

Dream machines



From ultra-portable wheelchairs to robotic exoskeletons, tomorrow's high-tech assistive devices are here today.

by **Matt Alderton**

Every January, more than 180,000 technophiles overtake the Las Vegas Convention Center like overzealous fans rushing the stage at a pop concert. What has them swooning isn't a teen idol, however. It's gizmos. Over 2.7 million square feet of them, to be exact. The occasion: the International Consumer Electronics Show (CES), an annual exhibition of the latest gadgetry. Highlights of the 2019 show, for example, included everything from a television that rolls up like a window shade for out-of-sight storage to a smart planter that alerts you when your indoor herb garden needs water.

For people with disabilities, events like CES can feel as disappointing as they do exciting. One can't help but wonder: If consumer technology can advance so far so fast, why can't assistive technology?

By the looks of the 2019 CES, assistive technology is finally catching up. Among the items on display were Temi, a personal robot that can carry things for people who have tremors or shakes; DFree, a wearable device that uses ultrasound technology to measure the contents of one's bladder, helping people with incontinence plan their toilet trips; and the WHILL Autonomous Drive wheelchair, a self-driving power wheelchair that users can "summon" for last-mile transportation in airports, theme parks and hospitals.



Jodi Johnson stays mobile and independent, thanks to her yellow scooter she calls Bumblebee. Photo courtesy of Jodi Johnson

But a downside to these and other cutting-edge innovations is a big one: their price tag. Although technology often becomes cheaper over time, its high cost out of the gate places many new products beyond the reach of people who could most benefit from them. Still, the upside is their potential impact and possibilities for more affordable versions, which eventually could make the world more accessible for people with multiple sclerosis.

Innovation—at a price

The old English proverb is true: Necessity really is the mother of invention, especially when it comes to mobility, says Don Clayback, executive director of the National Coalition for Assistive & Rehab Technology (NCART). In response to user needs, he says, manufacturers have spent the last decade making manual wheelchairs, scooters and power wheelchairs that are more functional and more flexible, if not always affordable for many people. (Note that prices were current in early 2019 and could change.)

“Manufacturers have really come to appreciate the fact that wheelchairs and scooters become integral parts of their users’ lives,” Clayback says.

Innovations range from the simple to the complex. On the simple end, for instance, are power-assist devices for manual wheelchairs, like the Permobil SmartDrive MX2+ (around \$6,400; permobilus.com), which comes with a Bluetooth-enabled wristband that allows users to control it with a tap of their wrist.

“Power-assist devices in essence are a motor and a wheel that you can attach to a manual wheelchair to give the user the best of both worlds: a manual and a power wheelchair, depending on the situation,” explains Clayback, who says devices can help users traverse longer distances with less fatigue, climb inclines and navigate uneven terrain.

Scooters also have made strides, according to Jodi Johnson of Darnestown, Maryland. When her MS began to affect her mobility in 2015, she began a search for the perfect scooter, a one-piece ride that was compact and portable. It took her three years, but in 2018 she finally found her mobility “match”: a yellow Transformer Electric Folding Mobility Scooter by Solax (around \$2,300; gosolaxscooters.com), which with the touch of a button, automatically folds to and from the size of a carry-on suitcase.

“It had me at ‘electronic folding,’” says Johnson, who calls her scooter Bumblebee after the yellow Transformers character of the same name. “Since getting Bumblebee, I’ve been to three concerts, several sporting events and museums. It’s even been on 10 airplanes. Because I can take it anywhere I want to go, it’s made me feel like I can get out and enjoy my life again.”

Portability also is front and center in the Zinger Chair (around \$2,400; zingerchair.com), which looks like a sporty folding transport wheelchair but moves like a power wheelchair, thanks to its battery-operated motor.

“The chair collapses down to a total of 10 inches thick, which will fit in the backseat of a car,” says Tim Hague, vice president of mobility at firstSTREET, the direct-marketing company that owns and sells Zinger Chair. The chair’s other defining features include a lightweight aluminum frame, a 24-inch turning radius and two patented steering levers that users push and pull in order to accelerate, brake and turn. “Nobody likes to think of mobility products as having a fun factor, but this one does,” Hague says.

Fun is what attracted Todd Lemay to the TerrainHopper (\$18,000; terrainhopperusa.com), an off-terrain electric vehicle designed to take wheelchair users to the beach, hiking trails and other outdoor locations. Engineered to traverse mud, sand, snow, rocks, water and even steep hills, it has four-wheel drive, a 35-degree climbing capability and handlebar steering, with optional joystick controls for users with limited dexterity.

“When you’re in a wheelchair and your friends and family want to go on a hike or go to the beach, they either have to modify their plans in such a way to include you—or sometimes they just don’t include you,” says Lemay, who has brittle bone disease and founded TerrainHopper USA to manufacture and sell the British-designed TerrainHopper in the United States. “With TerrainHopper, you can participate in activities you normally would not be able to participate in.”



Todd Lemay, the founder of TerrainHopper, enjoys a ride in this off-terrain electric vehicle designed for wheelchair users to traverse sand, snow and hills. Photo courtesy of Todd Lemay

The activities in which he most wants to participate are the everyday variety, says Scott Crawford, PhD, of Jackson, Mississippi. The product he most covets is the iBOT (mobiusmobility.com). Although it was discontinued in 2009, the manufacturer is working to reintroduce the device (estimated at around \$30,000), which has four-wheel drive but looks more like a traditional wheelchair than an ATV. Unlike the power wheelchair that Crawford currently uses, the iBOT can climb curbs and stairs, and has a “balance” mode wherein it stands on two wheels, lifting the user up to reach high shelves, see into pots on the stove, sit at a bar, converse at eye-level with standing friends or even dance with a standing partner.

“Just being able to visit a neighbor would be a big improvement in quality of life,” says Crawford, who’s been living with MS since 1999. “Private homes are exempt from ADA; a wheelchair that climbs stairs solves that problem.”

Amazing orthotics

Orthotics—devices that support or correct errant body parts—have seen their own advances. One promising innovation, for example, is exoskeletons, wearable robotics that assist users with walking. Take the ReWalk Personal 6.0 (\$77,000; rewalk.com). Featuring battery-powered motors at the hip and knee joints, it mimics natural gait when it senses a forward tilt of the upper body—the user’s cue that he or she wants to ambulate.



The Zinger Chair is a versatile folding wheelchair that collapses down to 10 inches thick. Photo courtesy of firstSTREET

Although exoskeletons' initial market is paraplegics, people with MS also could benefit from this device, according to Peter Neuhaus, PhD, a senior research scientist at the Institute for Human & Machine Cognition, which has been researching and developing its own exoskeletons since 2010. Its latest model, Quix, is a finalist in the Mobility Unlimited Challenge, organized by the Toyota Mobility Foundation to seed innovation in personal mobility.

"While specific devices may not be designed for all gait issues, the underlying technology has almost any application," explains Neuhaus, who says exoskeletons let users move around their home or workplace without modifying it and interact face-to-face with standing peers. Plus, there are health benefits, as being upright prevents pressure sores and facilitates healthy circulation and digestion.

Another orthotics innovator and Mobility Unlimited Challenge finalist is EvoWalk from Evolution Devices. The first Functional Electrical Stimulation (FES) device to use artificial intelligence to personalize stimulation, EvoWalk learns users' unique step patterns, then uses precisely timed electrical signals to stimulate the right muscles at the right time, helping users walk without falling. Creator Pierluigi Mantovani says the product was inspired by his father, who suffers from foot drop as a result of MS.

"The devices that are out now don't understand how someone walks," explains Mantovani, who says current FES devices stimulate just one muscle, while EvoWalk stimulates many.

“We target all the muscles involved in walking to help you get stronger over time and help your walking form generally.”

For Cheryl Hile of Pacific Grove, California, being able to walk with foot drop isn't enough. A distance runner who's completed 48 marathons since being diagnosed with MS in 2006, she insists on running with it, too. Although she's tried many ankle-foot orthotics (AFOs), her favorite is SpryStep by Thuasne USA (ranges from \$400 to \$900; thuasneusa.com), a custom brace made of a carbon-fiber composite that's lightweight yet durable.

“Older, plastic AFOs can't withstand long distances or pounding on the pavement,” Hile says. “With carbon fiber, I've got something sleek, flexible and springy, but also sturdy. It's a game-changer.”

Elegant living aids

MS can make it challenging not only to walk and run, but also to do basic everyday tasks. So yet another class of innovators is focused on products that make it easier to live independently.



A mechanized nail clipper can help make fingernail trimming safer and easier. Photo courtesy of ClipDifferent

Temi (\$1,500; robotemi.com) and DFree (\$500; dfreeus.biz) are two examples. Another is the ClipDifferent Pro, a mechanized fingernail clipper designed for people with motor impairments, including those with MS. A tabletop device that's outfitted with a stainless-steel blade and a safety plate that keeps skin out of harm's way, it automatically trims one's fingernails when they're inserted into the designated slot.

“MS can be a cruel disease because it can slowly take away your independence,” says Rick Ebner, a ClipDifferent user who now works for the company as one of its salespeople. “I've been dealing with MS for 35 years now, and it affects the left side of my body. My left hand curls almost into a ball at times, which means the only way I could cut my nails was to go get a manicure and have someone else do it. With the ClipDifferent Pro (\$149; clipdifferent.com),

I can cut my own nails at my leisure; I don't need help. Regaining just a little bit of my independence feels really good."

The price of progress

New technology has a major downside, according to Clayback: its high cost. "Insurance coverage for new technology continues to be subject to downward pressure," he says. "Insurance companies in some cases are covering fewer items, and in some cases are paying less for the items they do cover. The result is a dynamic where there's a lot of good new technology out there, but there often isn't the funding to support it."

Initiatives like the Mobility Unlimited Challenge can help. "Challenges like this create an opportunity for smaller players to enter the market and bring their ideas to life," says Julie Ann Burandt, manager of global strategy and communications for the Toyota Mobility Foundation, which has awarded five finalists \$500,000 each to develop their concepts and will award an additional \$1 million to one winner in 2020.

