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How a third-year project shaped
careers and changed lives

Randy Marsden
(Electrical '89)



How a third-year
project shaped careers
and changed lives

by Mike Sadava

the never-ending student project

Abused boom box—part of a third-year electrical engineering project aimed at helping a quadriplegic friend communicate—inadvertently launched two careers and a very successful business, and ended up playing an important role in advancing technology that has unlocked doors for disabled people around the world.

Randy Marsden (Electrical '89) is president and CEO of Madentec, a company that specializes in assistive technology to help disabled people communicate using adapted computers.

While the company is located in humble digs in a nondescript industrial strip mall on the south side of Edmonton, its products

are used around the world. One of Madentec's innovations, an on-screen keyboard, is included in every PC running Microsoft Windows. Madentec's technology has been used by celebrities such as Christopher Reeve and Muhammad Ali, and by thousands of disabled people worldwide. The company's spinoffs are also developing widespread applications for cellphones and computers.

It all started with a student project in 1987. This was the Jurassic period for personal computing. Macs were new, Windows had just been invented, and the Internet was still limited to a small circle of academics and military people.

Marsden and his lab partner, Michael Tanne (Electrical '88), faced two choices for

their third-year project: to design a system to push a button and generate a random number or to spin a wheel and count the number of times it goes around. Fortunately they were also given a third option of designing something that was their own idea.

Marsden had a friend, Si Peterson, who had been a quadriplegic since a gymnastics accident in junior high. Si couldn't move his head or hands, and he couldn't speak because he was ventilated. He could communicate only by mouthing words and gesturing with his eyebrows.

Peterson's parents asked if the electrical engineering students could design a power wheelchair for the young man. Marsden and Tanne suggested approaching mechanical

engineers for that task, but offered instead to create a speech synthesizer.

The challenge was to build a small computer that would enable their friend to at least communicate basic needs such as hunger and thirst.

It took much more time than the average class project, but Marsden and Tanne came up with a gizmo, mounted on a microphone stand, that enabled Peterson to communicate 25 different commands by touching switches with his lips. The pre-recorded digital sound, a new technology at the time, was played through a boom box.

"It was pretty rudimentary, but we basically built a laptop computer before they existed," says Marsden. Their supervisor, Professor Nelson Durdle, could see his students were on the cusp of some serious innovation, and he even wrangled them some space in a graduate lab—a rare privilege for undergrads.



Photos courtesy Randy Marsden

Si Peterson (top) benefitted enormously from technology developed by Michael Tanne and Randy Marsden. Peterson wrote an autobiography, gave public speeches, and gained enough independence to move back home for the last three years of his life after years in a nursing home.

"It was pretty rudimentary, but we basically built a laptop computer before they existed."

— Randy Marsden

With the bugs worked out of their project, Marsden and Tanne entered the Canadian Engineering Competition, the first of several competitions they would go on to win. When they arrived in Vancouver, the two suffered the fateful mishap that would reshape their destinies. On a sidewalk ramp outside the Vancouver International Airport, the two young engineering students were behaving like, well, like young engineering students.

"I rode the luggage rack down the ramp, and of course it crashed," says Marsden. When the boys surveyed the damage, they were horrified to discover that the boom box, a vital component in their presentation, was broken. They got to a UBC engineering lab for a quick repair. Then, as they walked through a dim corridor in the engineering building, they glimpsed a poster inviting student presenters to apply for a conference of the Rehabilitative Engineering Society of North America. They jotted down the contact information.

To make a long story short, they applied, were accepted, and ended up showing off the fruits of their labour in Montreal, in front of many of the major players in assistive technology. Before attending that conference, neither Marsden nor Tanne had known that they had been dabbling in an emerging field of engineering, and that they could make a career in assistive technology. After their presentation, the job offers began pouring in, even though the pair still had a year to go before receiving their degrees. The flood of interest sparked a new notion in them. "I thought that, if what we'd done was so great that people wanted to hire us, maybe we should just do it ourselves," recalls Marsden.

Tanne remembers the day he fully committed himself to the project. "We both had job offers through the engineering recruitment office—I had one from IBM and Randy had an offer from NovaTel," he says. "I was in the IBM lobby in North York where I was given the job offer, and they were giving me a

tour of the place, and I got on the phone with Randy to say, 'Are we really going to do this thing? Because if we are, I'm going to tell IBM to forget it.'

"It kind of dominoed and created my whole career, really."

Tanne politely turned down the IBM job and flew home. Madentec soon started to take off. The company received grants from the Alberta Heritage Foundation for Medical Research and the Alberta Opportunity Company and started partnering with Sym Systems in San Jose, California, developing voice synthesis software. While Marsden completed his degree, Tanne packed up and moved south, and continued working with Madentec. A year later, however, he amicably parted ways with Marsden to work for Sym full-time.

