Assistive Technology and Universal Design

A Toolkit for Interagency Collaboration

ICDR

INTERAGENCY COMMITTEE ON DISABILITY RESEARCH

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Introduction

Despite the passage of the Americans with Disabilities Act (ADA) prohibiting discrimination based on disability, people with disabilities continue to face significant barriers to accessing routine daily activities. While the government continues to engage in ADA implementation and enforcement activities, there remain significant access gaps for people with disabilities across a variety of realms: the physical environment, education, health care, technology, employment, transportation, and housing, among other areas. Assistive technology and universal design (AT/UD) are two areas of disability research that have the potential to significantly improve accessibility across society for people with disabilities.

The goal of AT/UD is to consider accessibility for all people at the outset of designing buildings, transportation, technological devices, and many other features of society. AT seeks to harness recent technological advances to allow people with disabilities to perform functions that would otherwise be difficult. UD research strives for accessible design of the physical environment, learning environment, technology, transportation, and a variety of other areas for all people regardless of disability, age, or other factors. These two concepts work together toward a vision for a more inclusive society. Qne where people with disabilities have equal access to engaging in the same activities as their peers without facing any barriers. This toolkit provides an overview of relevant legislation and recent federal research and resources on assistive technology and universal design and provides tools for engaging in future research.

About the ICDR

The **Interagency Committee on Disability Research (ICDR)** was authorized by the amended 1973 Rehabilitation Act to coordinate federal research efforts surrounding disability, independent living, and rehabilitation research, to include assistive technology research and universal design. The three goals designated in ICDR's 2018–2021 strategic plan are:

Goal #1: Improve interagency coordination and collaboration in four thematic research areas: transition, economics of disability, accessibility, and disparities.

Goal #2: Develop a government-wide inventory of disability, independent living, and rehabilitation research.

Goal #3: Promote ongoing stakeholder input on gaps and priorities for disability, independent living, and rehabilitation research.

This toolkit aims to address the ICDR's goal of improving interagency collaboration on accessibility and to provide an overview of current research efforts in AT/UD across the federal government. Innovative AT/UD examples from the private sector, as well as a collection of AT/UD tools and resources, are included in this toolkit, encouraging future research and collaboration in these areas.

Universal Design and Assistive Technology Working Group

The ICDR's Assistive Technology and Universal Design working group examines design, development, policy, systems, and services research related to AT, as well as the accessibility of electronic information and technology, products, and environments. The AT/UD working group also examines ways UD can be incorporated into the development of these technologies, products, and environments to increase benefits to all individuals, including those with disabilities. More information on the ICDR AT/UD working group and upcoming events is available here.

Legislation Related to Assistive Technology and Universal Design

Several disability rights laws shape the landscape for current AT and UD research. These laws outline significant advances in ensuring accessibility for people with disabilities, in addition to initiating AT programs. The following section will briefly describe disability rights laws from the 1970s through present that relate to assistive technology and universal design.

The Rehabilitation Act of 1973

The Rehabilitation Act of 1973 bans discrimination based upon disability in federal programs, as well as programs receiving federal assistance, federal employment, and federal contractors (U.S. Department of Justice [DOJ], 2020). This law was the first major piece of legislation to protect the civil rights of individuals with disabilities. The Rehabilitation Act outlines grants to states for vocational rehabilitation, supported employment, independent living, and personal assistance. It has several different sections, all aimed at rights, advocacy, and protections for individuals with disabilities. The Rehabilitation Act also established the U.S. Access Board, an independent federal agency that develops accessibility guidelines and standards for the physical environment, transportation, communication, medical diagnostic equipment, and information technology to ensure that people with disabilities have equal access (U.S. Access Board, n.d.).

SECTION 504

Section 504 was added to the Rehabilitation Act to prevent discrimination based upon disability in any program receiving special funds, to include public schools (Ohio Center for Autism and Low Incidence [OCALI], 2013). This allows students

who need special assistance, such as AT devices, but do not qualify for special education services as outlined in the Individuals with Disabilities Education Act to receive the necessary accommodations or devices through the school, at no cost to the parents.

SECTION 508

In 1998, the Rehabilitation Act of 1973 was updated with Section 508 to require all electronic and information technology used by federal agencies to be accessible to people with disabilities (DOJ, 2020). Section 508 establishes requirements surrounding the accessibility of electronic and information technology that is developed, maintained, procured, or used by the federal government. Section 508 requires that federal agencies give equal access to information for employees and citizens with disabilities as available to those without disabilities. It defines an accessible system as one that does not rely on one single sense or ability of the user, but rather has options that make the information accessible in multiple formats. In 2017, the U.S. Access Board released a final rule, updating the guidelines and standards for Section 508 of the Rehabilitation Act to reflect recent innovations in technology. The U.S. General Services Administration has a website regarding 508 requirements that can be accessed here.

The Individuals with Disabilities Education Act

The Individuals with Disabilities Education Act (IDEA) passed in 1975, mandating that public schools offer all eligible children with disabilities a free public education in the least restrictive setting tailored to their specific needs (DOJ, 2020). IDEA mandates that schools develop Individualized Education Programs (IEPs) for each child in special education that reflects their unique needs and related services provided. Specific procedures are outlined for the development of IEPs, as well as the requirement that they are developed by a knowledgeable team of persons and updated on a yearly basis. AT was not included in the original IDEA Act, but it

was added in under "Related Services" in 1990, and the 1997 amendments to the law required that AT be considered during the IEP process for each student with a disability (OCALI, 2013).

The Technology-Related Assistance for Individuals with Disabilities Act

The Technology-Related Assistance for Individuals with Disabilities Act was passed in 1988 (reauthorized in 1994) and provides funding to statewide AT programs. The state AT programs respond to the AT needs of consumers with disabilities of all ages. This Act is the basis of the Assistive Technology Act of 1998 (National Association of Special Education Teachers, 2019).

The Americans with Disabilities Act

The ADA, passed in 1990, protects the rights of people with disabilities by pre-venting discrimination in employment, state and local government, commercial facilities, transportation, telecommunications, public accommodations, and Congress (DOJ, 2020). The ADA defines disability as "a physical or mental impair-ment that substantially limits one or more major life activities, a person who has a history or record of such impairment, or a person who is perceived by others as having such an impairment" (DOJ, 2020). This law specifies that reasonable accom-modations must be made by employers for people with disabilities and outlines accessibility requirements for public accommodations. The ADA is considered a civil rights law and was celebrated by the disability community as a major milestone in working toward disability rights.

The Telecommunications Act

The Telecommunications Act of 1996 provides an update to the Communications Act of 1934 Section 255 and Section 251(a)(2) (DOJ, 2020). It requires telecommuni-cations equipment manufacturers and providers of telecommunication services to

assure their services and equipment are equally accessible and usable for people with disabilities if "readily achievable." It ensures that people with disabilities have access to operator services, cell phones, call-waiting, and other telecommunications services that were previously inaccessible.

The Assistive Technology Act

The Assistive Technology Act (AT Act), passed in 1998 (amended in 2004), builds upon the Technology-Related Assistance for Individuals with Disabilities Act of 1988 to emphasize that technology is an important tool to improve the lives of people with disabilities and to outline the federal responsibility of promoting access to AT devices and services (Assistive Technology Resource Centers of Hawaii, 2020). The AT Act establishes financial assistance to states to create grant programs for AT needs of people with disabilities within each state. The AT Act is designed to promote and strengthen funding, access to, and availability of AT for people with disabilities of all ages.

The Twenty-First Century Communications and Video Accessibility Act

The Twenty-First Century Communications and Video Accessibility Act (CVAA), passed in 2010, aims to increase access for people with disabilities to modern communications. It provides updates to accessibility laws from the 1980s and 1990s to ensure that they are inclusive of 21st century technologies (Federal Communications Commission [FCC], 2020a). The CVAA aims to ensure that people with disabilities have access to emerging innovations in broadband, digital, and mobile technologies. Title I of the CVAA details the requirements for ensuring that products such as broadband or mobile phones are accessible to people with disabilities. Title II of the CVAA focuses on requirements regarding the accessibility of video programming and the Internet for people with disabilities.

The Patient Protection and Affordable Care Act

The Patient Protection and Affordable Care Act (ACA), passed in 2010, expands access to health care for many groups of Americans. The ACA requires that people with disabilities receive equal access to participate in the health care system and attempts to reduce disproportionate costs for health care for people with disabilities (Assistive Technology Act Technical Assistance and Training Center, 2017). The ACA mandates standards for essential health benefits, which include rehabilitation and habilitation services and devices as well as a wide range of assistive technology. Another provision of the ACA, Money Follows the Person, aims to increase the transitions for people with disabilities from institutions into the community. This program addresses the AT needs that individuals may have in order to facilitate transitions into the community. Money Follows the Person works directly with state AT programs to assess and procure needed AT for this purpose.

Universal Design

Universal design is a term coined by Ron Mace, an internationally recognized architect, product designer, and educator, to describe designing products and the physical environment to be "aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life" (The Center for Universal Design, 2008). Ron Mace was an advocate for disability rights, which was reflected throughout his work related to UD. Other terms for UD include "design for all," "inclusive design," and "barrier-free design" (Steinfeld & Maisel, 2012). UD differs from accessibility standards because UD incorporates accessibility features throughout the entire process versus adding accessible features after the design process is complete (Steinfeld & Maisel, 2012). This is an important distinction; designing for all groups of users at the beginning results in a better overall design and works to end stigmatization that can be associated with accessible features.

View an example of a demonstration home designed with universal design principles here.

THE SEVEN PRINCIPLES OF UD ARE AS FOLLOWS:

1. **Equitable Use:** The design is useful and marketable to any group of users.

2. **Flexibility in Use:** The design accommodates a wide range of individual preferences and abilities.

3. **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.

4. **Perceptible Information:** The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

5. **Tolerance for Error:** The design minimizes hazards and the adverse consequences of accidental or unintended actions.

6. **Low Physical Effort:** The design can be used efficiently and comfortably and with a minimum of fatigue.

7. **Size and Space for Approach and Use:** Appropriate size and space is provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility (Burgstahler, n.d.).

Housing Visitability

The concept of UD in housing is referred to as visitability. Visitability differs from accessibility because it focuses on how new houses are designed instead of on renovations. Visitability seeks to change the construction of all new homes in a way that makes them easier for individuals with mobility impairments to live in and visit yet stay marketable to all potential homebuyers. Visitability focuses on three essential features: an entrance with zero steps, 32 inches or more of space through interior doors, including bathrooms, and at least a half bathroom on the main floor (National Council on Independent Living, 2020). The public sector can encourage visitability through tax cuts from the Low-Income Housing Tax Credit, impact fee waivers, construction or infrastructure funds, and a variety of other incentives.

The ICDR's Housing Toolkit provides additional resources and information on the concept of visitability and housing design for people with disabilities. It can be found here.

Universal Design for Learning

The concept of UD has also been applied to the field of education, known as universal design for learning (UDL). UDL has gained widespread use in the education sphere and is defined as a method of designing curriculum to meet the needs of all learners, regardless of their "ability, disability, age, gender, or cultural and linguistic background" (Teaching Excellence in Adult Literacy, 2010). UDL offers guidance for teachers on how to design their materials, assessments, and strategies to educate learners with a wide variety of needs. The goal of UDL is to ensure that all students have equal opportunities to learn and engage in the education system. This approach attempts to minimize the number of students with disabilities who need to seek accommodations by having instructors design courses that minimize barriers all students may face (Temple University, 2020). Resources related to UDL

have greatly increased in recent years. This toolkit provides a variety of resources related to UDL under the "Education" section on Toolkit Resources.

Economic Benefits of Universal Design

An important part of increasing widespread use of UD principles is illustrating the economic benefits to those planning and designing technologies, products, or environments. An important benefit of UD is that it can reduce costs, as waiting until later in a project to consider accessibility often results in additional expenses. It is estimated that for each dollar spent on projects and programs, 5.1 percent is wasted due to poor initial planning (U.S. General Services Administration [GSA], n.d.). Another major benefit to UD is that it can result in more innovative products, as multidisciplinary teams can brainstorm about how to design solutions that are accessible and usable for all people. It is estimated that by 2021, brands that adopted UD early on to redesign their website to offer both visual and voice search will see an increase in online revenue of around 30 percent (GSA, n.d.). UD also provides the benefit of engaging the workforce by allowing employers to attract, retain, and develop both employees with and without disabilities. Designing physical environments and technology based off of UD principles will ensure more employees have the access they need to complete tasks at a job. It is estimated that emerging technologies will facilitate 350 million people with disabilities to enter the workforce over the next 10-year period (GSA, n.d.).

Assistive Technology

Assistive technology is defined as "any item, piece of equipment, software program, or product system that is used to increase, maintain, or improve the functional capabilities of persons with disabilities" (Assistive Technology Industry Association, 2020). The AT market is predicted to expand to at least $26 billion by 2024, from $14 billion in 2015 (Bureau of Internet Accessibility, 2019). The need for further development of AT is significant, with only one in ten people in need of assistive products having access to them globally (World Health Organization, 2020). The reasons for lack of access to AT are wide-ranging, but can include high cost, lack of financing, availability of products, awareness of products, and trained personnel (World Health Organization, 2020).

Types of Assistive Technology

AT encompasses a variety of devices, equipment, software, and products. The following is a list of common AT by category:

AUGMENTATIVE AND ALTERNATIVE COMMUNICATION DEVICES

- Alphabet boards
- Communication boards
- Tactile symbol communicator
- Writing boards

ENVIRONMENTAL EQUIPMENT OR MODIFICATIONS

- Adaptive utensils
- Adjustable furniture/desks
- Grab bars
- Lights on telephones and doorbells
- Ramps

- Smart home technology using voice, eye gaze, touch screens, large switch access, or apps
- Switches
- Tools that extend reach

HARDWARE AND OTHER DEVICES

- Adaptive keyboards and mice
- Adapted writing tools
- Computer/laptop
- iPads
- Refreshable braille display
- Tablets
- Wearable technology
  - Hearing aids
  - Smart watches

MOBILITY DEVICES

- Canes
- Crutches
- Orthotic devices
- Prosthetic devices
- Scooters
- Walkers
- Wheelchairs

SOFTWARE

- Chrome apps and extensions
- Magnification
- Screen reading
- Text-to-speech
- Voice recognition

Federal Research and Resources on Assistive Technology and Universal Design

Across the federal government, there are a variety of innovative research projects and programs related to assistive technology and universal design. The ICDR's role is to encourage collaboration and coordination across the federal government's disability research programs. This section will highlight some of the major federal research projects, programs, and resources related to AT/UD.

Federal Communications Commission

The FCC is an independent U.S. government agency responsible for regulating interstate and international communications. This agency implements and enforces the United States' communications regulations. The FCC has authority over communication via radio, television, satellite, cable, and wire in all U.S. states, the District of Columbia, and U.S. territories.

The FCC states that it is "dedicated to ensuring that all Americans — including Americans with disabilities — have full access to our nation's communications revolution" (FCC, 2020b). The FCC has developed several resources for people with disabilities to ensure they have equal access to information and communication technology (ICT). In addition, they host a consumer complaint center, which has a category for "access for people with disabilities" where accessibility complaints can be submitted. The FCC's consumer guide on *Telecommunications Access for People with Disabilities* offers information on accessibility, usability, and compatibility, along with how to contact service providers or manufacturers with accessibility concerns.

ACCESSIBILITY CLEARINGHOUSE

The FCC has assembled an Accessibility Clearinghouse with resources for people with disabilities about the innovative ways that people communicate. The clearinghouse contains policy resources, programs and services, device information, consumer guides, and information databases related to ICT for people with disabilities. The Accessibility Clearinghouse aims to ensure that people with disabilities have access to emerging communications technology, as emphasized in the Twenty-First Century Communications and Video Accessibility Act.

BEST PRACTICES FOR ACCESSIBLE INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

In 2016, the FCC published a white paper entitled *Individuals with Cognitive Disabilities: Barriers to and Solutions for Accessible Information and Communication Technologies*. This paper discusses why access to ICT is beneficial for people with disabilities, yet how ICT is significantly underutilized by this population. The FCC outlines the history of policy related to ICT for people with disabilities and potential accessibility solutions. This paper also includes a list of best practices to promote effective access and use of ICT for people with cognitive disabilities.

NATIONAL DEAF-BLIND EQUIPMENT DISTRIBUTION PROGRAM

The FCC's National Deaf-Blind Equipment Distribution Program, iCanConnect, provides people who have significant vision and hearing loss with ICT equipment. The program serves all states, U.S. territories, and the District of Columbia. Participants must also qualify as low-income to be eligible, and their vision and hearing loss must cause extreme difficulty with independence in their activities of daily living, psychosocial adjustment, or obtaining employment. Equipment provided includes items such as voice communication devices, internet-based voice communication, video conferencing services, and internet access. This program also offers

accessibility needs assessments, equipment installation, equipment training, and other technical support for participants.

Interagency Committee on Disability Research

The ICDR is responsible for coordinating federal disability research. In an effort to promote the accessibility and usability of health information technology (HIT), in 2015 the ICDR conducted a two-day conference entitled Accessibility and Usability in Health Information Technology: A Research and Action Conference to Empower People with Disabilities, Older Adults, and Caregivers. This conference's purpose was to promote the importance of user-driven design and accessibility for HIT research and development to increase patient engagement and improve the health of people with disabilities. More than 35 leaders in HIT shared their perspectives on current issues and areas to move forward, including users, providers, HIT research-ers, and federal leadership. Participating stakeholders described ways to advance current knowledge on accessible HIT and methods, models, and tools associated with user-centered and universally designed HIT.

Additionally, the ICDR has put together a toolkit on federal HIT resources, overview-ing the current state of federal HIT efforts and areas for future progress. This toolkit can be found here.

National Aeronautics and Space Administration

The National Aeronautics and Space Administration (NASA) has been researching and developing technology since its inception, as technology is an essential part of astronauts living and working in space. Recognizing that many of these techno-logical advances (i.e., robots, 3-D mapping, body armor, etc.) can potentially help people with disabilities, NASA advances patents for technology transfer for incor-poration of this technology into the public's daily lives. A project called The Space

Between Technology and Disability showcases some of the applications for these devices to be used as AT for people with disabilities.

National Council on Disability

The National Council on Disability is an independent federal agency that, in collaboration with people with disabilities, advises the President, Congress, and other federal agencies on issues that affect the disability community. The Council engages in a variety of roles to advance equal opportunities for people with disabilities, to include: convening stakeholders for input and recommendations, gathering and analyzing data, engaging in current debates and agendas, developing solutions to both long-term and emerging challenges, and offering tools to further effective implementation (National Council on Disability, 2020).

In 2011, the National Council on Disability produced *The Power of Digital Inclusion*, a report that highlights six key digital technologies that can enhance social participation, employment opportunities, and workplace engagement for people with disabilities. The report discusses both the accessibility and usability of these six technologies. The report explores the economy's transition due to technology and provides recommendations for implementing digital inclusion as a path forward to increasing employment rates for people with disabilities.

National Science Foundation

The National Science Foundation (NSF) is an independent federal agency founded in 1950 that supports and promotes the field of science in order to transform the future of the country. In advancing science, NSF also assists with advancing "the national health, prosperity, and welfare" (NSF, n.d.). NSF grants support about 25 percent of all federally funded basic research in the fields of computer science, mathematics, and the social sciences at United States' colleges and universities (NSF, n.d.). NSF hosts a Disability and Rehabilitation Engineering (DARE) research

program, which includes several projects on AT. A list of active DARE awards can be found here. The following are a few of the many projects related to AT that DARE grantees are working on:

A NEW INTERACTION MODEL FOR EYES-FREE EXPLORATION OF TOUCH SCREENS

An NSF-funded project at the University of Colorado at Boulder (2017–2022) aims to increase the accessibility of personal computing and mobile devices for blind and visually impaired users. Current touch-based interfaces use primarily visual interaction with users, providing limited haptic or audio feedback. In addition, the current interaction model assumes that blind users will interact with only one finger and one on-screen item at a time, making it difficult to sort through large amounts of information. This project is developing a new touch-based user interface that will be accessible to blind users, as it will use eyes-free interaction with touch screens. This type of interface uses the principles of UD, as it will be useful to sighted users as well (e.g., when driving). This project will host inclusive design workshops and invite people with disabilities to participate. People with disabilities will also be part of the research team on this project. The research will then involve studies with people who are blind and teachers of the visually impaired. Benchmarks and metrics will first be developed. Then, a touch screen interface will be developed that can recognize free hand poses, movements, gestures, and navigation strategies preferred by people who are blind. More information about this project is available here.

EXPLORATION OF BRAIN COMPUTER INTERFACE FOR INDIVIDUALS WITH CEREBRAL PALSY

A project at the University of Cincinnati (2019–2022), funded by NSF, examines the use of a brain computer interface for people with cerebral palsy to enable them to communicate and control objects in their environment. Previous researchers' use of electrical brain signals (EEG) in order to do so were unsuccessful, as people with cerebral palsy often have unpredictable body movements. Therefore, the goal of

this project is to find an alternative platform for an EEG-based brain computer inter-face. This project will conduct four main tasks: (1) compare EEG signals obtained from the person with cerebral palsy with those from a person without cerebral palsy with similar physical and intellectual abilities; (2) compare the EEG signals for both subjects in a neutral state when engaging in a cognitive (visual and motor imagin-ing) task; (3) develop a novel machine learning approach; and (4) use information gained from the prior three tasks to propose a novel, general procedure for brain computer interface for people with disabilities (NSF, 2019). After completion, the project team hopes to enable individuals with cerebral palsy to perform simple actions independently that individuals without cerebral palsy can perform on a routine basis. More information on this project is available here.

BLADDER VOLUME AWARENESS FOR INDIVIDUALS LIVING WITH SPINAL CORD INJURY

An NSF-funded project at the University of California-Davis (2020–2023) is working on a discrete device to assist with bladder volume awareness for individuals living with spinal cord injury. Nearly all individuals with spinal cord injury lack control of their bladder and must use catheters, usually between four to six times per day. The goal of this project is to design a device that can be worn discreetly on the lower abdomen to detect how full the bladder is. Researchers want the device to run on a battery for at least a full day, be flexible, be about twice the size of a credit card, and be only a few millimeters thick. This project will build and train machine learning models to determine bladder fill predictions. Once developed, the project will test the device on human subjects and receive real patient and caregiver feedback on the practicality of the device. More information on this project can be found here.

ROUTEME2 — A CLOUD-INTEGRATED SENSOR INFRASTRUCTURE FOR ASSISTED PUBLIC TRANSPORTATION SERVICES

This NSF-funded project conducted at University of California-Santa Cruz (2016–2021) explores the creation of a smart device system that will assist individuals with disabilities with using public transit safely and confidently. This device system, RouteMe2, will allow users to pre-register their trip, even on different means of transportation from different agencies, and approve authorized users (family members, assistants, etc.) to receive update notifications about the trip. If the user gets on the wrong bus, is not at the correct location, etc., the user and other authorized users will receive alerts. The RouteMe2 device will use interconnected sensors that will track the individual during their trip and provide information updates to a smartphone. This research team plans to use focus groups to refine their design and then test the device on users. The goal of RouteMe2 is to make travel via public transportation safer and easier for people with disabilities. More can be found about the project here.

NEXT-GENERATION SCREEN MAGNIFICATION TECHNOLOGY FOR PEOPLE WITH LOW VISION

An NSF-funded project at the State University of New York (SUNY) at Stony Brook (2018–2021) works to address current problems with available screen magnifiers by developing next-generation screen magnification technology. Some current issues with screen magnifiers are that they indiscriminately magnify screen context, often blocking important information; lack customizing features for the varying needs of people with low vision; and lack navigation aids to locate elements of interest. This project's goal is to design and create SteeringWheel, a next-generation screen magnification tool that addresses these issues. The aim is to make it easier for low-vision users to interact with digital information. Information from this project will also help formulate accessible computing undergraduate and graduate courses at SUNY at Stony Brook. More information about the SteeringWheel project can be found here.

U.S. Access Board

The U.S. Access Board is an independent federal agency that creates accessibility guidelines on a variety of issues. The concept of UD is incorporated into their accessibility guidance. The Access Board was originally created in 1973 to ensure people with disabilities had access to federally funded facilities, but it now creates and maintains information on design criteria for the physical environment, vehicles, telecommunications equipment, medical equipment, and information technology. It also provides training resources on accessibility and enforces the accessibility standards for federally funded facilities.

ACCESSIBILITYONLINE

The U.S. Access Board and the ADA National Network created a collaborative training program called AccessibilityOnline. This free training program covers a wide range of topics related to accessibility in the physical environment, transportation, and information and communication technologies. All training webinars have real-time captioning, and new sessions are held each month. AccessibilityOnline can be accessed here.

U.S. Department of Agriculture

The U.S. Department of Agriculture (USDA) is a federal executive department that focuses on regulations for farming, forestry, rural economic development, and food. Their goals are to help rural America thrive, offer economic opportunity, and to preserve the country's natural resources and land (USDA, 2020). USDA focuses on helping farmers and food producers both domestically and in the world market.

AGRABILITY

AgrAbility is a USDA-funded program offering education, assistance, and support to farmers and ranchers with disabilities. The program was initiated in 1991 and remains consumer-driven. AgrAbility partners with nonprofit disability

organizations to educate and assist agricultural workers with disabilities. This program is run through state project grants; however, the program also has a national grant that provides additional technical assistance and professional training for the state projects. More information about the AgrAbility program and its success is available here.

TECHNOLOGY & ACCESSIBLE RESOURCES GIVE EMPLOYMENT TODAY (TARGET) CENTER

The TARGET Center was established in 1992 with the goal of promoting the use of technology to increase accessibility for individuals with disabilities employed by USDA. The TARGET Center's AT program collaborates with employees to find solutions to challenges they face in their positions. It also offers AT evaluations, both in-person and remotely, to determine what AT an employee might qualify for. The TARGET Center also loans out AT devices to USDA employees throughout the country for a two-week trial period. It also frequently engages in demonstrations of emerging technology that USDA employees might find beneficial. Additionally, the TARGET Center offers a wealth of educational resources on AT, to include webinars, videos, podcasts, and articles that are available on demand. Their website also offers a variety of other resources on accessibility, such as featured AT and reasonable accommodation guides.

U.S. Department of Defense

The U.S. Department of Defense (DOD) is a federal executive department that coordinates and supervises all agencies of the government related to national security and the U.S. Armed Forces. DOD is also the nation's largest employer, with 2.15 million service members and 732,079 civilians (DOD, 2020). This department's role is to provide the military power and presence to deter war and ensure the nation's security.

COMPUTER/ELECTRONIC ACCOMMODATIONS PROGRAM

The Computer/Electronic Accommodations Program (CAP) provides AT and accommodations to individuals with disabilities and wounded, ill, or injured service members in the DOD. The CAP program provides technology to improve an individual's capabilities to maintain, increase, or improve their job performance. Their website provides AT resources that can be sorted by disability type in the following five categories: (1) blind/low vision, (2) cognitive, (3) communication, (4) deaf/hard of hearing, and (5) dexterity. Individuals needing these technology resources can submit a request for a product from their database or may request an AT product not on their list. CAP also curates an Interpreter Services Database. In addition, the CAP program has a variety of product demonstration videos illustrating how various AT devices can benefit people with disabilities. More about the CAP program is available here.

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

The Defense Advanced Research Projects Agency (DARPA) invests in groundbreaking technologies that can be used for the purposes of national security. DARPA's mission was initiated by the launch of Sputnik in 1957, and in the years since they have worked with innovators across the public and private sectors to develop transformational technologies (DARPA, 2020). Some of the many results of DARPA's projects include precision weapons for the military, the Internet, voice recognition and language translation software, and Global Positioning System receivers small enough to fit into handheld devices. The following are a selection of DARPA's projects related to AT that have applications for people with disabilities:

Electrical Prescriptions (ElectRx)

The ElectRx program aims to develop non-pharmacological treatments for a variety of conditions, including pain, general inflammation, post-traumatic stress, severe anxiety, and trauma. ElectRx seeks to use the method of closed-loop, non-invasive modulation of an individual's peripheral nervous system to treat these conditions.

This treatment would work in conjunction with the body's natural healing abilities, correcting the body's nervous system activity when appropriate. This technology would artificially modulate the peripheral nerves to help the patient achieve healthy patterns of signaling. The ElectRx devices have completed early testing; DARPA is now beginning clinical studies on this technology. If this innovation proves successful, it will assist military members by reducing dependence on traditional drugs and providing a treatment option with no side effects. This technology can also be applied to the consumer market as well, helping doctors evaluate various physiological states and guide therapy for various conditions. Additional information about the ElectRx program can be found here.

Restoring Active Memory (RAM)

The RAM program seeks to develop neurotechnology to address memory formation and recall in military members with traumatic brain injuries. The RAM program is designing a neural-interface medical device that would help restore brain functionality. Few treatments currently exist for people with traumatic brain injuries, and restoring functionality of retrieving memories would significantly improve the quality of life for these individuals. Researchers are also looking to determine how stimulation in certain areas of the brain might improve functionality. More information on RAM is available here.

Systems-Based Neurotechnology for Emerging Therapies (SUBNETS)

The SUBNETS program develops neurotechnology designed to treat neuropsychiatric illness for military service members, including post-traumatic stress, major depression, borderline personality, general anxiety, traumatic brain injury, substance abuse and addiction, and fibromyalgia/chronic pain. While current treatments are imprecise, SUBNETS seeks to design technology that can treat all forms of neuropsychiatric illness. The SUBNETS program is conducting research on an implantable, closed-loop device that would provide stimulation therapy in multiple brain regions to treat illness. More about this technology is available here.

Revolutionizing Prosthetics

The Revolutionizing Prosthetics program designs technologies with the goal of facilitating near-natural hand and arm control for people living with the loss of an upper limb. This program has developed two prosthetic arm prototypes offering improved dexterity, strength, and range of motion when compared to prior versions of prosthetic limbs. Additionally, DARPA is examining methods of restoring sensation to an individual's arm through sensors on the system that provide haptic feedback to the user's brain. The two prototypes are the LUKE Arm system and the Modular Prosthetic Limb. The LUKE Arm system offers a simple, intuitive design that allows multiple joint arm and hand movements to be produced at the same time. The Food and Drug Administration approved this device in 2014, and in 2017 two veterans were prescribed the LUKE Arm system. The Modular Prosthetic Limb is a more complex system, designed primarily for research, that uses direct neural control. This system has been used to facilitate multidimensional control of the hand and arm and reinstatement of the individual's touch sensation. The goal of these advances in prosthetics is to restore functionality and independence for people with limb amputation or paralysis, helping service members to return to their military assignments. More information about the Revolutionizing Prosthetics program can be found here.

THE WOUNDED WARRIOR HOME PROJECT

An innovative collaboration between the National Institute on Independent Living, Disability, and Rehabilitation Research (NIDILRR) -funded Rehabilitation Engineering Research Center on Universal Design and the Built Environment (RERC-UD) and DOD developed the Wounded Warrior Home Project. The goal of this project was to move past accessible design to UD in creating two single-family homes at Fort Belvoir, Virginia, for wounded, active-duty soldiers. These two demonstration houses featured a wide range of UD elements: open floor plans, stepless entrances, roll-in showers, and several others. The program had families move into the houses and then RERC-UD researchers evaluated the residents'

opinion of the house. Results showed that the soldiers thought favorably of all the UD features but recommended additional security and privacy features due to the nature of post-traumatic stress disorder and brain injuries that are prevalent among wounded active-duty soldiers. More about this project and their current and future work can be found here.

U.S. Department of Education

The U.S. Department of Education (ED) is a federal executive department that is responsible for creating policy, administering and coordinating financial assistance for education, collecting data on schools, and enforcing federal education policy relating to privacy and civil rights. The concept of UDL is incorporated into much of their guidance. ED provides a factsheet on UDL for state adult educators.

CENTER ON TECHNOLOGY AND DISABILITY

The Center on Technology and Disability, funded by ED, was started in 2013 to offer free resources regarding AT. This program ended in 2019, but it will offer its resources through 2021. Their website has a vast library of resources on the following topics related to AT: early childhood education, K–12, family and student support, transition, and state and local leaders. The Center on Technology and Disability also offers free webinars to view on AT in the education field. Their web-site is available here.

THE CENTER FOR UNIVERSAL DESIGN IN EDUCATION

The Center for Universal Design in Education, co-funded by ED and NSF, is run by the Disabilities, Opportunities, Internetworking, and Technology Center at the University of Washington. It provides resources to educators on UDL to ensure all students are included in the educational experience. The Center has a variety of resources available on UDL and has published a toolkit on UD in higher education. In addition, it has published information on universal design for online courses.

U.S. Department of Health and Human Services

The U.S. Department of Health and Human Services (HHS) is a federal executive department whose mission is to "enhance the health and well-being of Americans, by providing for effective health and human services by fostering sound, sustained advances in the sciences underlying medicine, public health, and social services" (HHS, 2020). The Department's scope is broad. With 11 different operating divisions, HHS is working on AT/UD in a variety of contexts.

ADMINISTRATION ON COMMUNITY LIVING

The Administration on Community Living (ACL) within HHS aims to help older adults and people of all ages with disabilities to "live where they choose, with the people they choose, and with the ability to fully participate in their communities" (ACL, 2020a). ACL funds a variety of community-level targeted programs for older adults and people with disabilities, as well as research and education efforts.

Each state AT program, authorized in the AT Act of 1998, is required to report data on their program activities annually to ACL. There are 56 statewide programs, and they offer services to individuals with disabilities and older adults. These programs provide device demonstrations and loans, training, technical assistance, device reutilization, public awareness, and financial assistance for AT (ACL, 2020b). The national data summary of these statewide AT programs can be found here.

National Institute on Independent Living, Disability, and Rehabilitation Research (NIDILRR)

NIDILRR is the primary disability research agency in the federal government. NIDILRR's aim is to produce new knowledge and promote its effective use in order to improve the abilities of people with disabilities to perform their daily activities. In addition, NIDILRR's research hopes to expand the capacity for society to provide opportunities and accommodations for people with disabilities. NIDILRR examines

a wide range of disabilities across the lifespan, including all aspects of a living with a disability.

NIDILRR provides funding for the ADA National Network. This network offers wide-ranging information, guidance, and training on implementation of the ADA to ensure people with disabilities have equal opportunities and access to their communities. The Rocky Mountain ADA Center published a rapid response research report, *Assistive technology: Recent developments and advancements for individuals with disabilities*. This report offers an overview of the current state of AT research, including the review process, limitations, adoption, and product information. The AT research studies provided are divided into functional categories: sensory, physical, intellectual/cognitive, and communication.

The following are a selection of recent and ongoing NIDILRR-funded grantee projects related to assistive technology and universal design:

Assistive Wearables to Support Self-Regulation for Neurodiverse Postsecondary Students
This project at George Mason University seeks to improve the self-regulation skills of neurodiverse individuals following a postsecondary inclusive special education program. It also seeks to provide assistants with insight into the available interventions. The team is developing and evaluating an assistive smartwatch application that supports self-regulation for young adults with intellectual and developmental disabilities in independent living. Using a smartwatch application offers a less obtrusive approach to intervention than the traditional approach. This project's objectives are: "(1) to formally characterize the assistance process and elicit requirements for implementing the application; (2) to design, develop, and test an interactive application for smartwatches according to individual's needs for self-regulation; and (3) to assess the impact of the AT on self-regulation skills of neurodiverse

individuals following the postsecondary education program" (National Rehabilitation Information Center, 2020a). More about this project can be found here.

Interactive Exercise Technologies and Exercise Physiology for People with Disabilities

The RERC at the University of Alabama at Birmingham researches the use of new and emerging technologies to address the high rates of physical inactivity for people with disabilities. This Center conducts research and development on improving access to exercise facilities and equipment for people with disabilities, assisting with improved exercise adherence via technology, and encouraging active lifestyles for people with disabilities. Their projects involve the use of activity monitors, tele-exercise training, video-based virtual exercise, and a variety of other technology to increase physical activity for people with disabilities. Further information on this RERC can be found at their website.

RERC on Physical Access and Transportation

The RERC on Physical Access and Transportation at the Research Foundations of SUNY seeks to advance the concept of UD across the built environment and transportation services. This Center builds on its previous work to address key areas with knowledge gaps, utilize innovative software technology, and prove the value of evidence-based practice through improving building regulations and standards of UD. The team hopes to promote UD and enabling technologies that allow for an individual's independence in community engagement, employment, social participation, and community mobility. They also aim to expand the professional capacity of the built environment and transportation systems to incorporate UD. The team collaborates with a variety of stakeholders and partners to include the University Health Network and the University of Michigan. More can be found about this project on their website.

RERC on Technologies to Support Aging-in-Place for People with Long-Term Disabilities

This RERC at the Georgia Tech Research Corporation, in collaboration with the University of Illinois at Urbana-Champaign, seeks to develop and implement technology-oriented interventions for use in the home and community to facilitate aging-in-place and reduce secondary conditions for people with long-term disabilities. Some of their projects related to aging-in-place with a long-term disability include a needs assessment, a voice-activated home assistant, tele-wellness technologies, a motorized toilet system, augmented and virtual reality tools, a fall-detection system, and a health management app. This project is multidisciplinary and seeks to understand the needs of people aging with long-term disabilities and provide innovative supportive technology to address these needs. A recent publication on a multidimensional and holistic assessment of individuals aging with long-term disability is available here. Further information about this RERC's activities is available on their website.

RERC on Universal Design and the Built Environment

The RERC on Universal Design and the Built Environment at the University at Buffalo at SUNY examines ways to advance UD and accessibility in the built environment in four main areas: (1) housing, (2) commercial and public building, (3) community infrastructure, and (4) transportation. The RERC activities support research, development, training, and dissemination related to integrating UD principles into the generally accepted models, methods, and metrics that are used in fields of construction and product development. The goals of this RERC are to improve the physical access, health, and social participation for people with disabilities and benefit the broader population with these design elements. More about this RERC can be found on their website.

*The Assistive Technology Network: A Community of Practice
on Assistive Technology*

This project at the Georgia Tech Research Corporation constructs the Assistive Technology Network. This network consists of "an online community of practice connecting people with disabilities and older adults, assistive technology providers and social service case managers, and AT industry representatives" (National Rehabilitation Information Center, 2020b). This platform, managed by project staff, facilitates online discussion surrounding AT discovery, selection, application, customization, and training. The Assistive Technology Network also offers a library of resources on AT devices and technical information as well as information developed in the course of their grant. This network currently consists of 500 members. Other research activities on this project examine training needed for AT, benefits of AT in geographically isolated areas, and self-advocacy and comfort with using AT.

HEALTHY PEOPLE 2030

Healthy People 2030 creates measurable public health objectives to be tracked over a 10-year period. The objectives and tools to measure them are developed by an interdisciplinary team of experts. Healthy People 2030 has 355 measurable objectives. Its goal is to improve the health and well-being of Americans throughout the next decade. This effort seeks to prioritize public health issues to facilitate individuals, organizations, and communities with achieving these objectives.

Healthy People 2030 has specific goals relating to disability. Two of these objectives are related to AT and UD: (1) increase the proportion of homes that have an entrance without steps and (2) increase the use of assistive and adaptive devices by people with vision loss. More information about Healthy People 2030 is available on their website.

NATIONAL INSTITUTES OF HEALTH

The National Institutes of Health (NIH) is the country's main medical research agency. It aims to find ways to improve health and save lives. NIH research focuses on increasing knowledge about "the nature and behavior of living systems" to improve health, lengthen life, and reduce illness and disability (NIH, 2015). The following are programs related to rehabilitation research to include AT research and a variety of other topic areas.

The Medical Rehabilitation Research Resource Network (MR3 Network)

The MR3 Network aims to develop research infrastructure in the field of rehabilitation by offering researchers access to expertise, workshops, educational opportunities, technologies, and other opportunities to collaborate. This network brings together an interdisciplinary team of experts focused on rehabilitation research, to include the disciplines of engineering, neuroscience, applied behavior, and social sciences. The MR3 Network is supported by the National Institute of Child Health and Human Development's National Center for Medical Rehabilitation Research (NCMRR), with additional support from the National Institute of Neurological Disorders and Stroke, the National Institute of Biomedical Imaging and Bioengineering, the National Institute on Deafness and Other Communication Disorders, the National Center for Complementary and Integrative Health, and the National Institute for Nursing Research. Six resource centers across the country make up the MR3 Network. More information about the MR3 Network is available here.

Rehabilitation Research Career Development (RRCD) Program

The RRCD Program offers mentoring and career guidance for rehabilitation research-ers at four sites across the United States. The RRCD Program serves the following professionals: psychiatrists, physical and occupational therapists, allied health professionals, clinicians working in neurological rehabilitation, and bioengineers. Its aim is to assist these researchers with building independent research programs

and careers. The RRCD Program is administered by NCMRR. More information about this program can be found here.

NIH-Funded Assistive Technology Research

In Fiscal Year 2019, NIH spent $385 million on AT research (NIH, 2020). A complete list of all the AT projects from 2019 is available on their website. The areas of research they engage in are diverse, including: human diseases; human growth and development; effects of environmental contaminants; mental, addictive, and physical disorders; and exchange of information in the medical field. Since its inception, NIH has been involved in rehabilitation and AT research. Initially, this research focused on people with intellectual and developmental disabilities. Upon the formation of the NCMRR within the National Institute of Child Health and Human Development of the NIH, the focus began to expand to research on improving and restoring function for people with disabilities from a variety of causes. Currently, NCMRR coordinates all NIH activities related to rehabilitation research, specifically rehabilitative and assistive technologies. NIH-funded studies on rehabilitative and AT can be found here. The following are a selection of AT projects funded by NIH:

IntelliWheels — Multispeed Geared Wheels for Manual Wheelchairs

IntelliWheels, funded through an NIH Phase II Small Business Innovation Research grant, worked to develop ultra-light, multigeared wheels for manual wheelchairs. IntelliWheels, Inc. also partnered with University of Illinois Urbana-Champaign, the University of Wisconsin-Milwaukee, and TiLite, an ultralight wheelchair manufacturer. This allowed the company to more easily test their product as its developed. This innovation aimed to give people who use wheelchairs the option to shift into a higher gear in order to more easily maneuver across uneven surfaces. Their goal was to allow people who use manual wheelchairs to achieve greater independence in exploring their environment. Further details about this project are available here.

A Music-Based Rehabilitation Device for Training and Assessing Hand Function
The MusicGlove, an NIH-funded Small Business Innovation Research project, developed an affordable instrumented glove to help users practice gripping movements to improve hand function. When patients return home post-injury, there is often no professional assistance to help them improve hand function, as compliance with written home therapy programs remains low. The MusicGlove provides an alternative, with a custom computer game inspired by Guitar Hero. The device and game accurately measure hand impairment level and assist people with forming more than 1,400 practice grip movements during 40-minute training sessions. In Phase 1 of this project, the device was associated with greater improvements in hand function than conventional therapy. Additional details on the grant and project can be found here.

A Brain-Computer Interface for Paralyzed Individuals to Control a Robotic Arm
An NIH-funded project called BrainGate developed a brain-computer interface for individuals who are paralyzed to use their thoughts to control a robotic arm. BrainGate allowed these individuals to make reach-and-grasp movements with the robotic arm; they reached for a cup and sipped the drink independently. There were a variety of other tasks that BrainGate allowed these individuals to complete with the robotic arm. The goal of this AT is to increase independence and everyday functioning for people who are paralyzed. BrainGate is currently conducting a pilot clinical study of their BrainGate2 Neural Interface System. This project seeks to demonstrate the feasibility of people with tetraplegia using the brain-computer interface to control a computer cursor and other assistive devices. More information on BrainGate is available at their website.

U.S. Department of Housing and Urban Development

The U.S. Department of Housing and Urban Development (HUD) is a federal executive branch agency that oversees housing and community development assistance

programs, ensuring everyone has equal and fair access to housing (HUD, 2020). HUD engages in a wide range of housing- and development-related activities, to include managing rental assistance programs, conducting housing research, maintaining housing datasets, and facilitating community planning efforts.

HUD began promoting the concept of UD throughout the late 1990s. HUD released two publications on UD in 1996, *Homes for Everyone: Universal Design Principles in Practice and Residential Remodeling and Universal Design*. HUD also released a report in 1997 on home modifications for consumers, builders, and service providers called *A Blueprint for Action: A Resource for Promoting Home Modifications*. This report offers strategies to promote and incorporate the concepts of UD into home modifications. In 2000, HUD released a report entitled *Strategies for Providing Accessibility and Visitability for HOPE VI and Mixed Finance Homeownership*. This report outlines how accessibility and visitability should be promoted in the HOPE VI housing program to ensure that people with disabilities have accessible, attractive, and affordable housing throughout the country. A more recent report incorporates UD into the concept of aging in place. The report entitled *Aging in Place: Facilitating Choice and Independence* can be found here.

U.S. Department of Justice

DOJ is a federal executive agency responsible for enforcing the law and defending the interests of the United States based upon the law. DOJ is responsible for enforcing the ADA, a leading piece of legislation on accessibility standards. In 2010, DOJ revised the ADA standards and released the *2010 ADA Standards for Accessible Design*. These standards outline the minimum requirements that state and local government facilities, public accommodations, and commercial facilities must follow when constructing and designing buildings and other types of facilities. When buildings do not comply with these minimum standards, DOJ's role is to investigate and enforce the law. While these standards are not necessarily best practices in UD,

they are a starting place for organizations to determine how to construct facilities that meet the requirements of the ADA.

U.S. Department of Labor

The U.S. Department of Labor is a federal executive agency that oversees federal labor laws. This encompasses issues related to occupational health and safety, wage and pay standards, unemployment insurance, economic statistics, and protection from employment discrimination. Their mission is to "foster, promote, and develop the welfare of the wage earners, job seekers, and retirees of the United States; improve working conditions; advance opportunities for profitable employment; and assure work-related benefits and rights" (U.S. Department of Labor, 2020).

OFFICE OF DISABILITY EMPLOYMENT POLICY
The Office of Disability Employment Policy is an agency in the U.S. Department of Labor that promotes policies that foster increased employment opportunities and success for people with disabilities. They accomplish this mission by coordinating with employers and various levels of the government to increase the use of effective practices and policy to encourage the employment and retention of people with disabilities. The Office of Disability Employment Policy offers effective strategies, policy information, and technical assistance for all types of employers.

Partnership on Employment and Accessible Technology (PEAT)
PEAT aims to form partnerships that ensure emerging technologies are accessible and to support workplaces in using inclusive technologies. PEAT defines accessible technology as AT where inclusivity and accessibility are considered from the beginning of the design process. Accessible technology is when AT is designed with the UD principles. Their website offers a wealth of resources on accessible technology, including podcasts, digital accessibility toolkits, fact sheets, and infographics. PEAT released a podcast called *The Role of Universal Design in Workplace Inclusion*

and Accessibility. This podcast details workplace technology challenges that people with mobility disabilities face and offers ways in which incorporating UD into the workplace can combat these challenges and lead to inclusion for all employees.

Job Accommodation Network (JAN)

JAN offers a wide range of resources on workplace accommodations. JAN provides free, one-on-one consulting on accommodation solutions that will benefit both employers and employees. Services are offered to employers, people with disabilities, and families of people with disabilities. JAN offers resources that can be sorted by disability type or by topic area and has several resources related to UD and AT. A publication, *Accommodation and Compliance: Assistive Technology*, gives a step-by-step guide for how to choose the right type of AT to meet employees' accommodation needs. In addition, they released *Accommodation and Compliance: Universal Design in the Workplace,* which outlines why considering accessibility for all employees before purchasing new equipment can ultimately save employers money and lead to high employee retention rates. Another resource JAN published, *Assistive Technology Solutions for Employees with Speech Impairments*, discusses a variety of specific AT options for employee accommodations.

U.S. Department of the Interior

The U.S. Department of the Interior (DOI) is a federal executive department that oversees natural resources and cultural heritage sites across the country. DOI also provides information to the public about natural resources and natural hazards (DOI, 2020). Additionally, DOI works to ensure that special commitments to American Indians, Alaska Natives, and affiliated island communities are honored to ensure their well-being.

NATIONAL PARKS SERVICE

The National Parks Service (NPS) manages the National Park System, allowing the public to enjoy, learn from, and be inspired by the natural and cultural resources across the country. NPS frequently partners with tribes, local governments, nonprofit organizations, businesses, and individuals to support community revitalization, preservation of local history, and celebration of local heritage. NPS seeks to create unique opportunities for the public to enjoy the outdoors and live a fun, active lifestyle. NPS recognizes that significant barriers still exist for people with disabilities to access all aspects of the national parks. In 2014, they produced a five-year plan on accessibility improvements, *All In! Accessibility in the National Park Service*. This report outlines goals related to improving the inclusivity and accessibility of all NPS programs. The concept of UD is included in this plan, as Goal 2 states that NPS will "ensure that new facilities and programs are inclusive and accessible to people with disabilities." NPS recognizes that using inclusive design from the beginning of the building and design process will ensure the most people have access to their facilities and programs. More information about accessibility and UD at NPS is available here.

U.S. Department of Transportation

The U.S. Department of Transportation (DOT) is a federal executive agency that coordinates safe, efficient, and modern transportation across the United States. DOT aims to ensure that the nation's transportation system helps improve economic productivity and global competitiveness, enhancing life for all citizens in both rural and urban areas (DOT, 2020).

The Federal Highway Administration's 2011 report, *Technological Innovations in Transportation for People with Disabilities*, provides an overview of a workshop conducted on emerging technology innovations to improve access to the transportation system for people with disabilities. It highlights technology, tools, methods,

and concepts related to pedestrians with disabilities and provides insights from participating speakers, disability experts, transportation experts, and academic researchers. The participants' insights cover current knowledge gaps, possible technology applications, and existing barriers to implementation.

ACCESS AND MOBILITY FOR ALL SUMMIT

In October 2019, DOT hosted the Access and Mobility for All Summit, an event to promote and improve transportation accessibility for people with disabilities, older adults, and individuals of low income. This event showcased both federal and non-federal innovations in the field of transportation, featuring topics such as accessible vehicles and ridesharing. Archived recordings of this event are available here. Additionally, a showcase of all the innovations presented at the Access and Mobility for All Summit can be viewed here.

Complete Trip — ITS4US Deployment Program

As announced at the Access and Mobility for All Summit, in 2020 DOT launched the Complete Trip — ITS4US Deployment Program. This program works to improve mobility challenges for all travelers and ensure equal access regardless of income, location, or disability status. Improvements through the program will allow individuals to have improved access to employment, education, health care, and a variety of other activities. This program focuses on creating more efficient, affordable, and accessible transportation options, specifically for people with disabilities, older adults, and other underserved communities. The concept of a complete trip refers to an individual's ability to go from their origin to their destination without any gaps. A complete trip may include elements such as trip planning, outdoor navigation, indoor navigation, transferring between modes of transportation, etc. This program aims to use integrated innovative technologies to address the challenges surrounding facilitating complete trips for all users, especially underserved populations. Further information about the Complete Trip — ITS4US Deployment Program can be found here.

Inclusive Design Challenge

DOT recently unveiled their Inclusive Design Challenge, aimed to foster innovative design solutions to enable people with wide-ranging disabilities to use automated vehicles. This challenge asks the disability community, researchers, advocates, and entrepreneurs to collaborate to address significant access barriers that exist for people with disabilities. Applicants can submit both hardware and software solutions to address these access barriers. The total prize for the challenge is $5,000,000. Additional information about the goals and requirements for the Inclusive Design Challenge can be found here.

Mobility for All Pilot Program Grants

In 2020, the Federal Transit Administration announced the Mobility for All Pilot Program Grants, which offer $3.5 million total in grants for projects to advance mobility and access to public transportation systems for people with disabilities, older adults, and individuals with low income. These grants are offered across 16 states, for a total of 17 projects. The Mobility for All Pilot Program Grants aim to improve the mobility options in the community for these underserved populations. Examples of the types of projects these grants will fund include vehicle purchase, the employment of mobility management strategies, and equipment or facility lease. More information about this grant program is available here.

U.S. Department of Veterans Affairs

The U.S. Department of Veterans Affairs (VA) is a federal executive agency responsible for administering benefits and services earned by veterans of the U.S. military. The VA operates in four main areas: (1) veteran health care, (2) veteran benefits administration, (3) national cemeteries, and (4) preparation for war, emergencies, and disasters (VA, 2020). As the VA serves veterans, many of whom experience injury leading to disability, they engage in a variety of activities related to AT/UD.

The VA Assistive Technology website is dedicated to AT information and interventions. It offers a directory of resources, including AT clinical practice recommendations, product reviews, AT policies and procedures, education templates, and a variety of other information. Areas of AT intervention that the VA offers are: mobility assistive equipment, adapted computer access, electronic aids to daily living/environmental control units, augmentative and alternative communication, electronic cognitive devices, adapted automotive equipment, and adapted sports and recreation equipment. The VA also offers an AT certification and a variety of other webinar resources that can be found here. The following are a selection of VA-funded research projects related to AT/UD:

ADAPTIVE ANKLE ROBOT CONTROL SYSTEM TO REDUCE FOOT DROP IN CHRONIC STROKE

A project at the Baltimore VA Medical Center (2015–2019) investigated the use of an ankle robot (anklebot) adaptive control approach in combination with treadmill training to reduce foot drop and improve ankle mobility for stroke survivors. The researchers developed an adaptive anklebot controller that precisely times when to intervene to stabilize the ankle when walking. Their pilot study provided evidence that six weeks of treadmill training with the anklebot is more effective than just treadmill training alone. Researchers then engaged in a randomized study to determine if six weeks of treadmill training with the anklebot would improve gait biomechanics, static and dynamic balance, and mobility function in chronic stroke survivors compared to treadmill training alone. The aim of this study was to gather results on the use of treadmill training with the anklebot in order to hopefully incorporate this into VA physical therapy care in the future. More information about this project can be found here.

ADVANCED PERSONALIZED MODULAR PRESSURE-RELIEF SEATING CUSHION SYSTEMS

The Louis Stokes Cleveland VA Medical Center is conducting a project (2018–2021) to determine low-cost options to develop a pressure-relief seating cushion system for wheelchair users. Preliminary research has shown the importance of pressure-reliving cushions for reducing the risk of pressure injuries for wheelchair users. Researchers determined that new low-cost, dynamically responsive materials appeared to show potential for use as a pressure-relieving cushion system. This project is looking for cushions that can be fitted and customized for each user individually, using a fitting algorithm to optimize the distribution of their body's pressure distribution. This iteration of the project will continue to develop the low-cost modular pressure-relief cushions and fitting algorithms, aiming to lower the weight of the cushions and to ensure they are suitable for use in manual wheelchairs. This project will complete a pilot study with 30 veterans who are full-time wheelchair users to determine the effectiveness of this pressure-relieving cushion system. Ultimately, this project aims to provide a foundation for personalized low-cost, high-performance pressure-reliving cushion systems for wheelchair users. More about the project can be found here.

CENTER FOR WHEELCHAIRS AND ASSISTIVE ROBOTICS ENGINEERING

The Center for Wheelchairs and Assistive Robotics Engineering (WARE) is funded by the Veterans Health Administration and is led by and designed for veterans, using a participatory action design. WARE's focus is on four main areas: (1) smart device application, (2) advanced wheelchair design, (3) assistive robotics and intelligent systems, and (4) human-machine interfaces. A main goal of WARE is to educate veterans with disabilities, families and caregivers, and providers with information about emerging technologies and practice guidelines. WARE also focuses on capacity building and desires to train the next generation of rehabilitation scientists and engineers. The Center offers mentoring services to new investigators, and especially to veterans, ensuring their career's success. WARE's work draws from the

expertise at the VA Pittsburgh Healthcare System, partnerships in the rehabilitation industry, Veterans Service Organizations, and the University of Pittsburgh. The central goal of WARE is to make tangible improvements for veterans with disabilities who use wheelchairs and robotics technologies, translating the Center's findings throughout the entire VA system. Additional information about WARE can be found here.

POWERED PERSON TRANSFER SYSTEM

The Veterans Health Administration is conducting a project (2019–2023) on the development of a powered person transfer system for people with mobility limitations. In a survey the researchers conducted, more than 80 percent of mobility device users indicated that new powered transfer devices are "important" or "the most important" type of future invention. More than 90 percent of clinicians selected powered transfer devices as "important" or "the most important" type of future invention. This project aims to develop the AgileLife product for manual wheelchairs, which would allow people with disabilities to transfer in or out of their wheelchair with minimal or no assistance from caregivers. They have developed a prototype and are working to refine, advance, and test this product. Some of the barriers to developing this project include high cost, distribution, data collection and sharing in the VA system, and reliance on the AgileLife bed technology. Researchers aim to keep the cost at a price similar to other assistive devices, such as power lift devices or hospital beds. A product such as this powered person transfer system could have a profound impact on the independence of people with disabilities with mobility limitations. More information about this project can be found here.

Innovative Examples of Universal Design and Assistive Technology Across the Private Sector

In addition to AT/UD innovation across the federal government, there are a variety of innovative case studies across the private sector as well. The following will provide a brief overview of some compelling recent projects related to AT/UD that have the potential to greatly impact the lives of people with disabilities.

First Universally Designed Hotel in the Nation

In summer 2020, Uniland Development Company opened a Hampton Inn by Hilton that is the first universally designed hotel in the country. The company worked together with the Inclusive Design and Environmental Access Center at SUNY Buffalo to implement UD standards throughout its design and construction process. The hotel is the first in the country to be isUD certified. This Hampton Inn offers 105 universally designed rooms, level thresholds on all doorways, grab bars in all bathrooms, hallways wide enough to turn around in a wheelchair, an accessible swimming pool and fitness center, visual alarms in public areas, and a visual and vibrating alarm clock in each room. Additionally, all hotel staff are trained to assist with the needs of people of all abilities. More information about this universally designed hotel is available here.

Digit Music's Control One Musical Interface

Digit Music, a UK-based inclusive audio production company, aims to create assistive hardware, software, and content for music-making that meets the needs of a diverse range of customers. They have developed an innovative, accessible musical

interface device known as Control One. This device was developed through collaborations with AT specialists and feedback from the Able Orchestra to offer a way to think about technology and inclusivity in music-making in a new way. Control One is designed to look similar to an electric wheelchair controller, but it sends digital data to interact with music software, enabling people with restricted movement to engage in music creation. Control One users can switch between a variety of instruments, genres, and tempos, and they can choose to play an instrument in a group or independently. More about Digit Music and their Control One interface can be found here.

Microsoft's Eyes First Computer Games

In 2019, Microsoft announced the release of their Eyes First games on the Microsoft store, which allow people to play on a Windows 10 PC using their eyes. Microsoft recognizes the challenges that people with disabilities face when collaborating and engaging with others through technology and hopes that this innovation and others to follow will address these limitations. These games incorporate the concept of UD, as they are designed to be fun and engaging for all users; they also offer the ability to use a mouse or touch screen. Microsoft notes that their Windows 10 Eye Control is being used by a formal pro football player to drive his wheelchair with his eyes and by a data guru living with ALS. They host a Windows 10 Gaze Interaction Library, where developers can explore the possibilities of using this innovative technology. More about the Eyes First computer games can be found here.

pathVu's App to Assess Sidewalk Accessibility

In 2014, University of Pittsburgh rehabilitation and engineering researchers began a startup company called pathVu. This company aims to use the concept of UD to map sidewalks across the country in order to make them more accessible and provide information on obstacles to all pedestrians (Mericle, 2020). pathVu created a surface profiler known as the PathMeT, which looks similar to a baby stroller. This

device assesses sidewalk accessibility according to the U.S. Access Board standards. They have developed an app that digitally maps the information collected by the PathMeT as well as crowdsourced information about obstacles on sidewalks. So far, the app has mapped 100,000 miles of sidewalk and 640,000 obstacles and hazards. App users can customize features such as their "comfort settings" with elements like hills, narrow paths, or tripping hazards. The real-time app will then adjust their route based on these settings, similar to Google Maps. Currently, the app is being implemented mainly in Pittsburgh, but pathVu hopes to work with a variety of other major cities in the future.

