

# The Role of Technology in Removing Barriers

*John C. De Witt*

## EDITOR'S NOTE

*Technology is a powerful presence in our society, mediating how we work, play, and communicate. In the last decade the application of technology to the particular needs of persons with disabilities (generally called "assistive technology") has slowly gained momentum so that it is developing as a field in its own right. The combination of the emergence and development of assistive technology and the maturation of civil-rights protections for people with disabilities yields a depth and breadth of unique opportunity as we proceed with the implementation of the Americans with Disabilities Act (ADA).*

*John C. DeWitt examines "assistive technology" in the context of the ADA, other recent federal mandates, and daily application in businesses and public accommodations. Holding that the creative use of technology is a key to the success of the ADA, DeWitt offers considerable practical advice for implementation.*

*DeWitt is president of DeWitt, Mendelsohn & Associates, a private consulting firm in New Jersey specializing in assistive technology and related disability issues. A charter member of AT&T's Consumer Advisory Panel, DeWitt has evaluated a range of technologies from closed-circuit televisions to synthetic speech-computer products. A 1989 National Institute on Disability and Rehabilitation Research Switzer scholar, DeWitt has testified before Congress a number of times.*

The success of the ADA as civil-rights legislation will depend upon the creative use of technology, especially by American businesses and public institutions, as much as upon the good will of the general public. Technology is a powerful force throughout American society. For people with disabilities the application of technology is particularly powerful. It may enable a person who previously could not talk to do so, or a person who could not walk to become otherwise mobile.

In this article, I consider the limitations of hearing, seeing, moving, speaking and interpreting, especially in employment and public accommodations. I examine the contribution technology can make to the removal of barriers to equal opportunity and meaningful participation for people with disabilities.

For entities covered under the ADA, the essential questions, in terms of technology are:

- In the workplace or public facility, is access or participation restricted for an individual with a disability?
- Would use of technology reduce or eliminate that individual's limitations for essential job tasks or participation in the use of a public facility?

Solutions abound that could meet the needs of most individuals with a disability much of the time, especially for employment and education. However, there remain challenges not yet fully addressed, especially in places of public accommodation and transportation. Communication barriers exist almost everywhere.

Within the disability community and among companies manufacturing and distributing technologies useful to persons with disabilities, the term "assistive technology" has gained widespread use. Terms such as "rehabilitation engineering" or "adaptive technology," which are less inclusive, appear to be fading from use. Assistive technology can be low-tech or high-tech. The term will be used throughout this article and discussed more fully later. When the ADA refers to "auxiliary aids" and "reasonable accommodations," it implicitly includes assistive technology.

Assistive technology is a recently coined term. Shortly after World War II, the term "tools and equipment" was used in vocational rehabilitation for veterans. In the blindness field, "aids and appliances" was used from the late 1930s until 1979. About this same time, 1978,

“sensory and communications aids” were being provided through vocational rehabilitation services. With the passage of the 1986 amendments to the Rehabilitation Act of 1973, the term “rehabilitation engineering,” already used in academia, was added to the lexicon.<sup>1</sup>

By 1988, when Congress passed the Technology-Related Assistance for Individuals with Disabilities Act (“Tech Act”), a coalition of disability-related organizations worked with Congress to develop a definition of “assistive technology devices and services” commonly called assistive technology.<sup>2</sup> Although the term “assistive technology devices and services” does not appear in the ADA, it should be thought of as a component of both “reasonable accommodation” and “auxiliary aids and services.”

The Tech Act defines an “assistive technology device” as “any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities.”<sup>3</sup> A corollary concept is also defined: “Assistive technology service . . . means any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device.”<sup>4</sup> Later in this article, I shall discuss the important role “services” play in assistive technology. For now, it is useful to bear in mind that knowledge about how to find, select, acquire and use devices is *critical* to their successful deployment for persons with disabilities, American business, and public institutions.

