

The Illustrated Guide to Assistive Technology and Devices

Tools and Gadgets for Living Independently

By
Suzanne Robitaille

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To Gregory, for teaching me to soar

Foreword

Imagine you're starting to lose your vision—something that happens to many of us as we grow older. Suddenly the magazines and newspapers you're used to reading every day are no longer available to you. The books you enjoy are gone. Even more importantly, you may not be able to continue working if you cannot read the documents and manuals you need for your job. If you are young and a student, how do you read your textbooks and class assignments? The challenge of learning takes on a whole new meaning for you.

Twenty years ago, people with vision problems needed to spend more than \$5,000 to get a computer that talked, along with a scanner that made textbooks and other publications accessible. Thankfully, today there are more options—and the situation is getting better. Manufacturers are building assistive technologies directly into their computers, making them more accessible to people with disabilities. Apple's and Microsoft's latest operating systems have free, built-in screen readers, which are speech engines that read aloud words on a screen for the blind and visually impaired. There is also a free, open source screen reader available for download, funded by Mozilla, Microsoft, Yahoo!, Adobe, and other tech giants, which will expand access to information for those who need it most.

Today, user-friendly, inexpensive mobile technology offers an unprecedented opportunity to reach even the most disadvantaged communities. This is the future of assistive technology: affordable devices and gadgets that are universally designed and accessible to everyone, including people with disabilities. Imagine a cell phone that will see for those who cannot see, listen for those who cannot hear, speak for those who cannot speak, remember for those who cannot remember, translate for those who do not understand, and guide those who are lost.

I have been working in the field of assistive technology for more than two decades. I entered the field by chance. As a student at the California Institute of Technology in the 1970s, I had planned to become an astronaut. This all changed during a modern optics class, in which I learned how to develop pattern recognition systems. In class we learned how to build a smart bomb with a camera in the nose, which used optical pattern recognition to find a target in the distance and blow it up. I left the class knowing that there had to be a way to use this technology to help rather than hurt people.

My idea was to use optical pattern recognition to build the world's first affordable reading machine for the blind. It was a few more years before I started my deliberately nonprofit company, Arkenstone, to begin to produce this device. Our first prototype, built in

1987, cost almost \$50,000. It took a page of text and ran it through a scanner, taking a digital photograph of the page. The optical character recognition software turned the picture of the page into a word-processor text file, just as if someone had typed it in by hand. Then a voice synthesizer read the text aloud in a very mechanical voice.

We anticipated that the market for this machine would be \$1 million per year, but within three years our nonprofit social enterprise was making five times that revenue annually. By 2000, we had provided more than 35,000 reading systems in sixty countries that could read in a dozen languages.

How were we able to do this? Simple. As the technology components became cheaper, more blind people were able to afford the machine. Over ten years the cost of an Arkenstone reading system dropped from \$5,000 to \$1,200. Each time the price went down, our unit volumes went up—and more people got the benefit of this technology.

We also discovered that nearly 20 percent of our users were not blind but dyslexic. The original software highlighted each word as it was spoken, making it an ideal reading tool for users with dyslexia and other learning disabilities.

In 2000, we renamed our nonprofit company Benetech, which stands for “beneficial technology.” Benetech is a collection of social enterprises, hybrids that combine the best aspects of business skills and nonprofit heart to create innovative solutions to the problems facing humanity. One of our objectives is to empower the world’s 650 million people with disabilities through technology.

This is essential. Technology touches every part of our lives, from education and work to entertainment and shopping. If we don’t make technology accessible to everyone—including people with disabilities—we may find someone we love, or even ourselves, left behind. And to remain globally competitive, we must ensure that all of our citizens have the tools they need to participate independently in school and in the workplace.

One of Benetech’s biggest initiatives, Bookshare, was inspired by my then 14-year-old son Jimmy, who introduced me to Napster, the music-sharing Web site. I quickly recognized how a Napster-style approach could help people with disabilities. Hundreds of Arkenstone users were independently scanning the exact same books. What if they could share scanned books over the Internet? It would save many, many hours of effort and greatly increase the availability of books.

Today Bookshare is a digital library with more than 60,000 titles, built initially by people with vision, learning, and physical disabilities who volunteered to scan books into digital formats and upload them to the Bookshare Web site. More than 35 publishers have partnered with Bookshare to upload their digital files directly to our library so that our members have access to an enormous variety of books, including the majority of titles on the *New York Times* best-seller list and reference books such as *Encyclopaedia Britannica*. Once downloaded, these digital books can be read aloud using synthesized speech, enlarged for those with low vision, or rendered in electronic print or braille.

