily living including bathing, cooking, toileting, and dressing. [7; 18; 20; 46; 60] These changes may increase stress on all members of the social sphere.

Fig. 1. Social sphere of a patient. Note: This graphic is not indented to indicate that the individual with the neurological disorder is or should become the center of all relationships or that activities should revolve around him/her. Instead it is a simplified representation of the interdependencies between the patients, members of his/her social sphere and the mediating effect of the environment and products within the environment.

(parents, spouses, children, and siblings), caregivers, friends, doctors, and close community members create, what will be modeled in this article as, a sphere of support and bi-directional influence. This social sphere (see Fig. 1) provides bi-directional interactions between the patient and the many individuals in their lives. The outer ring (including environment and products) represents the mediating effect of the environment and products available to those individuals and relationships in the social sphere. The environment and products available can ease burdens, facilitate relationships or can add stress during activities to all members of the social sphere. Universal design focuses on selecting products and creating environments in which individuals can use their abilities (senses, strength, coordination, reflexes and sensation) to accomplish tasks without special accommodation.

2. What is Universal Design?
Universal design is a paradigm where people of all abilities are included in the intended population of users [19,23,24,26,32,41,48,51,58] of a product or environment. This approach is known by many names around the globe [47,56] – inclusive design [13,14,22,36], design for all [9], lifespan design [1,6] or barrier-free design [24]. A traditional review of peer reviewed literature will leave the reader wanting since designers frequently convey their results and success in presen-
current solutions. Rapid changes in technology make previously impossible tasks realistic, ubiquitous— even universal [27–29]. Since time affects which designs are considered universal, this review will include references to seminal articles but will focus on current solutions.

Universal design literature extends into three primary areas: information design (education and internet) [2, 8–10, 35, 42–44, 55], product design (consumer [5, 12, 24, 34, 59] and transportation [24, 38]) and place (interior [19, 24, 34, 62], exterior/ landscapes [15, 17, 19, 24, 39, 49, 58], and structure [3, 4, 11, 17, 24, 49, 62]) design. In books surveying multiple UD solutions, specific resources (such as product sources and manufacturer’s contact information) for solutions depicted are often provided [19, 34].

General internet search engines produce millions of hits; however, searches of databases (e.g.: compendex, Avery index to architectural periodicals or design and applied arts index) of peer-reviewed journals for “universal design” produces limited results—50 to 100 relevant citation spanning multiple decades. This highlights the challenge in solution documentation in the field of design—where peer review publication is historically overshadowed by books, juried reviews, awards, and mentions in popular press articles.

So how does one keep up with the broad and changing offerings associated with “universal design”. First, understand the basic premise of universal design. Second, involve the intended and likely users in defining tasks and goals. Third, understand the social sphere within which the individual exists so that the solutions are seamless—virtually invisible. Fourth, understand what is not universally designed. Finally, partner with a trusted resource. Each step will ensure that the beneficiaries of a UD solution are many.

Leveraging universal design requires an understanding of its origin and examples of current solutions. The origins of Universal Design in the United States began with the barrier free design [61] movement at the Federal level in the 1950s, followed by the tumultuous 1960s civil rights movement. The civil rights movement inspired the disability rights movement, generating new legislation in the 1970s, 80s, and 90s designed to protect people with disabilities from discrimination in multiple arenas [50, 52]. During this time, Universal Design was defined by Ron Mace, the founder of the Center for Universal Design at North Carolina State University, as “The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.” This approach to design was made operational for designers through the creation of a set of principles of universal design.

2.1. Principles of Universal Design (UD)

Universal Design benefits people of all ages and abilities. At the Center for Universal Design (CUD), a working group (architects, product designers, engineers and environmental design researchers) collaborated to establish a set of Principles of Universal Design to guide a wide range of design disciplines including those focused on environments, products, and communications. These seven principles (see Table 1) may be applied to evaluate existing designs, guide the design process and educate both designers and consumers about the characteristics of more usable products and environments [16]. Many designers and consumers have difficulty distinguishing between UD and accessibility. A common rhetorical question follows this line of thinking, “if we have accessible designs do we need to concern ourselves with UD?” UD focuses on designs which are usable for everyone not just adding on components to provide access to a space or activity. To understand the benefit of UD beyond accessibility we must understand the difference between the two [45].