## TECHNOLOGY AND DISABILITY INEVITABLY LINKED

Society is increasingly impacted by technology. When a device assists us in functioning either physically or mentally, we are employing technology. Technology often makes the performance of tasks easier, but is sometimes itself a barrier. Imagine that you want to:

- *Hear* the sound of a stadium sports announcer or fire alarm in a hotel
- *See* the signs in a shopping mall or the screen of a PC
- *Move* from home to work on public transportation or ascend an escalator
- *Speak* into a telephone

- *Interpret* the array of buttons and switches on a photocopy machine

Similarly, imagine yourself doing these common everyday tasks without technology if you had a limitation in functioning:

- *Hearing* a normal conversation
- *Reading* print
- *Walking* across the room
- *Speaking* to someone
- *Interpreting* instructions

For centuries simple technologies have helped some individuals with disabilities gain access to the world about them: for instance, a walking stick, eye glasses, an ear trumpet, or a wooden leg, and more recently, prosthetic hands or wheelchairs.

To overcome barriers, including those created by technology itself, assistive technology devices are frequently employed to provide an alternative way of doing things. Some of these are:

- *Hearing* with use of a hearing aid, amplified telephone handset, infrared system in a theater
- *Reading* with the aid of large print, taped materials, synthetic speech added to a PC
- *Moving* in a wheelchair over curb cuts, onto a bus with a lift or into a building's elevator; using an alternative keyboard for data entry, or an implement to permit feeding oneself
- *Speaking* with use of an artificial electric larynx, amplified telephone transmitter, or augmentative communications board
- *Interpreting* through pictographs on a computer, a telephone auto-dialer, simple diagrams, concise language, or consistent symbol sets

How assistive technology is used differs from setting to setting. Telecommunications deployed for dual-party relay services and TV captioning under title IV of the ADA, requires a more limited range of assistive technology. However, within workplace settings and places of public accommodation, many of the same assistive technology solutions will be found applicable. Before providing many more examples, let's more closely define the term "assistive technology."

Assistive technology devices are not simple to define in practice. Removing the casters from a chair may make it easier for an individual with balance difficulties to rise more easily and stand. Is that assistive technology or merely a technique? An operator-style telephone headset makes it convenient for an individual to take notes with one hand and use the other to operate an artificial larynx. Is this assistive technology or merely using common sense? Is a pacemaker assistive technology or a life-sustaining medical procedure? Most practitioners will agree that the first two examples are assistive technology, even though the "device" also has nondisability applications. As for the third example, some might argue that a medically based device is not assistive technology.

Assistive technology appears in many guises. Individuals with disabilities may be enabled in the performance of actions or tasks with:

- an off-the-shelf general market product without any modification
- a general market product that has been modified or adapted for specific tasks
- a product developed and manufactured specifically for its "assistive" application
- a customized device fabricated to meet the needs of a particular individual

What constitutes assistive technology is not always clear cut. A device that assists an individual in detecting the ringing of a telephone by visual rather than the body's natural hearing mechanism is clearly assistive technology. A work-station modification that permits an individual with a cardiovascular condition to sit rather than stand while working is clearly assistive in nature, even if the individual is also wearing a pacemaker. It is less clear that one could contend that such medical devices as pacemakers or cochlear implants are assistive technologies, or that it is the responsibility of an employer or public institution to provide them. In general, assistive technology includes devices that enhance the ability of an individual with a disability to engage in major life activities, actions, and tasks. It is helpful to distinguish between life activities and actions taken or tasks performed in relation to them. Major life activities include hearing, seeing, moving body parts, speaking, and interpreting information. Assistive technology currently exists to assist in the performance of actions (or tasks) associated with each of these major life activities.

For example, tasks associated with seeing, like reading or writing, can be assisted in a variety of ways. Some of these enhance seeing itself; for example, a closed-circuit TV magnification system. Others substitute the function of seeing with another function. For instance, a person who cannot see a computer's monitor can hear its contents using synthetic speech or feel the text via an electronic braille display.

Table 1 illustrates many major life activities and actions where substantial limitations in performing them exist due to disability. Assistive technology might be used to augment or substitute for the activity and thereby eliminate or modify the effects of a functional limitation. A significant contribution to our understanding of the connection between major activities and specific tasks, especially the moving of body parts, has been made by James Mueller (1990).