In 2007, the U.S. Department of Education awarded Bookshare a five-year contract to deliver accessible books free to all qualified K–12 students with print disabilities in the United States. Bookshare is a great example of how social enterprise (i.e., government, charity, and business working together) can devise a much-needed solution to a pressing concern.

Indeed, the U.S. government, by passing laws such as the Americans with Disabilities Act, the Tech Act, and the Individuals with Disabilities Education Act, helps to get assistive technologies into the hands of the people who need them. Private insurance helps, too, but only for some people and some technologies.

At Benetech, we imagine a world where everyone on the planet has access to the assistive technologies that he or she needs for employment, education, and social inclusion. The reality is that we're not there yet because of the high costs associated with building specialized devices and the training and support associated with them.

If all mainstream technology companies design accessibility into their products from the beginning, those with disabilities won't be left behind. The market for assistive technology will actually strengthen in response: with basic technologies taken care of, people with disabilities will thrive economically, and the market for premium assistive technologies will expand as this group can afford newer and better solutions (and costs will go down, too).

We're already seeing this happen with the nation's 75 million baby boomers, many of whom are purchasing home appliances and other gadgets that are geared to their age-related disabilities, such as arthritis and macular degeneration.

I firmly believe that technology can be an immense force for good in the world. But I've also learned that this won't happen in a vacuum. We in the technology industry must work together to create more accessible products at prices that people can

afford. Governments must actively seek private and public sector solutions, and social enterprises should play a larger role in effecting change.

Ultimately, it's about ensuring access to the tools people with disabilities need to pursue their dreams of independence. We have the technology; we just need to raise the floor for everyone. Every person with a disability should have the basic tools he or she needs to ensure equal access to information and knowledge.

And we should also educate—through books such as *The Illustrated Guide to Assistive Technology and Devices*—to help people with disabilities find what they need to take charge of their lives. All of these efforts will deliver sustainable change and, ideally, enable each person on the planet to access the information he or she needs for education, employment, health, and social inclusion.

Jim Fruchterman
Founder and CEO of Benetech
Palo Alto, California

Preface

*If we all did the things we are capable of doing,
we would literally astound ourselves.*

—Thomas A. Edison

I never quite understood why most assistive technology books were relegated to obscure sections in national bookstore chains. Assistive technology is a topic that's as worthy as any management, human resource, and corporate responsibility title on today's business bookrack, or any mainstream health book at the front of the store.

I'm a business writer at heart, having worked for BusinessWeek.com as an assistive technology writer. I'm naturally interested in technologies that will help improve the working life of a person with a disability, as well as better their daily living needs. In March 2009, I founded a blog and Web site, Abledbody.com(www.abledbody.com), which covers assistive technology and disability news for people with disabilities.

So I'm writing this book about assistive technology in a way that has not been done before. I wish to help people with disabilities make informed purchasing decisions that will help them to succeed in their workplace and lifespace. At the same time I want to teach others, including family members, educators,

and employers, how individual technologies are able to make an impact on a disabled person's life and open their opportunities for advancement and prosperity.

This book isn't going to focus on just *any* technology for *anyone* with a disability. I simply don't have that kind of expertise (or the wherewithal). I won't focus on educational or rehabilitative technologies. I'll leave that to the educators and medical professionals. Rather, I'll draw on my own experience living with a disability and working in several Fortune 500 companies where I found that any device or gadget that I needed I had to find on my own.

Aside from professional and personal experience, I interviewed a lot of people before sitting down to pen these chapters. Jay Leventhal, formerly the editor of AccessWorld at the American Foundation of the Blind, was extremely helpful and thoughtful in helping me shape the chapters on vision loss. Paul Willington of TecEar supplied me with details around assistive listening devices for the deaf and hard of hearing. Mark Felling, president of Broadened Horizons, offered up excellent overviews of adaptive phones and other equipment for people with physical limitations. Merideth Berger, director of the Clarke School for the Deaf in New York, taught me about different technologies for note taking and meetings for people who are deaf and hearing impaired. I also want to thank my

editor, Noreen Henson, for developing the idea for the book and trusting me to bring it to life; and my intern, Tess Timoshin, for helping me pull together illustrations and other resources. Of course none of this would be possible without the help of the more than 100 assistive technology vendors; their products truly inform this book and are helping millions of people with disabilities.