Tanne, who now lives near Palo Alto, California, is still amazed at what he and Marsden did with a third-year project, and at the impact it had. "It's a lesson in life—you walk a journey and you never know where it will lead," he says. Much groundbreaking innovation has started from university projects, Tanne says, pointing out that Google was originally a campus project at Stanford University. An assignment like his 1987 student project "gives engineers a chance to solve a real-world problem—to solve something that a business person would. It forces you to look at it not just in an academic way or an engineering way, but what problems does it solve and what are the constraints?"

Like Marsden, Tanne had a knack for business. He temporarily left the high-tech industry to earn an MBA at Stanford. Next, he joined the Enterprise Corps, a business version of the Peace Corps, to help former communist countries develop a business framework. Tanne has since built a thriving career in the dot-com world, starting, developing and then selling companies. In 1996 he started Ad Force, the first Internet advertising company, which he later sold to CMGI. Then it was XDegrees, a data storage company, which he eventually sold to Microsoft. More recently he started wink.com, the world's biggest Internet people finder and one of the top 100 visited sites on the Internet. Wink was recently merged with Reunion.com.

Meanwhile, Marsden and Madentec made their own mark. As personal computers became more sophisticated, so did the compa-

Edmonton artist Bill Miller, stricken with multiple sclerosis, used GPS and video game technology to participate in a golf competition staged by Marsden's company, Madentec.

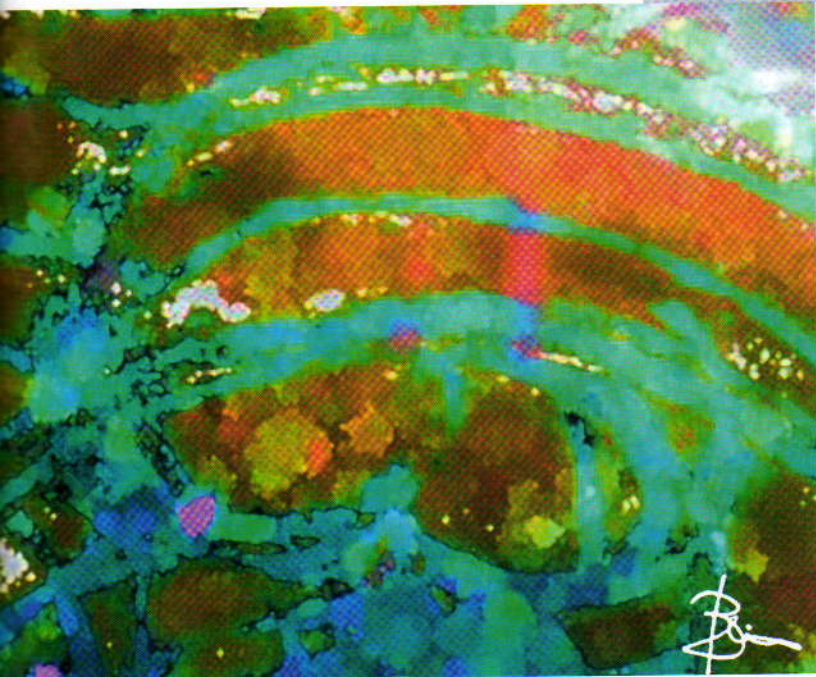


Artist Bill Miller longed to use his power wheelchair as a paint brush. One morning as he and his wife Evelyn were leaving the house, Miller looked at his driveway, covered in snow. "What I saw before me was a 15 x 80-foot unbelievably white, virgin canvas," he says. "My wheelchair was a new mid-wheel drive Quickie 424 that allowed me to turn a complete circle like I was on a turntable. Therefore I was able to turn complete circles without going over my tracks. As a result I ended up with a series of connecting circular patterns that were impossible for me to create any other way."

That morning's work was the inspiration for *The Chairbrush Project I* and *The Chairbrush Project II*, a series of works based on images Miller created by wheeling through snow, and documented in photos taken by Evelyn. Miller uses computers to artistically build on the images.

Miller has lost the use of his hands and without technology provided by Madentec, the artist's creative voice would be silenced.

At left: *In the Eye of the Dragon*, by Bill Miller.



Bill Miller

ny's innovations. By 1991 Madentec had developed the on-screen keyboard, which was licensed by Microsoft. The life of Marsden's friend Si, the impetus and first benefactor of his ideas, became more complete and productive. With the help of the technology, Si wrote a book about his life and gave public speeches. He was also able to move back home for the last three years of his life after years in a nursing home. Unfortunately, Si died of pneumonia in the mid-1990s.

Currently, Madentec's technology is used by about 20,000 individuals—including Seattle-based Steve Harper, a man with cerebral palsy who maintains Madentec's company website. When he was 11, Harper learned Morse code. He used it to communicate by banging head switches, and was fortunate to have been given a Morse code communicator. In the '90s, a company in the United States developed software called Ke:nx that allowed users of Morse code to operate a computer. Ke:nx changed Harper's life, but when the new generation of Macs—running OS X—came out, the software was no longer compatible.

"So I found out that Madentec bought the old Ke:nx technology," Harper says by e-mail. "I e-mailed Randy in 2004 and told him all about myself and I told him that I needed an updated Morse code system that would work on the Mac OS X. Quickly Randy and his brother found out how persistent I am. I wasn't rude but I kept on e-mailing and e-mailing them."