2.2. Differences between UD and accessibility

Modeled after earlier laws prohibiting discrimination based on race and gender, the purpose of the Americans with Disabilities Act, ADA, is to recognize and protect the civil rights of people with disabilities. The ADA focuses on requirement to meet the needs of individuals with disabilities in areas including mobility, stamina, sight, hearing, communication and learning. Five separate areas are addressed (Titles I-V respectively): the workplace, state and local government services, public and commercial facilities, phone companies, and miscellaneous instructions to Federal law enforcement agencies. The basic standards (under title II and III) developed and maintained by the ADA Accessibility Guidelines (ADAAG) are enforced by departments of Justice and Transportation. Clarification and reiteration of who is covered by the ADA was signed into law on September 28, 2008 as an amendment. This amendment became effective January 1, 2009.

Accessibility refers to what is legal—what is required to meet building codes and requirements [57]. For example, a building can be designed with the en-
Table 1
Principles of Universal Design

PRINCIPLE ONE: Equitable Use
The design is useful and marketable to people with diverse abilities.
Guidelines:
1a. Provide the same means of use for all users: identical whenever possible; equivalent when not.
1b. Avoid segregating or stigmatizing any users.
1c. Provisions for privacy, security, and safety should be equally available to all users.
1d. Make the design appealing to all users.

PRINCIPLE TWO: Flexibility in Use
The design accommodates a wide range of individual preferences and abilities.
Guidelines:
2a. Provide choice in methods of use.
2b. Accommodate right- or left-handed access and use.
2c. Facilitate the user’s accuracy and precision.
2d. Provide adaptability to the user’s pace.

PRINCIPLE THREE: Simple and Intuitive Use
Use of the design is easy to understand, regardless of the user’s experience, knowledge, language skills, or current concentration level.
Guidelines:
3a. Eliminate unnecessary complexity.
3b. Be consistent with user expectations and intuition.
3c. Accommodate a wide range of literacy and language skills.
3d. Arrange information consistent with its importance.
3e. Provide effective prompting and feedback during and after task completion.

PRINCIPLE FOUR: Perceptible Information
The design communicates necessary information effectively to the user, regardless of ambient conditions or the user’s sensory abilities.
Guidelines:
4a. Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.
4b. Provide adequate contrast between essential information and its surroundings.
4c. Maximize “legibility” of essential information.
4d. Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).
4e. Provide compatibility with a variety of techniques or devices used by people with sensory limitations.

PRINCIPLE FIVE: Tolerance for Error
The design minimizes hazards and the adverse consequences of accidental or unintended actions.
Guidelines:
5a. Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded.
5b. Provide warnings of hazards and errors.
5c. Provide fail safe features.
5d. Discourage unconscious action in tasks that require vigilance.

PRINCIPLE SIX: Low Physical Effort
The design can be used efficiently and comfortably and with a minimum of fatigue.
Guidelines:
6a. Allow user to maintain a neutral body position.
6b. Use reasonable operating forces.
6c. Minimize repetitive actions.
6d. Minimize sustained physical effort.

PRINCIPLE SEVEN: Size and Space for Approach and Use
Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user’s body size, posture, or mobility.
Guidelines:
7a. Provide a clear line of sight to important elements for any seated or standing user.
7b. Make reach to all components comfortable for any seated or standing user.
7c. Accommodate variations in hand and grip size.
7d. Provide adequate space for the use of assistive devices or personal assistance.

Universal Design is unobtrusive, even invisible. If you’ve ever been through an automatic door, you’ve experienced a version of Universal Design. A ramp or curb cut is just as welcome to someone with a baby stroller as it is to someone in a wheelchair. In addition to those whose mobility is limited, the design is intuitive to those who cannot read or hear or those who read or speak a foreign language. These examples of universal design provide the little or no difference in the
manner in which they are experienced for the greatest number of people possible. No one is stigmatized or inconvenienced by their use.

3. Beneficiaries of UD

Most environments, including residences, are designed for the average individual. The average individual is a myth which only exists in anthropometric tables and ergonomics classrooms. Tasks or space designed for the average and retrofitted to be legally accessible often create a social imbalance or stigma by removing disabled individuals from the task at hand. Designing for the average means that everyone is compromising. This does not sound bad until you are the one compromised and perhaps incapable of completing a task, or you are the person constantly assisting the individual incapable of completing the task. This is both physically and emotionally demanding for both indi-
viduals. These imbalances are exacerbated in multi-generational households or households with individuals with physical and/or cognitive limitations due to neurological disorders. Living in a place designed for the average with members with non-average abilities is challenging at best. A universally designed space can reduce dependence, ease burdens and strained relationships, and empower multiple members of the social sphere (see Fig. 1). Resources supporting the research, dissemination and application of universal design can be found in the private and government sectors (see Table 2).

4. Residential applications of UD

There are a plethora of books and technical packets devoted to the subject of Universal Design. UD for residential design focus on entrances and site designs, doors and doorways, kitchens, bathrooms, bedrooms, transportation/parking, and exterior living spaces such as decks, patios, porches, and balconies. Here solutions addressing the changes in gait, memory, strength, precision and accuracy of motion and sensations brought on by neurological disorders will be highlighted with regard to performing activities of daily living within a residential setting. We will focus on entrances, living spaces, kitchens, and bathrooms. Within each section we will discuss products and management systems that may be used within the residence in each of these areas to focus on UD solutions and decision making. In addition to those found in the literature, the solutions presented are aggregate examples found while traveling, visiting individuals’ homes, and consulting with colleagues.

4.1. Entrances

Entering an individual’s residence should provide a sense of ‘Welcome’, not a struggle. UD entrances afford all individuals entering a home to feel ‘welcome’ and that are wanted inside. They need not struggle to enter. The quality of this experience sets the tone for existence within the residence.

Many of the traditional notions of community and home are rooted in the sense of space surrounding the doorways to our homes. Raised porches are traditional vantage points from which to survey and engage with our community; however, the raised entrance poses problems for individuals needing the assistance of crutches, wheelchairs, and other mobility assistive devices. Traditional retrofits include: ramps, lift and re-grading and sites to produce stepless entrances [19,23, 53,62]. Five alternative methods for stepless entrances are outlined in a CUD Tech Sheet on Stepless entrances: a raise shared alley, shared boardway, raised parking pads, shared walkways, and raised central courtyards. A stepless entrance is defined by a shallow path, and benefits not only the impaired, but also those in his/her social sphere while moving furniture, rolling luggage, pushing a stroller or using a wheelchair. In a theoretical UD house plan, Mace called out a bridge with a railing and attractive landscaping as the primary means to enter a house at grade. This entrance called for a well lit, oversized, covered space for guests to wait to be greeted. A bench was place to afford guests and residents the opportunity to sit and rest or place packages while opening the door. Similar resting spaces were to be placed inside the entrances to set packages down while the guests were greeted, or while doors were closed and locked.

Welcome mats and area rugs designed to minimize the transmission of dirt into the residence pose additional barriers to be traversed, and may pose slip hazards to individuals using crutches, walkers, or those with balance issues. Once inside the home, selection and arrangement of furniture (with UD principles in mind) in each space will similarly support the quality of life and integration of all individuals into the activities within the home.

4.2. Living spaces

Living spaces include opportunities for improving quality of life using both large and small UD solutions. Of considerable importance is the selection of furniture, flooring materials, interior doors, archways, halls, lighting, and amount of clear space.

When selecting furniture, it is important to consider design characteristics such as the apron, arms, and seatpan heights and depths. A couch with a low apron will prevent an individual from sliding their feet under the couch (and therefore their center of gravity) and will make rising from the couch more difficult for individuals with decreased lower extremity strength or joint problems. A piece of furniture without armrests may facilitate an individual’s ability to transfer from the side of the piece of furniture; however, armless pieces reduce a person’s ability to use the strength of their upper body to augment their lower body strength when ascending and descending. Furniture with low seatpans may fit the popliteal height of a person of
shorter stature, but again, may require additional effort (e.g. strength in the quadriceps) while rising. Furniture with deep seat pans may afford someone to curl-up on the furniture and read a book, but it may also require weaker, smaller individuals to scoot forward multiple times to gain purchase on the edge of the seat in order to rise. This may not be an issue if a child is scooting forward in a social situation; however, this may be quite a different experience for an adult in front of his/her peers or family.

The selection of floor materials also impacts an individual’s mobility, and therefore, his/her ability to engage in the activities of multiple areas [19]. Thick carpets challenge users of wheelchairs, crutches, and canes. In contrast, there are disabilities, such as those creating degenerative joints and altered joint angles, where the cushion associated with a thick carpet is a benefit. Hence, each social sphere member’s needs should be considered. Changes in flooring materials create tripping hazards and threshold impediments [19]. Unsecured edges, creases, or buckles in rugs can create similar and unexpected hazards. These impediments may discourage an individual from moving with the rhythm of the house and promote a sedentary lifestyle.

To promote ease of movement, interior doors, archways and halls should be at least 32 inches wide, preferably 36”. Archways are a feature which separates spaces without requiring the effort associated with opening and closing doors [19,23]. If a door is desirable to control noise or provide privacy, there are several items to be considered in the selection and installation of interior doors. Clear hinges can be installed to maximize the width of doorway opening by allowing the door to open so that the thickness of the door does not reduce the width of the doorway opening. Interior doors in confined spaces created where multiple rooms come together may benefit from pocket doors [19], which don’t require individuals to change direction to accommodate a door swing. However, pocket and traditional interior doors require the use of a hand to open and close them. A swinging door hung to stay open once pushed out of the way affords the individual the privacy of a door without requiring the use of his/her hand to open or close it. In such situations where the momentum of the door aids in the opening or closing, it is wise to be able to see through the door at multiple heights to avoid hitting an individual of any height approaching from the opposite direction (see Fig. 2). Traditional doors may be made easier to use by installing lever handles [23]. Lever handles don’t require the user to have the same strength or range of motion necessary to grip and turn a traditional/round door knob (see Fig. 4).

The quality of the experience within a space is affected by the lighting. The level of illumination, spectrum, direction, and level of control are all important to consider when creating UD environments. Individuals with low vision or performing precision tasks, such as sewing or cutting, may require higher levels of illumination in a focused area. Such task lighting also benefits readers and individuals working in a group with mixed visual capabilities. What is adequate lighting for one
Outlet located just above knee height
Outlet located in the base board

Fig. 3. Electrical Outlets. Note: Though the height of the outlet will address the effort required of individuals reaching to use the plug. No designs are readily available to make plug insertion easier for individuals with upper extremity tremors, tics or palsy. Care should be taken to select outlets that provide tension on the plug sufficient to avoid the plug slipping out without requiring undue exertion during the plug’s insertion.

Long Handle on Blinds and Lever Door Handle
Small Finger Tip Pull on Blinds

Fig. 4. Natural Light Control.

individual may produce glare for another. Therefore, UD lighting solutions include general room and task lighting preferably with dimming features. Light fixture selection and placement also impacts an individual’s ability to use the fixture (see Fig. 3). A small thumb wheel control located on a floor lamp placed behind a chair will be of little use to an individual with decreased pinch grip strength, tactile sensitivity, range of motion, or limited reach or mobility challenges. Instead, lights placed behind or adjacent to furniture should be connected to wide toggle wall switches or portable switches with dimmers. If the light fixtures are easy to reach, pull chains descending below lamp shades or touch lamps may suffice.

Natural lighting can be a real positive [8,21,37,40] as long as it is well controlled and directed [33]. Blinds are a popular method for handling natural light. However, the operational mechanisms for blinds vary from long levers that may be used at any height to small bobbles and cords that twist and are difficult to operate (see
In addition to selecting UD products, providing clear space within the living space will afford a person room to enter and move about within a room without bumping into or knocking over objects [19,23]. With adequate clear space, the value is placed on the inclusion of the individual and not the material items within the room. The ability to move freely is liberating and provides the sense that one fits and is welcome in this space.

### 4.3. Kitchens

The kitchen is where we spend a great deal of our waking, social hours in our home. Not only do we prepare and eat food in the kitchen, we share our experiences, plan our days and manage our lives. These are activities for which we should design. Lower cabinets with adequate toe room, drawers rather than shelves, and shallow sinks coupled with cabinets with swing away doors are commonly touted UD features affording improved usability to individuals with limited reach and wheelchair users [19,23]. Upper cabinets hung lower or mounted on adjustable tracks also afford improved usability to those with limited reach. Details that afford increased participation in kitchen activities include [19,23]: selecting refrigerators with handles that extend the length of the machine, multiple height work and eating surfaces [23], and under the counter cutting boards and non-slip cutting boards. Placemats with anti-skid textures keep plates and mixing bowls in place to avoid spills and other mishaps, minimizing the impact of tremors, lack of strength or lack of an appendage. Care must also be taken to support large and hot items to avoid spills, burns, and embarrassment. Food storage containers that provide a grip along the length of the package and control the direction and flow of materials (see Fig. 5) help provide control for individuals with minor tremors or coordination difficulties. UD considerations may be given to details such as selecting plates and counter surfaces that are chip resistant and forgiving (shock absorbing) when items are set down too hard, clanked or dropped from a short distance.

Appliance selection and installation location can afford easier use [19]. Separate stove tops [23] and built in ovens should be installed such that cooked items are placed and retrieved at approximately counter height to support independence in the kitchen. Ovens with side swing doors afford use with reduced reach [23]. Combining competing concerns for usability and minimization of accidental activation can be achieved by selecting controls that require two steps for activation, located toward the front of the appliance. Controls also should have clear indicators of position with asymmetric shapes or clear, high contrast labels.

To address memory challenges, several strategies may be deployed. To aid in cooking and food preparation it may be useful to group task related items together in drawers, in bins or in sight. For example, hang insulated gloves adjacent and within sight of the oven rather than placing them in the drawer for storage. Augment a written recipe, an old fashioned memory...
Levered faucets
Traditional two handled faucets

Fig. 6. Sink and Bath Faucets. Note: The levered faucet is activated by pushing up/down and adjusting the lever right/left for temperature control. The traditional two handled faucets are easily turned with minimal force and without the need for a pinch grip.

Automatic Soap Dispenser is Motion Activated
Soap Dispenser is Activated by Pushing Down

Fig. 7. Soap Dispensers. Note: Both may be placed near the edge of the sink/counter to minimize the reach requirements

Faucet controls (including sprayers) can have an impact on ease of use. Dual and single levered faucets (see Fig. 6) allow individuals the ability to control the water flow without requiring gripping capability. These faucets can be operated with the back of the hand or elbow, thereby reducing germ transmission. Faucets may be installed on the side of the sink to reduce reach requirements. UD faucet selection also has applications in the bathroom, laundry and mud rooms. Temperature controls should be installed in plumbing systems to limit scalding (for children and individuals with decreased tactile sensitivity) similarly hot and cold water supply lines should be concealed below wall mounted, pedestal and cantilevered sinks to prevent injury. Replacing bars of soap with dispensers which require pushing or motion activation to dispense soap are excellent UD examples (see Fig. 7).