Most important to me when writing this book was making sure I captured the most useful and up-to-date technologies that are available for purchase today. Some of these devices, of course, are cost-prohibitive, so I am operating under a few assumptions: First, that employers who hire qualified people with disabilities will also work to provide them with reasonable accommodations, similar to how employers also provide health insurance to all of their employees regardless of any preexisting conditions. Providing accommodations is a provision of the Americans with Disabilities Act (ADA). Second, the Individuals with Disabilities Education Act (IDEA) includes provisions for assistive technologies for all students up to grade 12. Third, state agencies, under the Tech Act, provide many of the technologies that appear in this book to people with disabilities.

Finally, the reality is that it's expensive to have a disability, and to pretend that it isn't would be a lie. People with disabilities very often have to make a

choice to use their income to purchase technologies that will help them live fulfilling lives. This book reflects those choices, which are difficult for many in this demographic to make.

If I can supply people with disabilities, their families, educators, and employers with a modicum of knowledge to help them make thoughtful and intelligent purchasing decisions about assistive technology, and if a person with a disability is able to use any of technologies in this book to fabricate a more independent and productive life, I will have achieved my goal.

1

What Is Assistive Technology?

Self-preservation is the first law of nature.

—Samuel Butler

Having a disability isn't easy. Believe me, I know. I have had a hearing disability since I was four years old. Growing up profoundly deaf impacted my education, my lifestyle, and eventually my employment. Indirectly, it affected my parents, my sister, my teachers, my friends, and my bosses.

But being deaf was also a blessing. It helped me build character; it gave me insight into a more realistic world than the one my peers lived in; and it brought for me a love of books, and of writing, which my wonderful mother—who, like the rest of my family, was hearing—encouraged me to pursue as a career.

The definition of “disability” is any physical or mental impairment that substantially limits a major life activity. Disabilities include, but are not limited to, learning disabilities, blindness or low vision, hearing loss, speech impairments, and mobility impairments. Assis-

tive technologies have helped many people to circumvent, mitigate, or eliminate the barriers to major life activities.

In my case, I couldn't comprehend language or use the telephone with just my hearing. When I was twenty-seven I got a cochlear implant; the surgery removed my natural hearing forever and replaced it with artificial hearing. Today I can hear on the phone. I have a device implanted inside my head that's attached to a processor I wear behind my ear. I made the choice—and for me it was a good one—to allow assistive technology to play a large role in my life so that I could hear again.

When I tell people I write about assistive technology, I can see their eyes glaze over—that is, until I tell them that this is technology that helps people with disabilities succeed in the workplace and life space. Then their faces light up: "Oh my, that's so wonderful," they exclaim. "My sister has a learning disability" or "Gee, my father is losing his hearing."

Suddenly, they can relate. That's because disability affects most of us in one way or another. In the United States, 54 million people have a physical or mental disability. That's 20 percent of the population. More than 20 million families have at least one family member who has been touched by disability. And one can add to that the 80 million baby boomers, the

growing number of children with special needs, and the thousands of soldiers returning from Iraq and Afghanistan who have service-connected disabilities such as limb loss and brain injury.

Today, disability has been threaded into our national discourse. It affects health care, employment, education, and recreation. It has an impact on the person's physical and financial health and well-being, not to mention the strain on a family trying to provide care and attention.

That's why technology is so important for people with disabilities. Assistive technology devices can help improve physical or mental functioning, alleviate a disorder or impairment, prevent the worsening of a condition, improve a person's capacity to learn, or even replace a missing limb.

Types of Assistive Technology

Assistive technology comes in many different shapes, sizes, and packages. It can be acquired commercially off the shelf, modified or customized, or designed specifically for one or more disability types. The one thing that all assistive technologies have in common is that it's a capability enhancer.

There are ten classes of assistive technology devices, categorized by their main objective:

1. Architectural elements, such as adaptations to the home and other premises
2. Sensory elements, such as aids for communication and hearing
3. Computers, such as software and hardware
4. Controls, including environmental controls
5. Aids for independent living, such as personal care items
6. Prostheses and orthoses
7. Aids for personal mobility, including wheelchairs
8. Modified furniture and furnishings
9. Aids for recreation and sports
10. Services, such as device selection and training

This classification is widely used in the U.S. and around the world.

In addition, assistive technology can be “no-tech,” such as Velcro for fastening your shirt; “low-tech,” such as a walking cane; or “high-tech,” such as screen-reading software. It can be specially designed

equipment for the disabled or standard equipment that has been modified for their use. Here are some more examples:

- Hearing aids
- Access ramps
- Wheelchairs
- Speech generators
- Talking books
- Closed-captioned television

In this book I discuss all types of assistive technology, looking at technologies that can aid individuals in their work, home, and lifestyle. These devices include the various types of low-tech and high-tech hardware, software, and gadgets that are available to people with different disabilities. However, I will pay closer attention to products on the higher end of the technology spectrum.

For example, people with limited hand function may use a keyboard with large keys or a special mouse to operate a computer, people who are blind may use software that reads text on the screen in a computer-generated voice, people with low vision may use

software that enlarges screen content, people who are deaf may use a text telephone (TTY), and people with speech impairments may use a device that speaks out loud as they enter text via a keyboard.

In many cases, higher-tech assistive technology is more expensive, is harder to find, and has a learning curve, but the results can be extraordinary, in the sense that these are life-changing devices. Without these technologies, someone might not be able to go to school, sustain a job, or communicate with family members.

Defining Assistive Technology

Many people in my field don't like the term "assistive technology." It's medical sounding, doesn't trip off the tongue, and, quite frankly, sounds boring. The legal definition of assistive technology was first published in the Technology-Related Assistance for Individuals with Disabilities Act of 1988, known today as the Tech Act. This act was replaced with the Assistive Technology Act of 1998, which established a grant program to provide states with funding for assistive technology products and services. In 2004 the law was amended to mandate, in some instances, that states provide alternative financing and loans for assistive technologies. I talk more about this in Chapter 9, "How to Pay for Assistive Technology."

Congress defines assistive technology in Section 3 of the 1998 Tech Act as follows:

Assistive technology is any item, piece of equipment, or product system, whether acquired commercially or off the shelf, modified or customized, that is used to increase, maintain, or improve the functional capabilities of a person with a disability.

People with disabilities might be pleased or even surprised about what the U.S. government has to say on assistive technology and disability. According to the Assistive Technology Act, disability is “a natural part of the human experience and in no way diminishes the right of individuals to live independently, enjoy self-determination and make choices, benefit from an education, pursue meaningful careers, and enjoy full inclusion and integration in the economic, political, social, cultural, and educational mainstream of society in the United States.”

Under the Assistive Technology Act, the Department of Education provides grants and funding to increase the “availability [of] and access to assistive technology devices and services” that will “significantly benefit individuals with disabilities of all ages.” Keep in mind that this law was passed two years before the proliferation of mobile devices, smartphones, mp3 players, and electronic book readers. It also

preceded the Americans with Disabilities Act (1990)—the landmark civil rights legislation for people with disabilities—which I’ll talk about later in this book.

On a less formal note, a former BusinessWeek.com colleague, John Williams, should get some credit for coining the phrase “assistive technology.” John has been writing about disability and assistive technology since 1980—a decade before the Americans with Disabilities Act was passed into law. He also started the Assistive Technology column, which I took over after he left *BusinessWeek* in 2001 and continued until the end of 2004.

Benefits of Assistive Technology

The benefits of assistive technology cross categories of age, disability, and health challenges. From young children to seniors, people may face a range of physical and cognitive limitations. Today, there are thousands of assistive technology products on the market to help people with disabilities with all sorts of needs, from the simple to the sophisticated. If you or someone you know has difficulty typing on a keyboard, reading a document, or hearing the TV, there’s probably a product that will fit your needs or theirs. It’s really just a matter of finding the right technology and figuring out how to use it.

Sometimes I meet people who are afraid of using assistive technology because it seems like a crutch. Believe me when I say it is not. In all the conversations I've had with people outside of the assistive technology world, they use words such as "cool," "brave," and "inspiring."

This is especially noticeable when the assistive technology is associated with helping someone who is already doing something well do it even better: like Oscar Pistorius, the Paralympic athlete from South Africa who straps on blade runners—prosthetic legs—to run 100-meter races, or Stephen Hawking, the brilliant astrophysicist with a neuromuscular disability who uses a device that helps him communicate his theories about black holes.

Users of assistive technology must acknowledge that the device exists to help them. There is no stigma in using assistive technology as a daily or occasional aid in your life. Quite honestly, self-preservation is a human responsibility; it's a hard world out there, and if you want to thrive, it is wise to do whatever it takes to stay on top of your game.

With assistive technology, the families of people with disabilities benefit too. Instead of a wife having to read the mail of a person who is blind, he can read it himself using scan-and-speak software. In-

stead of a child making a phone call for his mother who is deaf, she can do it herself in sign language, over the Internet.

One of the most important things to remember is that, as humans, we're all temporarily abled. At one point or another, it is likely that each of us will use some form of assistive technology. If you have a disability now, you're just starting a little sooner.

Assistive technology is a life-changer. It can help individuals with disabilities increase their independence, build their self-confidence and self-esteem, improve their quality of life, and break down barriers to education and employment. The real challenge, of course, is finding the right devices and gadgets, for the right purpose, at the right price.