A mutual friend ("with Randy's blessing") made a Morse code system for the Mac OS X. This year, Madentec is coming out with a commercial version of the Morse code for the Mac OS X, with more features. Harper finally met Marsden face-to-face in April 2007, when "really right out of the blue," Marsden invited him to go on a cruise to Mexico with Madentec. During the cruise, Harper made a presentation on the great potential Morse code has for Madentec. A couple of months later, Harper e-mailed Marsden, asking him if he wanted help on the company website. He landed a job as Madentec's webmaster.

"I love the job," Harper says. "With America's economy basically down the toilet,

a lot of 'able-bodied' people are unfortunately unemployed. However, I'm employed. When I think about that, I just laugh in amazement."

Marsden talks a lot about how Madentec's technology "just gives people their lives back." Bill Miller is another example. Miller, an Edmonton visual artist and former industrial arts teacher, suffers from multiple sclerosis. As the disease progressed he lost use of his right hand, then his left. "When I met Randy in 1995, I was at a point in my life where as an artist I was left expressionless because at the time I had lost the use of both hands," he says. Within a week of being outfitted with equipment that allows him to manipulate a cursor through head movements, Miller was back creating art on the computer. He now does it four or five hours per day. He has become part of an on-line network of like-minded colleagues and has delivered PowerPoint presentations at conferences.

In 2000, Marsden thrilled Miller by inviting him to play in a special golf tournament at the famed Pelican Hill golf course in



Marsden with boxing great Muhammad Ali, whose ability to communicate is seriously compromised due to Parkinson's disease. New technology, Marsden says, allows "extraordinary people to do ordinary things."

"I get upset when people say we've given them a gift. We say we enable extraordinary people to do ordinary things."
— Randy Marsden

Newport Beach, California. Each foursome had one quadriplegic golfer who used a computer simulation and assistive technology to make shots, and the best shot of each foursome of every hole was counted. Miller, an avid golfer before MS set in, made the best drives of his group. Golf carts were equipped with a GPS, and the ball would be placed where he "drove" it on the computer. The event received coverage from all the major American television networks.

Much of Madentec's activity is built around its TrackerPro technology. A camera mounted on a computer tracks the movement of a small dot of reflective tape worn on the user's forehead, glasses, or hat brim. The user can then use head motions to do anything a computer mouse can do, or to perform word processing with the help of an on-screen keyboard. Other Madentec options allow users to operate computers with blinks, tooth clicks, puffs, or touching with lips. It may seem like a laborious process, but with practice people become adept at using these technologies, says Marsden. "It's slower than when you or I use a mouse, but they get surprisingly fast. If you were like my friend Si, you've got the time.

"I get upset when people say we've given them a gift. We say we enable extraordinary people to do ordinary things. Just about in any case, anything made for people with disabilities ends up helping everybody." Marsden cites the example of on-screen keyboarding, which has become a feature of devices such as iPhones.

Madentec's achievements have made Marsden a key figure in the field of assistive technology. Kelly Fonner, a special education teacher who trains teachers and therapists throughout the U.S. in the use of assistive technology, has known Marsden and the products of Madentec since the early '90s. She says he is a leader in the trade association to which dozens of companies belong. Fonner says that many assistive technology companies, like Madentec, got started because someone knew a disabled person who needed help. The innovations created by these companies have not only changed lives; they have changed society as a whole. By expanding the ability of disabled people to communicate, they have shattered the misconception that people who cannot speak have nothing useful to say. This in turn has allowed more people to enter the labour force and become more productive citizens.

In her days as an educator, Fonner saw this happen to her own students. "It is through this technology they can be independent, have employment, lives and families," she says. The technology allowed Fonner to "know what these students know." It also allowed her students to participate more actively in the classroom.

Marsden is often amazed by the path his career has taken. He grew up in the small town of Magrath in southern Alberta, where his father was a TV repairman and telephone lineman. He received a circuit kit for Christmas when he was 10, and spent the next year immersed in his present. He didn't settle on his chosen career until he was almost finished high school, when an aptitude test showed that he had the most potential in engineering. As a kid, he had thought engineers were the people who drive trains.

Professor Durdle, who has taught in the Faculty since 1982, remembers Marsden and Tanne being very energetic and motivated by the needs of their disabled friend. Other students have gone on to form companies based

on work they started during their projects, Durdle says, but he doesn't know of another that has had the success and impact of Madentec. It is generally difficult for companies to survive in rehab areas, a fact Durdle knows from experience—he had his own company that he had to wind down for economic reasons.

"There is a big need in our society for companies to take on these things," says Durdle. "The rewards are not that big—you don't have the world-wide market." But as he points out, many computer innovations in the mass market, including voice recognition, pop-up toolbars and speech synthesis, all had their origins in assistive technology.

Today, Madentec is branching out to new areas, some of which could eventually prove quite lucrative. One spinoff is called cleankeys, a touch-sensitive glass keyboard, similar to a microwave oven keypad. