The Washington Post

An 'Out of Wheelchair Experience'
May 2, 2000

By Carolyn Cosmos
Special to *The Washington Post*

Adam Toobin sits at his computer playing baseball. As each pitch comes flying toward him on the screen, he uses specially designed controls to swing his virtual bat.

A 17-year-old who wants a career in sports broadcasting, Toobin's already good at announcing basketball games. What he's not good at is eating. Due to cerebral palsy, the spastic muscles in his arms are too tight to let him raise his hands carefully. When he attempts to eat, he sometimes sends a fist shooting beyond his head.

To help children with such handicaps, several local researchers are creating medical devices disguised as toys. In Toobin's case, they hope, the better a batter he becomes, the easier it will be for him to feed himself.

"The goal is to create a cool toy with therapeutic value," says Corinna Lathan, 32, a leader in these efforts to improve rehabilitation through remote-controlled devices.

Washington is an emerging center of innovation in "teleplay," an offshoot of "telemedicine." While the latter uses advanced communications and sensory devices to link physicians to patients who are far away, the former uses similar technology to connect disabled people to ordinary objects — such as baseball bats-- that are otherwise out of their reach.

Teleplay is "going to revolutionize the way rehabilitation is delivered," says Tim Bowman, director of a rehabilitation research program at the Sister Kenny Institute in Minneapolis, which is collaborating on some of the Washington-based projects. Says Kathie Cummins, Toobin's therapist, "As physical therapy, this is brand new. This is big news [because] motivation is everything."

"Kids develop through exploration," explains Lathan, a professor of biomedical engineering at the Catholic University of America (CUA). The question behind her research is, "Can they develop through virtual exploration?"

So this afternoon Adam Toobin is working hard at playing, with a black "tilt sensor" strapped to his arm. The size of a matchbox, the device sends signals that swing the bat when he moves his arm. When he swings properly he's

rewarded with a hit on his computer screen and a "vibrotactile feedback device" sends a buzz to his batting arm, telling his muscles they've made the correct motion.

While Toobin may never be an athlete, relentless practice of this swing could be vital to his long-term independence. Not only do people with cerebral palsy need to strengthen and stretch their muscles, they need to develop new neural connections between brain and muscle to compensate for those damaged early in life. Building these connections demands thousands of repetitive motions.

Another rehab device in development at CUA is a toy car controlled by human muscle voltage.

To demonstrate this robot, Gonzalo Mendoza, 26, a graduate student from Bolivia, places electrodes on the forearm of a visitor to his engineering lab. When the visitor makes a fist, signals pass through a computer and send the car careening across the lab. The car came from Radio Shack and the remote control device cost less than $60.

Such inexpensive robots can give a child a priceless "out-of-wheelchair experience," says another CUA graduate student, Adrian Blanarovich, who has developed a similar toy with a video camera attached. Through electrodes attached to neck or cheek, a child who is almost totally paralyzed can control the car and watch where it goes on a video screen.

The researchers at CUA are also trying out wireless gloves, a pressure-sensitive foot pad and virtual reality goggles. The goal in each case is to use high-tech devices to liberate the child from his or her handicap. "We use whatever it takes to capture the child's ability," Lathan explains.

Teleplay prototypes are also taking shape at the National Rehabilitation Hospital (NRH) and the University of Maryland Some of this work is funded by a $4.5 million grant from the U.S. Department of Education and includes experiments to help children with autism and other developmental disorders.

Michael Rosen, the director of rehabilitation engineering services at NRH, is working on "Boing!," a device that looks like a swing set fitted with a bungee cord. By bouncing in the "exercise arcade" or pulling on the cord, a preschool child with physical handicaps can activate cartoons or customized video games that appear on an attached screen. More bouncing produces more playful images, motivating the child to exercise.

While a delight to any techie, the devices raise a basic question: Do they work?

"Telerehabilitation efficacy is yet to be proven," says Grigore Burdea, a virtual reality expert and professor at Rutgers University in New Jersey. "We can show

that the individual patient does get better. It's an important first step. But we need to take the second step: Show that it's better than classic rehabilitation" and that it's cost-effective.

Similarly, Jack Winters, a bioengineer formerly at CUA and now at Marquette University in Milwaukee, asks of teleplay, "The kids have fun, but what is their health status? Have they improved or not?"

Researchers such as Lathan are working on answers. In preparation for a larger study, she and Katherine Alter, medical director of rehabilitation programs at Washington's Hospital for Sick Children and Baltimore's Mt. Washington Pediatric Hospital, gave teleplay versions of Nintendo games to four children with cerebral palsy in December, sent the kids home and collected final measurements in March.

"Every child showed some improvement on some or all measures," such as range of motion or degree of spasticity, Lathan says.

Children, parents and therapists who have tried teleplay agree the devices are fun and they motivate kids. Toobin, for example, says of his baseball game, "I enjoy it a lot and it helps me bring my arm up to my mouth."

However, one of the Nintendo parents, Dwight Yen, says, "While the tech is interesting, it's still very much in its infancy and limited in what it can do. It has potential, but studies need to control for variables such as other therapies the children might be taking at the same time." Yen, 47, of Rockville, works for the Food and Drug Administration evaluating medical devices.

John Haines, 44, of Reston, says the game was somewhat helpful for his daughter Abby, 5, who has weak muscles and used a pressure sensor on one heel and tilt sensors on both legs to activate the Nintendo controls. "She liked playing," Haines says. "I believe this technology will unlock a lot of doors."

Graduate student Blanarovich hopes Haines is right. "Some people dream of changing the world and making it a better place. Well, I decided to go ahead and do it," he says. "I feel the potential of merging medicine and technology is untapped. . . . It is an absolute rush to work on the edge of two volatile fronts, helping people, especially children, in ways they never dreamed of."