The assistive-technology solutions cited in the table are by no means exhaustive. Rather they are examples that have a track record of success in a variety of settings: employment, educational institutions, and places of public accommodation.

Many assistive technologies must be used differently in different settings. In employment they must always be matched to an individual's needs, preferences, capabilities, and comfort. Sometimes the solutions need time to evolve and mature. The individual with a disability is usually best qualified to figure out the appropriate technological solution cooperatively with the employer and, perhaps, an outside expert.

In contrast, assistive technologies for telecommunications and places of public accommodation need to address as broad a group of potential users as possible. Detailed attention to very specific individual needs would not be cost effective. The maximum level of accessibility for the broadest range of actions associated with disability must be part of any comprehensive design configuration. There will be many instances where individuals will choose personal assistance over an assistive-technology solution. A hard-of-hearing individual might prefer an aural interpreter to an assistive listening device during a meeting. A visually impaired person might prefer a personal reader to an optical scanner/PC with text-to-speech capability. Personal interaction may foster better overall acquisition of information.

Personal-assistance services should not be substituted for assistive technologies because they are *easier* for the employer or business, or they are *assumed* to be preferred by the individual with a disability. Use of assistive technology often enables a person to take responsibility for

TABLE 1  
Major Life Activities, Consequences of Functional Limitations, and Assistive Technology Solutions

Major life activity	Consequences of functional limitation	Assistive technology solution
Hearing	Difficulty in understanding usable speech, identifying sounds, discriminating between sounds—with or without amplification; deafness—inability to process auditory information in both ears	Unambiguous labels, signs, written communication, electronic mail/Fax means less need for verbal communication; maximize face-to-face communication; lower ambient noise in restaurant, terminal, work station; telephone handset receiver amplifier, signal light for incoming calls, visual displays of call status, TDD; vibrator for paging—PA, intercom, phone message; additional amplification for face-to-face communication, pocket-size transmitter/receiver, body aid; inductive loop, infrared or FM systems for meetings, large-group situations; captioning of audiovisual materials to capture spoken dialogue
Seeing	Difficulty reading, writing or printing, recognizing objects or faces, distinguishing between colors—with or without corrective lenses or glasses; total blindness, inability to process visual information in both eyes	Even, nonglare lighting to provide sufficient lumens, maximum contrast; large-print labeling, signs with high-contrast letters (white or yellow on black or dark blue); tactual labels, signs with raised characters and braille; reduce sole reliance upon written/printed information—closed-circuit TV magnification for reading print, enhancing handwriting; redundant audio signals for visual displays such as machine gauges, shopping-mall directories, room numbers, exits, restrooms, ATMs; optional voice prompts for telephone system, Fax, photocopier; synthetic-speech output, large print or electronic braille access to PCs, mini-computers, and mainframes; electronic mail, local area networks, optical document scanning to reduce reliance upon print media, especially dot matrix; telephones with large LED rather than LCD arrays, raised “nibs” for important keys; voice prompts and/or audible status signals

(continued)

TABLE 1. (*continued*)

Speaking	Capability of only soft, indistinct, or very slow speech; nonverbal or nonvocal communication	Unambiguous labels, signs, written communications, electronic mail/Fax means less need for speaking; maximize face-to-face communication; PC with synthetic speech output; speech-amplified telephone handset; speaker phone or operator headset for artificial larynx users facilitates writing with free hand; portable speech amplifier, other augmentative communications—boards, cards for common words/messages/symbols, laptops with LED, speech output, built-in printer; continuous-loop tape recorder for short messages; TDD for telephone conversations
Interpreting	Impaired ability in perception of visual, auditory, or tactual information; impaired memory ability; difficulty in sequencing; impaired ability in reasoning or understanding spoken or written information	Maximize use of multisensory information paths, e.g., audible and visual signs; confirming beep tones for telephone-programming features; unambiguous labels, signs, written communications; minimize distractions, e.g., high ambient noise, clutter; telephones with single-button dialing using pictures or familiar symbols to aid identifying person/use; sufficient time to respond to electronic messages, e.g., voice mail, computer-error messages; optional large print for PCs, with or without programmable font styles; optical document scanning to PC; macros, spell checking, word prediction, grammatical software; voice-recognition input for PC; mouse, joystick, pull-down menus, clear graphics
Moving	Head—difficulty in looking up, down, or to the side	Swivel chair with adjustable recline feature; maximize face-to-face communication without need for turning head; limit need to reach, stretch, bend; reach extenders, grabbers where appropriate; fish-eye lenses, mirrors to improve field of view