Still, insurers—the Centers for Medicare & Medicaid Services (CMS), in particular—remain key players whose support, or lack thereof, can make or break new technologies.

"Most insurance plans will pay only for equipment that's 'medically necessary,'" explains Clayback, who says emerging technology often struggles to prove that it's needed, not just wanted.

Johnson says her private insurance plan didn't cover Bumblebee. Instead, she paid for it using money from a flexible spending account. Hague says private insurance sometimes will pay for the Zinger Chair, but CMS will not. In most cases, Lemay says neither private nor public insurers will pay for the TerrainHopper, although there are rare exceptions. The story is similar for ReWalk's exoskeletons. Hile's orthotist, Ara Mirzaian of California's Hanger Clinic, says AFOs generally are covered and FES devices generally aren't.

"I've seen some crazy advancements in technology," Mirzaian says. "But for now you have to be realistic about what insurance will and will not pay for."

Still, people like Crawford insist that independence is priceless. "A \$30,000 wheelchair sounds like a lot of money until you consider that disease-modifying drugs range from \$60,000 to \$80,000 a year and may or may not slow the progression of the disease," he says. "Suddenly, the wheelchair sounds like a bargain."

Smart shopping

Because people with MS often must pay for new technology out of pocket, it's important to know exactly what you're buying. To ensure you get the best product for the best price, consider these tips:

- **Get a prescription:** If you're interested in a new device, get your healthcare professionals on board, advises Clayback, who says physical and occupational

therapists can help vet new equipment to determine if it's effective and safe. Doctors can help with insurance. "Some insurance plans will cover anything that's been prescribed by a doctor as medically necessary, so check your coverage," Clayback says. "And if you submit for something that's denied, don't stop there. If your healthcare provider says it's medically necessary and you appeal, you might have a pathway to coverage."

- **Buy through local dealers:** Instead of buying direct, consider purchasing through a local medical supply company. "They have highly trained and credentialed staff who have expertise not only in equipment, but also in how to get it paid for," explains Clayback.
- **Ask about alternative funding:** If insurance won't cover a coveted device, ask its manufacturer about alternative funding. Both ClipDifferent and TerrainHopper, for instance, have philanthropic partners that purchase devices for select individuals. The latter also offers financing. You also can contact a National Multiple Sclerosis Society MS Navigator to make sure you're exploring all potential community financial resources for the item. Call 1-800-344-4867, email ContactUsNMSS@nmss.org, or online at nationalMSSociety.org/navigator.
- **Try before you buy:** Consider renting equipment or borrowing it before you purchase it. "Equipment rentals are one way to know if the device is a good fit for you, if it meets your needs and whether it has any flaws you did not foresee," Crawford says.
- **Spread the word:** If you can't get the devices you need, tell your elected officials. "It's important to let your state legislatures and members of Congress know that new technology should be covered," Clayback says.

The next generation of assistive devices is chock-full of cool capabilities. To ensure that new technology is as accessible as it is awesome, however, consumers, manufacturers and insurers must focus less on features and more on benefits.

Concludes Burandt, "It's not just cool technology for technology's sake. It's technology for a real person who is going to use it to live the life they want to live."

Soup to nuts: the prices of devices

The latest technology can be cost-prohibitive for many people with disabilities. The following information can help you set a realistic budget and obtain financial assistance if the device is beyond your means.

What traditional devices cost

Before you evaluate the cost of new devices, it's a good idea to set a benchmark based on traditional ones:

- **Manual wheelchairs:** A standard manual wheelchair costs an average of \$500, according to CostHelper, a website that specializes in consumer-goods research. A chair

designed for everyday use costs between \$1,000 and \$2,000, depending on what features it has. The American Elder Care Research Organization says manual wheelchairs range from \$100 to \$750.

- **Power wheelchairs:** Because of the variety of features, the cost for power wheelchairs varies dramatically, according to CostHelper, ranging from \$1,200 to \$30,000. The average cost, according to one study of 15 different models, is \$7,132. The American Elder Care Research Organization says prices typically range from \$1,000 to \$3,500.
- **Scooters:** An analysis by AARP found that new scooters cost between \$1,800 and \$5,000, but can cost as much as \$15,000 to \$25,000 for custom models. The American Elder Care Research Organization says scooters typically range from \$600 to \$2,000.

What new devices cost

New devices can vary in cost just as much as traditional ones do. The mobility products that Momentum researched for this article, for instance, ranged from \$2,295 for a folding electric scooter to \$30,000 for an all-terrain power wheelchair that can climb stairs and stand on two wheels. Another cutting-edge product, exoskeletons, can cost as much as \$77,000.

For the best pricing information, contact manufacturers directly or look for a local equipment provider, suggests Don Clayback, executive director of the National Coalition for Assistive & Rehab Technology. “The best recommendation is to shop within your community like you would for any product and look for a qualified and reputable provider.”

Matt Alderton is a Chicago-based writer and editor.

To learn more about assistive devices, visit [Staying Mobile](#).