Universal Design Living Laboratory

In 2010, construction was completed on the Universal Design Living Laboratory, a project to bring awareness regarding UD to the public and the construction and design industries. The Universal Design Living Laboratory is a groundbreaking national demonstration home in Columbus, Ohio, that showcases the principles of UD as well as green building and healthy home construction principles. This project serves as a resource for builders, designers, architects, and the public for how to design and construct houses that lead to a better quality of life. A virtual tour of the home is available here. In addition, they provide handouts, toolkits, resources, and articles related to UD in a variety of industries. The Universal Design Living Laboratory's website can be accessed here.

Voice Guidance in Google Maps

Google Maps released a new feature in 2019, voice guidance for walking navigation. This feature was built with people with vision impairments in mind, and it incorporated their input and feedback throughout the development process. This feature also considers the principles of UD, as it will appeal to all users who desire a screen-free experience in addition to those with visual impairments. Google Maps voice guidance for walking navigation will allow people with vision impairments to

independently and confidently navigate in new or unfamiliar places. Google's goal is to design products that work for everyone, and the new voice guidance feature is one that will prove useful to a wide array of Google Maps users. More about this new feature can be found here.

WeWALK Smart Cane

WeWALK is a company focused on developing technology for people who are visually impaired, inspired by their team's experiences of visual impairment. Over the past 10 years they have worked on projects related to audio description in movie theaters and indoor navigation systems. However, in 2017, WeWALK decided they wanted to bring their software experience to the hardware realm and bring updates to the traditional white cane. The resulting innovation, WeWALK's Smart Cane, acts as a new handle to a traditional long cane. This device provides warnings via vibration regarding obstacles a traditional cane may miss. When linked with the WeWALK app, it can access several smart features such as navigation, a voice assistant, and accessing public transit information. WeWALK developed the Smart Cane in collaboration with Microsoft, Imperial College London, the Royal National Institute of Blind People, and Light House. The ultimate goal of WeWALK is to create a hub for people with visual impairments and increase mobility resulting in improved societal integration for people of all abilities. More about WeWALK can be found here.

Toolkit Resources by Topic Area

Toolkit resources on AT/UD in the following section are divided by topic area: aging, AT, education, financial, health, ICT, physical environment, and research. Resources of benefit to the entire disability community are listed in addition to specific resources designed to further disability research on AT/UD.

Aging

A Friendly House — UD and Aging-in-Place Resources

A Friendly House is the project of a longtime journalist and interior designer, Lynette Evans, based off her own experiences with creating an accessible house for her parents. This website offers resources on UD, aging in place, safe living, and livable communities. A Friendly House offers a virtual tour of an age-friendly home, as well as a variety of resources and tips on UD for each room of a house. In addition, A Friendly House answers a wide variety of frequently asked questions and hosts a gallery of pictures of UD features.

- Link: http://afriendlyhouse.com/home/

Center for Independent Living of Northwest Florida — AT to Promote Independence and Aging in Place for Seniors

The Center for Independent Living of Northwest Florida released a webinar on how AT can promote independence and aging-in-place for older adults. The webinar covers a wide range of AT devices, including medication alert systems, smart watches, telecommunications devices, transportation apps, home automation devices, and many others.

- Link: https://www.youtube.com/watch?v=8k2iCSwExbA

**Committee on Technology of the National Science and Technology Council —
Emerging Technologies to Support an Aging Population**

The Committee on Technology of the National Science and Technology Council
published a 2019 report discussing emerging technology that can facilitate aging-
in-place for older adults. This report formulates recommendations in a variety of
topic areas, as well as cross-cutting topics, for future research and development
and exploration. The goal is that this report will be used across the public and pri-
vate research and development sectors to work to develop innovative technologies
that enhance the lives of people with disabilities.

- Link: https://www.aarp.org/livable-communities/housing/info-2020/homefit-
guide.html

Pennsylvania Housing Research Center — Presentation on the Cost-Effectiveness of UD

This presentation from the Pennsylvania Housing Research Center explains the con-
cept of UD and makes the case for why it is a cost-effective method of design. The
presentation asserts that since all people will age and there is a growing number
of aging baby boomers, UD is essential to save money in accessibility accommo-
dations later. The Pennsylvania Housing Research Center explains how UD can
facilitate aging-in-place and ultimately is a form of sustainability.

- Link: https://www.phrc.psu.edu/assets/docs/
Publications/2016RBDCCPresentations/Gerring2-2016-RBDCC-Presentation.pdf

Tech-enhanced Life — AT Product Reviews and Resources

Tech-enhanced Life is an organization with the mission to improve the quality of
life for older adults and their families. As there is often a gap between emerging
technologies and the potential end users who could benefit from a product, Tech-
enhanced Life aims to bridge the gap between these two entities by promoting
innovative and affordable solutions for older adults to improve functioning and

lifespan. This organization maintains a list of useful technology products with reviews and links to the vendors to assist older adults in aging-in-place.

- Link: https://www.techenhancedlife.com/resources

Assistive Technology

Christopher and Dana Reeve Foundation — AT Resources for Driving a Vehicle

The Christopher and Dana Reeve Foundation has compiled resources on AT designed to help people with disabilities who have decreased mobility drive a vehicle. The option to be able to drive a vehicle creates a significant amount of independence for the user, eliminating a reliance on public transportation or other options. The Foundation offers resources on driving evaluations, funding for adaptive vehicles, joystick motoring, and a variety of other topics.

- Link: https://www.christopherreeve.org/living-with-paralysis/home-travel/driving

Computer/Electronic Accommodations Program (CAP) — Webinars and AT Demonstrations

DOD's CAP Program offers a library of free webinars on a diverse selection of topics, many related to AT. Some of the related topics they cover include: the ADA, AT headsets and keyboards, the AT needs assessment process, and the aging workforce. In addition, they host a collection of AT demonstration videos. The CAP Program is a valuable resource for training-related materials on AT as well.

- Link: https://www.cap.mil/Default.aspx

Georgia Tech Tools for Life — AT Resources

Georgia Tech's Tools for Life website offers a diverse set of AT-related resources. This website offers information on AT demonstration, AT evaluations and

assessments, funding options for AT, the Tools for Life Assistive Technology Lending Libraries, AT and durable medical equipment reuse, and AT training for both individuals and groups. Their AT reuse program, the Pass It On Center, is available here. Other valuable resources they offer include their in-depth AT Guides and their AT AppFinder. Tools for Life is designed to make accessing updated and relevant information about AT for people with disabilities and their families straightforward and informative.

- Link: https://gatfl.gatech.edu/index.php

National Assistive Technology Act Technical Assistance and Training (AT3) Center
The AT3 Center is a project of the Association of Assistive Technology Act Programs that operates with a grant from ACL in HHS. The overall goal of the AT3 Center is to provide both training and technical assistance to state and territory AT programs and to provide AT information to the public and stakeholders on their website. An important resource this Center provides is issue briefs to increase access to AT for people with disabilities. They also offer a convenient and straightforward method of finding the AT program in a user's state, along with detailed information about the AT Act. The AT3 Center hosts webinars and calls related to AT and regularly posts these opportunities on their website. Additionally, the Center maintains a list of AT device databases and has published an *Assistive Technology Toolkit* that provides resources on assessing an organizations AT needs and how to collaborate with state AT programs.

- Link: https://www.at3center.net/repository/atpolicy

Rehabilitation Engineering and Assistive Technology Society of North America — Standards for AT
The Rehabilitation Engineering and Assistive Technology Society of North America has an AT Standards Board that is responsible for developing voluntary sets of standards in the United States for AT. The Standards Board also doubles as the U.S. Technical Advisory Group to the American National Standards Institute to help

formulate international standards for AT and other products for people with disabilities. The Rehabilitation Engineering and Assistive Technology Society of North America offers various certifications in AT as well as AT standards for purchase or for free to members.

- Link: https://www.resna.org/at-standards

Education

Assistive Technology Industry Association (ATIA) — Policy Brief on AT for Students with Disabilities

ATIA developed a policy brief on AT for students with disabilities that details specific barriers to AT use during testing and instruction. The brief outlines relevant legislation, lessons learned, and specific challenges faced. This policy brief argues that AT should not be prohibited for use during testing on a large scale, but rather administrators should look at each test and measurement construct individually and identify specifically how AT compromises that measure. Additionally, the brief discusses how security has often been prioritized over accessibility, forcing students to use built-in access features to assessments instead of AT. ATIA ends each section of the policy brief with a clear call to action at the district, state, and federal levels.

- Link: https://www.atia.org/wp-content/uploads/2018/03/Policy-Brief_Equity-Through-Access.pdf

Center for Applied Special Technology (CAST) — UD for Learning Guidelines

CAST is a nonprofit organization that focuses on education research and development. CAST created the UDL framework and corresponding guidelines. Their aim is to make learning and education more inclusive. Through testing and refining principles and priorities over a period of 10 years, CAST developed their understanding of how to improve education to make it more flexible and adaptive to all learners'

needs. Their Universal Design for Learning Guidelines can be accessed on their website, along with a video and other resources explaining what UDL is and how it can be used.

- Link: https://www.cast.org/impact/universal-design-for-learning-udl

Center for Independent Living of Northwest Florida — Webinar on School and AT Needs

The Center for Independent Living of Northwest Florida released a webinar, *Assistive Technology to Promote Independence: School and Assistive Technology Needs*. It discusses various AT devices students might need in a school setting, the framework teams use to make decisions about AT, and various accommodations for students. Best uses for various types of AT devices are discussed in detail with pictures and examples of application.

- Link: https://youtu.be/e-ZsEtl4SGo

The Universal Design for Learning Center at the Ohio Center for Autism and Low Incidence (OCALI) — AT Resource Guide

The Universal Design for Learning Center at OCALI produced an AT resource guide in 2013 for students and their families. This guide emphasizes that choosing the appropriate AT requires an assessment process to ensure that the AT is effectively meetings the student's identified goals. This resource guide outlines the AT assessment process by the education team. It describes how the AT process is initiated, how the team is identified, how the student is assessed for AT, how devices are acquired and implemented, and how AT follow-up and assessment is conducted. The resource guide also offers a discussion of various AT systems as well as recommendations.