Upper extremities—  
absence of limbs,  
complete paralysis,  
severe incoordination,  
impaired mobility of  
arms, hands or fingers  
(range, strength, lack  
of control in placing  
or directing, spasticity)

Rocker switches, large-handle slide controls, push-action door latches decrease twisting, gripping motions; large handles on drawers; nonslip surfaces; concave surfaces for areas to be depressed, e.g., telephone keypads, computer keyboards, office and machine-equipment controls; gloves with gripping surfaces, e.g., velcro; printer with single-sheet feeder rather than tractor; store computer data on hard rather than floppy disks; key guards to avoid accidental keystrokes; adjust keyboard sensitivity, expanded keyboard or emulator; software to enhance multiple keystroke functions, word abbreviation/prediction; mouse, alternative key mapping; copy holder with electric scrolling, page turner; optical document scanning to PC; go/no-go gauges for precision measuring; speaker phone, gooseneck cradle switch, headset, single-digit or voice-activated dialing; portable note taker; limit force required for activating, e.g., force-2 use levers; powered letter openers, staplers

Upper body—impaired  
mobility, range of motion  
of strength for reaching,  
lifting, or carrying

Lazy Susans, pull-out shelves, suspended storage; mechanical reachers; powered lift tables for positioning heavy work; extensions for hard-to-reach controls; environmental control units; telephone headset, speaker phone, gooseneck for holding handset and cradle switch, "sip and puff" switches/other alternative switches; back pack, shoulder bag, wheeled cart for carrying

Lower body—impaired  
mobility, range of motion  
of strength for turning,  
bending, balancing, or  
sitting

Appropriate chair for individual, e.g., height size, arms, angle, castors (on/off); seat belts, cushions; increase angle of work surfaces, raised edges to prevent slippage; also, many items listed above for upper-body limitations such as shoulder bag/back pack, reach extenders, telephone/PC-assistive technologies

Lower extremities —  
absence of limbs, complete  
paralysis, slowness of  
gait, impaired ability to  
kneel, rise, walk, stand,  
or climb stairs

Wheelchair, walker, supports while standing; rising assist devices, cushions, grab bars, lap trays; room for wheelchair under desk/table, public telephone, work area (including footrest); also many items listed above for upper-body limitations such as shoulder bag/back pack, reach extenders, telephone/PC-assistive technologies

him/herself and maintain high self-esteem. The valued and meaningful involvement of persons with disabilities in decision making will result in the most effective solutions.

## AN ACCESSIBLE WORLD IS INCLUSIVE

Virtually everyone benefits when products, services, and their underlying technologies are designed and deployed with persons with disabilities in mind. If a task is made easier for a person with a disability, those without disabilities also often find the same task easier for them. This is not to say that every product and service can or must be designed to accommodate every individual combination of functional limitation. Individuals with severe mental or multiple disabilities may require customized approaches. Generally, design approached from a broad perspective will help a broad range of people, with and without disabilities. Here are three examples:

### CURB CUTS

Sidewalk curb cuts were originally believed to be of benefit only to those in wheelchairs. Just observe: mothers pushing baby carriages, shoppers with carts, children with bikes find the gradual slope easier to navigate. Even travelers who are blind and use canes find that the gradual slope serves as a tactile warning of the sidewalk's end. Many benefit from this accessibility feature; no one is inconvenienced because of it. This is a concrete example of simple technology in action.