4.4. Bathrooms

Common problems in the bathroom include: narrow doorways, insufficient turning space, lack of knee room under the sink, insufficient transfer areas to the bath and toilet, and inadequately reinforced walls for grab bars. There are three primary opportunities for application of the UD principles in the bathroom [19,23,54]: 1) the shower/bath, 2) the toilet area, and 3) the sink. One of the difficulties with tradition showers and baths is the effort needed and fear associated with entering and exiting the shower and baths for individuals with mobility and strength challenges. In addition to the step required to enter most showers or baths, individuals are entering or exiting a wet area. The addition of water to slick floor coverings makes for a hazardous combination. One UD solution is the installation of curbless showers which utilize a 2–4” threshold and trench drain instead of a center drain (see Fig. 8). These designs are also popular. The first is the installation of a new walk in tub designed with half doors which seal water tight. The second approach is to provide an oversized flat surface flush with the top of the tub to allow individuals to transfer or...
Fig. 8. Universally Designed Bathroom with Curbless Shower*. Note: This design affords transfer from the side or front of the toilet. The reaches required for and usability of all fixtures are good and there is generous unobstructed turning space. The lavatory counter width affords easy retrieval and storage of frequently used personal hygiene items or those of multiple users. This design also includes a linen closet, base cabinet and windows. In order to afford greater privacy and the opportunity for simultaneous users, moisture resistant (shower) curtains are located in front of the “curbless” roll-in shower and between the wet area and the toilet/sink area. A pocket door minimizes the use of the clear space for door swing into the bathroom or the hall. *This design and image are reprinted with permission from the Center for Universal Design, concept illustrations generated by Rex J. Pace.

Fig. 9. Toilet Seats and Heights.

simply sit before lowering themselves into the tub. This solution requires greater upper body strength when an individual lifts and lowers herself into and out of the tub.

Although new toilets (17” to 19” [23]) may be purchased and installed, this may be infeasible within a residence. However, a standard or taller toilet height used in combination with a stool has multiple benefits. Utilization of stools may help individuals obtain a squat posture which facilitates bowel evacuation. A stool may also help shorter individuals ascend to the toilet without aid and prevent their legs from dangling, which results in decreased circulation in the lower extremities if extended time on the toilet is necessary. This bene-
fits youngsters during toilet training, older individuals with problems sitting and rising, short stature adults, and adults having recently had surgery, delivered babies, are prone to constipation, or lack bowel control owing to a neurological disorder. Another UD solution to toileting support is the installation of a lid with dual diameters for the seat opening (see Fig. 9).

Secondary opportunities for UD solutions in the bathroom are similar in both problem and solution to those in the kitchen (sink shape and clearance, cabinet door swings, and toe room). Again, care must be taken to either limit water temperature or to provide visual feedback for individuals with reduced tactile sensitivity or numbness. (See solutions in Section 3.3). Storage and retrieval of items for personal hygiene, grooming, dressing, and cleaning may be addressed by utilizing a combination of shallow shelves at heights ranging between 30–45”, or using lower storage locations (under the counter) using drawers. This allows individuals to retrieve stored materials without the increased effort associated with bending, twisting or stooping to reach under cabinets closed in with doors.

5. Recommendations

Researchers and clinicians have a broad range of responsibilities and opportunities to impact the lives of the individuals they are treating who live with neurological disabilities. There are several opportunities for such impact: 1) educating those in the patient’s social sphere as to the benefits of universal design, 2) helping inform patients how to leverage universally designed products and approaches in their lives and living spaces, and 3) incorporating universal design principles into research and clinical spaces as demonstration pieces for patients.

By discussing the activities of daily living performed throughout a residence with a patient, researchers and clinicians may identify areas of stress for the patient and within the social sphere.

Researchers and clinicians can discuss and provide resources for UD (see Table 2) to patients, caregivers, and peers. These discussions can highlight the opportunities to include UD principles in daily activities through major and minor purchases, layouts, and development of forms and data collection surveys. Opportunities to deploy UD with minimal financial investment present themselves when redesigning living rooms, reception areas and office spaces. Solutions are more costly when retrofitting (e.g. UD is not considered in the design phase). Removing or reorienting furniture affords clear spaces for easier mobility. Small UD investment opportunities occur when purchasing office supplies such as scissors, selecting varied and directional lighting, and selecting lighting controls. Although the individual’s capabilities cannot always be restored to those of an ‘average individual’ his/her abilities can change. By redefining problems, changing environments, and selecting UD products and approaches, the quality of life of the individual and those in his/her social sphere may be greatly enhanced.

References