- Link: https://www.ocali.org/up_doc/AT_Resource_Guide_5.pdf

**The Universal Design for Learning Center at the Ohio Center for Autism
and Low Incidence — Webinars**

The goal of the Universal Design for Learning Center at OCALI is to remove barriers to learning for students through planning that makes education meaningful and accessible to all students. They offer monthly 30-minutes webinars and curate a collection of all past webinars on their website. The webinars are all focused on aspects of UDL, with educators and experts focusing on topics from family engagement, equity, growth mindset, and a variety of others. All of the UDL Center at OCALI's webinars are indexed so that users can easily access the segments of the webinar that will be most relevant to their interests and needs.

- Link: https://www.ocali.org/project/udl-webinars

Financial

Achieving a Better Life Experience (ABLE) Accounts

Resulting from the passage of the 2014 ABLE Act, ABLE Accounts are tax-advantaged savings accounts for individuals with disabilities and their families. The ABLE Act recognized that people with disabilities and their families were essentially required to remain in poverty in order to meet the less than $2,000 asset limit present for many public benefit programs. ABLE Accounts allow people with disabilities or their family members or representative to place up to $15,000 per year into this account, which will not disqualify them for public benefit programs. ABLE Accounts can be used for "any expense related to the designated beneficiary as a result of living a life with disabilities." AT is an approved expense that can be purchased with the funds in ABLE Accounts.

- Link: https://www.ablenrc.org/what-is-able/what-are-able-acounts/

Assistive Technology Industry Association — AT Funding Guide

ATIA recognizes that often one of the most challenging parts of obtaining AT is how to afford the technology. Since their goal is for all to have access to assistive technology, ATIA created a funding resource guide to assist consumers with obtaining AT funding. Some of the various funding sources they provide information on are: organizations known for funding AT, insurance providers, federal and state programs, special education and public school, advocacy organizations, state vocational rehabilitation centers, VA employers, grants, and scholarships. ATIA also provides information on other ideas for obtain funding for consumers such as fundraising, other private pay options, or submitting a request for proposal. ATIA's funding resource guide is a wealth of information on this topic and a great resource to start with when looking for AT funding.

- Link: https://www.atia.org/home/at-resources/what-is-at/resources-funding-guide/

National Disability Institute — Alternative Financing Programs for AT by State

The National Disability Institute provides a list of alternative financing programs for AT, organized by state. The Pennsylvania Assistive Technology Foundation curates and updates this list on a regular basis. This list offers a point of contact, email address, and website for each of these state alternative financing programs. These programs provide a place to start when looking for AT funding resources specific to a state or locale.

- Link: https://www.nationaldisabilityinstitute.org/wp-content/uploads/2019/01/AlternativeFinancingProgramListing.pdf

Health

**Joint Commission on Accreditation of Health Care Organizations —
UD for Health Care Facilities**

This fact sheet outlines the principles of UD as they relate to health care. It provides recommendations on how to involve patients in the UD process and how modifications can be simple and low-cost. The Joint Commission makes the case that UD is a way to ensure patient safety and access to care are adequately addressed for a diverse patient population, including people with disabilities.

- Link: https://cs.uwaterloo.ca/~jhoey/teaching/cs793/wiki/uploads/universal-design-for-health-care-facilities-1.pdf

**The Center for Universal Design at North Carolina State University —
Removing Barriers to Health Care**

The Center for Universal Design at North Carolina State University published a guide to UD and removing barriers in the health care context. The guide asks health care providers to assess how usable their facilities and equipment are for people with disabilities. They offer a specific list of UD features that should be included in the health care setting, as well as detailed, labeled diagrams that explain how various elements of the health care physical environment can be made accessible for all patients. Brief overviews of accessibility legislation and building code are also included so health care settings can ensure they are meeting the standards for patient accessibility.

- Link: https://fpg.unc.edu/sites/fpg.unc.edu/files/resources/other-resources/NCODH_RemovingBarriersToHealthCare.pdf

Information and Communication Technology (ICT)

Southwest ADA Center — IT Toolbox on Universal Design

The Southwest ADA Center's IT Toolbox on Universal Design offers a variety of resources on UD for an educational environment. The resources cover applications of UD that can reduce physical and learning barriers for students, benefit all learners, minimize the negative impacts of inaccessible technology, and maximize the abilities of all learners to be successful. The toolbox covers UD definitions and tools, fact sheets, NIDILRR-sponsored projects related to UD, NIDILRR grantee resources related to UD, and UD state initiatives.

- Link: http://www.southwestada.org/html/IT/toolbox.html

U.S. General Services Administration — Section 508 — Accessibility Training Online Courses

GSA offers Section 508 accessibility training courses, including live online training courses and on-demand webinars that can be accessed at any time. These training courses are designed to improve understanding of IT accessibility and Section 508 law and to help users produce digital content that meets the current Section 508 Standards. Their training website also provides links to other trainings offered by the GSA and their partners.

- Link: https://www.section508.gov/training

U.S. General Services Administration — Section 508 — UD: Transform IT Accessibility in the Federal Government

The Section 508 website provides a white paper on UD and how to transform IT accessibility throughout the federal government. As the private technology industry is beginning to commit to principles of inclusive design, it is important that the federal government also addresses IT accessibility. This paper outlines how the federal government should approach IT accessibility and how incorporating elements of

UD can help engage the workforce, reduce costs, and meet their goals in innovative ways. Included in the white paper is an overview of UD, the benefits of adopting these principles in federal IT, and recommendations for how to embed UD into the federal workplace.

- Link: https://www.section508.gov/sites/default/files/Copy%20of%20 Universal_Design_%20White%20Paper_vFinal_0.pdf

Physical Environment

American Association of Retired Persons — HomeFit Guide

The American Association of Retired Persons published *HomeFit Guide*. It offers solutions for designing a home that is comfortable and safe, both for older adults and people of all ages. The aim is to encourage people to create "lifelong homes" that are suitable no matter a person's age, abilities, or life stage. This guide uses the elements of UD to provide innovative solutions to designing environments that are comfortable and livable for all groups of people. It also serves as a resource for officials, policymakers, and leaders to advocate for UD in housing policy. The guide goes through each area of a house and offers design elements to consider to ensure that the house will meet all residents' potential needs.

- Link: https://kronikare.ai/wp-content/uploads/2019/09/Emerging-Tech-to-Support-Aging-2019.pdf

Center for Inclusive Design and Environmental Access at SUNY Buffalo — Inclusive Smart Cities

The Center for Inclusive Design and Environmental Access (IDEA Center) at SUNY Buffalo published a resource guide on inclusive smart cities. This guide discusses that the concept of building smart cities has neglected to include elements of UD for people with disabilities. The IDEA Center provides tools, resources, and a list of best practices for how to ensure that smart cities are designed for all people in

society, not just able-bodied individuals. Additionally, the IDEA Center's website is filled with books, reports, articles, and websites related to UD and can be found here. The IDEA Center also offers continuing education and training services related to UD that can be accessed here.

- Link: http://idea.ap.buffalo.edu/wp-content/uploads/sites/110/2019/04/InclusiveSmartCities_Report.pdf

Research

Assistive Technology Industry Association — Research Tools
The ATIA website features a section on relevant research articles and research tools. Some of the research tools included are reference management software, statistical analysis software, electronic data capture, behavior imaging software, qualitative research analysis software, PC survey software, and crowdsourcing tools. In addition, ATIA's website offers access to surveys that their association has conducted on AT.

- Link: https://www.atia.org/home/at-resources/research-articles-tools/

Center for Assistive Technology Act Data Assistance —
AT Datasets and Resources
The Center for Assistive Technology Act Data Assistance provides custom charts and tables, raw data, consumer stories, initiatives from the field, and state AT program information. The state and territory AT programs are designed to improve the delivery of AT services through programs that are responsive to consumers and increase access to AT. These programs service people with of all ages and disabilities and in all settings. While this site provides AT-specific data for researchers, it also offers a variety of resources for policymakers, advocates, people with disabilities and their families, and state and territory AT programs.

- Link: https://catada.info/

**International Conference on Computers Helping People with Special Needs —
Compendium of Research**

In 2020, the 17th International Conference on Computers Helping People with
Special Needs published their first digital edition of their open-access compendium
of research, *Future Perspectives of AT, eAccessibility and eInclusion*. This compen-
dium includes knowledge, application, and experience related to AT. It includes
findings building on the past 30 years of the Conference. The aim of this compen-
dium is to communicate the current state of knowledge on ICT, AT, and accessibility
for people with disabilities to the disability community, as well as to connect
researchers to the end users of these technological innovations.

- Link: https://www.icchp.org/sites/default/files/ED_1_ICCHP_Forum.pdf

The Center for Universal Design — UD: Product Evaluation Countdown

The Center for Universal Design at North Carolina State University developed a prod-
uct evaluation tool based on the seven principles of UD. This tool can be used to
evaluate a product for its usability for people of all ages and abilities. The product
evaluation tool is designed to help the evaluator think about their own needs and
the needs of others in relation to the product. Evaluators state either agreement
or disagreement with various statements about the product. Products with more
agreement to the tool's statements are then determined to be easier to use than
products that have fewer agreement to the statements.

- Link: https://projects.ncsu.edu/ncsu/design/cud/pubs_p/docs/UDPEC.pdf

**Universal Design of Research: Inclusion of Persons with Disabilities
in Mainstream Biomedical Studies**

This paper published in *Science Translational Medicine* offers guidelines based on
the principles of UD for including people with disabilities in mainstream biomedical
studies. This population is frequently left out from major biomedical studies, so
it is important to consider inclusion in future studies. These authors offer prac-
tical guidelines for recruitment, accommodation, site selection, communicating

information in research instruments and interventions, and providing multiple means of responding to research instruments and interventions. The authors' aim is for biomedical researchers to use these guidelines when designing future studies to ensure that all people, including those with disabilities, have access to participating in the study.

- Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3320239/

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