### ELEVATORS

Building architects and engineers met, so the story goes, to figure out a way to keep elevator doors open long enough for people in wheelchairs to move to the open door and enter. Designing new buildings with additional elevators would reduce rental space. Retrofitting the buildings with additional elevators would be infeasible as well as costly. Keeping doors open would increase waiting time on all floors. A software engineer came up with the simple low-cost solution: reprogram the lights and bells at each floor to indicate sooner which elevator would stop next at the floor. Given more time to move to an elevator,

the person in a wheelchair would be able to enter in the same time required by anyone else. This technological innovation also helped travelers with suitcases in hotels, mail clerks with carts, and many others.

#### VOLUME-AMPLIFIED TELEPHONE HANDSETS

Many public telephones contain volume controls built into the handset, installed for people who are hard of hearing. However, the volume control is useful to everyone wishing to hear better when the ambient noise level is high. For very little extra cost, everyone benefits.

There are three elements to consider when planning for accessibility. What is the nature of the facility? What barriers restrict access? Which assistive technologies might help reduce these barriers?

The suggestions given below may be matched with the potential assistive technology solutions outlined in table 1. As with all examples given in this article, they are illustrative rather than exhaustive.

#### SIGNS

- avoid hard-to-read scripts, unusual fonts
- avoid small print, less than three to four inches high at five feet from observer
- include braille *and* large print in elevators, adjacent to room entrances, and with other points of orientation
- provide aural equivalents for frequently encountered information (cash registers, mall directories)

#### LIGHTING

- eliminate harsh fluorescent colors/tints
- cover bare bulbs
- relocate lamps away from eye level
- provide minimum of 300 lumens in public areas

#### DECOR

- provide definitive color contrast between adjoining areas (walls and doorways, floors and walls, columns and floors, etc.)
- avoid dark color schemes exclusively throughout area
- avoid single color throughout area

- avoid busy or changing patterns (especially on floors/ carpeting)

#### SOUND

- augment public address system with visual equivalent
- offer paging-system alternatives to clients, patrons (visual or tactual)
- decrease multiple sound sources, confusing sounds
- provide “quiet spaces” in high ambient-noise environments

#### ALARMS

- include both aural and visual methods for all systems, i.e., fire, smoke, danger (vehicles backing up, electric carts in airports, etc.)
- include audible as well as visual “exit” signs

#### AISLES/COUNTERS/DISPLAYS

- provide space between aisles, near counters for wheelchairs/ walkers
- provide lower surface at counter area to accommodate wheelchairs, persons of short stature
- provide reachable display areas for persons with motion impairments

#### TELEPHONES

- install systems with built-in volume controls (preferably return to normal setting on public phones)
- provide TDD capacity for some public phones, assure availability for hotel/motel guest rooms
- provide both aural and visual methods for ringing and message-alert functions

#### TV/VCR IN LODGING

- provide accessible switches for motion impaired (remote control, membrane pad)
- provide nonvisual method for selecting stations/functions
- provide captioning equipment

## A/V PROJECTION SYSTEMS

- provide alternative listening method (inductive loop, infrared)
- provide captioning for audio portions of presentations, films
- provide “descriptive narration” for visual aspects of presentations, films, plays, operas

For anyone thinking about improving accessibility there are two essential steps to take. First, try it yourself. Close your eyes, wear ear plugs, sit in a wheelchair (if available). Then try to see, hear, or move throughout your facility.

Second, consult with clients, patrons, patients and customers with a broad range of disabilities. They can help identify specific barriers and suggest particular assistive technology solutions. In addition, consult with organizations and consultants having expertise with particular disabilities *and* assistive technology.

## DETERMINING WHICH ASSISTIVE TECHNOLOGIES TO USE

Which products will address which disability? How can their performance be evaluated? This is a special concern for small businesses that may not have had experience making accommodations for people with disabilities. Assistance is available and more is forthcoming.

Each of the federal agencies responsible for implementing titles of the ADA will also be providing technical assistance. For assistive technology, the most relevant federal agencies are the Architectural and Transportation Barriers Compliance Board (ATBCB), the Department of Justice (DOJ), Equal Employment Opportunity Commission (EEOC), the President's Committee on Employment of People with Disabilities, and the U.S. Department of Education's National Institute of Disabilities and Rehabilitation Research (NIDRR).

ATBCB has already established minimal standards for communications and architectural accessibility. The ATBCB, the DOJ, and the EEOC have instituted technical-assistance programs. The President's Committee, through its long-standing Job Accommodation Network, is expanding its services, especially to small businesses. They have thousands of examples on file of successful accommodations. A toll-free 800 number is answered by trained personnel. NIDRR is setting up regional technical-assistance centers to facilitate the implementation of the Act.

In addition, each major type of disability is being addressed by Rehabilitation Engineering Centers (REC) funded by NIDRR. Twenty-four states now have Technology Assistance Programs (TAPs) focusing specifically upon assistive technology. Soon every state will have its own program. Many other government and nongovernment regional, state, or locally based initiatives are in place. A number of well-qualified consulting firms are in the assistive-technology arena.

Persons with disabilities often know what they need to make their jobs accessible. The same principle applies to places of public accommodation. Frequently, the individual's suggested accommodation is simpler and less expensive than the accommodation the employer, business, or public entity might have devised. Several companies involved with telecommunications and transportation have consumer advisory panels to counsel them.

Here are some guidelines for persons wishing to use assistive technology properly:

- Accommodation is best understood as a process in which barriers to opportunity are removed.
- A problem-solving approach should be used to identify the particular tasks or actions related to employment or use of public facilities.
- Assistive technology that can lead to meaningful access should be identified.
- Any assistive technology device should be effective for the specific application. Factors to be considered include its suitability, reliability and potential for timely delivery.
- Acquire the assistive technology.
- Provide for appropriate training of personnel who will use or show others how to use the assistive technology device(s).
- Establish a program of maintenance, upgrading and replacement.

These guidelines are similar to the ones suggested by the U.S. Congress in a House Committee report accompanying the ADA,<sup>5</sup> and meet the definition of assistive technology services in the Tech Act.<sup>6</sup> The process fosters cooperation between employee and employer, customer and business, or patron and public facility. It generates solutions acceptable to each and creates a basis for changing stereotypical attitudes about disability.

## BENEFITS OF ASSISTIVE TECHNOLOGY

Assistive technology has extended horizons in education and employment, for personal independence and social integration. The sheer volume of devices in use and the number of companies that develop, manufacture, and distribute them are evidence of a lively marketplace. In addition, the American business community, especially the retail trade, is likely to find strong incentives to provide assistive technology. Creating public good will is one such incentive. A more powerful force is the quest for new customers.

Assistive technology is still not widely deployed, however. Knowledge about and appreciation of its value in places of public accommodation, transportation, and telecommunications is limited. Although persons with disabilities know a great deal about technology, they are not universally aware of the variety of devices available or how to obtain them.

The extent to which assistive technology is being used is not clearly understood. Many devices are purchased and later laid aside. Some simply never worked right; others became obsolete.

Moreover, little systematic research supports the anecdotal evidence of the benefits of assistive technology. Much of this research is several years old and does not address the more recent infusion of newer technologies. However, the most frequently quoted studies have set the foundation upon which future research may be built (Berkeley Planning Associates 1982; U.S. Congress 1982).

Data gathered more recently about assistive technology for visual impairment might be extended to other disabilities. In 1986, the National Technology Center of the American Foundation for the Blind embarked upon a project to capture information about the use of electronically based devices by people who are visually impaired. To date, about 1,200 persons have volunteered information.

From the interviews, some significant data have emerged.<sup>7</sup> Eighty-three percent of respondents were employed, more than 90 percent full time. By contrast, only 30 percent of the overall population of visually impaired persons of working age are employed. Fifty-one percent of respondents used a computer with assistive technology components as an accommodation to their disability a minimum of five days per week. Overall, about 70 percent of respondents used computers.

## COSTS OF ASSISTIVE TECHNOLOGY

The deployment of assistive technology in the workplace and places of public accommodation will not be a burden on American business and public institutions. The cost of assistive technology is frequently quite small. Offsetting tax and accounting treatments might reduce its impact upon tight budgets. Most important, the economy benefits as Americans with disabilities become integrated more fully into society as employees, customers and taxpayers. Moreover, work productivity increases with the use of assistive technology. In addition, the customer base increases when people with disabilities can spend their larger disposable income to reach and use accessible business establishments. Finally, the general taxpaying public contributes less to programs of support and aid.

Testimony before Congressional committees demonstrates that the cost of most accommodations and auxiliary aids is usually minimal. For instance:

“Sears and Roebuck made their whole national headquarters accessible for \$7,600 with TDDs, ramps, this and that and the other thing. It is hard to believe that they could do it for that cheap a price. But if a person wants disabled people, the accommodations really don’t become a burden. If they don’t, they always do.”<sup>8</sup>

“Jay Rochlin, former Executive Director of the President’s Committee testified that a 1982 study showed that a majority of accommodations provided by Federal contractors involved little or no cost.”<sup>9</sup>

“Charles Crawford, Commissioner for the Massachusetts Commission for the Blind, stated: ‘ . . . I think that the application of technology for disabled persons will bring down the cost of a number of accommodations. For example, with the blind community, it is possible through microcomputer networks and braille production to produce accessible materials with very little cost . . . ’ ”<sup>10</sup>

The cost of assistive technology is frequently limited to an “add-on” for existing equipment. Prime examples are assistive technologies for personal computers: synthetic-speech or alternative data-entry modules



are added to existing equipment. Similarly, Go/No-Go switches can be added to existing workplace machines. Gooseneck clamps that hold telephone handsets are only an add-on.

The funding of assistive technology is a key issue for persons with disabilities. Solutions can be expensive and prohibitive in times of tight budgets and limited funds. Furthermore, there is no systematic funding or reimbursement for the purchase of assistive technology. The National Council on Disability has initiated a study on the financing of assistive technology, as mandated by Congress in the Tech Act. Businesses and public entities subject to the ADA must pay for required accommodations or auxiliary aids. However, there are limits, which are addressed in other articles in this volume.

Both tax credits and tax deductions are available for entities making expenditures in order to comply with the ADA. Another article in this volume examines ADA-related tax incentives in depth.

In weighing the costs and benefits of utilizing assistive technology, consider the following two hypothetical examples.

- Many patrons of the Good Times Restaurant who are deaf really like the food, ambiance and service. However, making reservations is a pain! The restaurant has never had a TDD connected to its telephone line. The Better Times American Bar & Grill is also excellent. Having installed a TDD as well as a public pay phone with TDD capabilities, they have geared up to attract customers with disabilities, including family and friends.
- The Palace Shopping Plaza and Capitol Mall Shopping Center traditionally engage in fierce competition for customers. When the Capitol Mall management decided to refurbish all its public areas, store entrances, and other facilities, they consciously tried to make it accessible. Not only were architectural barriers removed, but also many communications barriers. Entrances to the center have convenience kiosks nearby. Customers with visual impairments can pick up special receivers, about the size of a garage-door opener, to use while in the mall. With this assistive technology device, each store could be identified through Talking Signs™ transmitters placed above their entrances. In addition, the mall directory includes optional synthetic-speech output to assist shoppers with visual or perceptual impairments.

In both examples, the incremental cost of providing assistive technology can be quickly offset by increasing the customer base. The cost of the TDD (about \$250) can be recouped from only a few extra meals. The same principle applies to the Capitol Mall scenario. Accessibility design features were integrated into plans for renovations. Increased mall traffic would soon have offset the costs. Both examples might be eligible for a tax subsidy.

## CONCLUSION

The role of technology will be especially important in the successful implementation of the ADA. A particular branch of technology, assistive technology, will be key to persons whose physical or mental impairments substantially limit one or more of their major life activities. Hearing, seeing, speaking, interpreting information, or moving are essential for performing a wide variety of actions or tasks. Many of these tasks are made possible, or enhanced, through appropriate assistive technology.

I have stressed a common-sense approach to incorporating assistive technology. Simple low-tech solutions often work well for some tasks. When higher-tech solutions are called for, several products are frequently available from which to choose. The task of an individual with a disability and his or her employer, is to analyze the job to be done and match it with available options. The critical question changes for public institutions, transportation carriers, telecommunications companies or places of public accommodation. It becomes, What solutions will work best for the greatest number of persons with disabilities in the greatest number of situations?

The Americans with Disabilities Act is part of an evolutionary process. Its goal is inclusion. Its promise is opportunity, enlightened attitudes and social integration. Its rewards will be realized as persons with disabilities become coequal, as students, colleagues, taxpayers, customers and contributors to society, with their peers. A key to its success is the infusion of appropriate assistive technology: access to books, information, and the tools of learning; access to transportation; accommodations for employment; elimination of architectural and communications barriers in retail and service businesses, telecommunications, and in places of leisure and enlightenment.

## NOTES

1. P.L. 99-506 §103.
2. P. L. 100-407 codified at 29 U.S.C. §2201 et seq. Subsequent references are to P.L. rather than U.S.C. sections.
3. P.L. 100-407, §3(1).
4. Id., §3(2) (A-F).
5. H. Rep. no. 101-485, part 2 at 65-67.
6. P.L. 100-407, §3(2) (A-F). Condensed, the points are: "(A) . . . evaluation of the needs of an individual . . . in [his or her] customary environment; (B) . . . the acquisition of assistive technology devices by individuals with disabilities; (C) selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing of assistive technology devices; (D) coordinating and using other . . . interventions or services with assistive technology devices . . . and programs; (E) training or technical assistance for an individual, or where appropriate, the family; and (F) training or technical assistance for professionals who provide services to, employ, or are otherwise substantially involved in the major life functions of individuals with disabilities."
7. Careers in Technology and Information Base (CTIB), National Technology Center at the American Foundation for the Blind, October 1990.
8. Testimony before the House Subcommittees on Select Education and Employment Opportunities, September 13, 1989, no. 1010951 at 20.
9. Id. at 35.
10. Testimony before the House Subcommittee on Select Education, October 24, 1988, no. 10009109 at 29.

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# Summing Up: Opportunities of Implementation

*Jane West*

**A**t the White House signing ceremony for the ADA, President Bush ended his remarks by articulating one of the Act's most significant opportunities. He said, "Let the shameful wall of exclusion finally come tumbling down." The opportunity to remove barriers that have excluded and denied persons with disabilities from participating, developing their skills and talents, and contributing to the riches of our nation is one we have before us. It is a chance to recommit ourselves to a fundamental cornerstone of the American dream: equal opportunity.

The ADA presents an opportunity to turn the corner on policies promoting welfare-like dependence and to develop instead supports for independence in the context of working, living, and recreating in the mainstream. In this sense, implementing the ADA is an opportunity to contribute to an improved economy. When persons with disabilities give up public subsidies for jobs, they leave funds in the public coffers. When they become taxpayers, they contribute directly to the public treasuries. When persons with disabilities become consumers in the marketplace, they strengthen the economy.

The ADA offers opportunities for partnerships between the private and public sectors, between persons with disabilities and the business community, and between accessibility experts and industry. The generation of these partnerships will bring opportunities for creativity and

ingenious problem solving as people with disabilities join government officials, proprietors of shops, business owners, industry leaders, unions, technical-assistance experts, and disability service providers to fashion accessible and inclusive situations, environments, and practices.

Finally, implementation of the ADA offers an unprecedented opportunity to advance our knowledge about effective practices in constructing an inclusive and integrated world for people with disabilities. We can learn more about what sort of technical assistance is effective, for whom, and in what circumstances. We can learn about how behaviors and attitudes toward persons with disabilities can change. Research undertaken while policy is put into practice is likely to be relevant to policy makers when they raise the inevitable questions about the success and impact of the ADA. In the rush to proceed with implementation, let us not overlook evaluation as an important component of our efforts.

The ADA is not the answer to all of the challenges faced by persons with disabilities—rather, it is a new beginning. Justin Dart, chairman of the President's Committee on Employment of People with Disabilities, articulated this thought lucidly when he said, "The ADA is only the beginning. It is not a solution. Rather, it is an essential foundation on which solutions will be constructed."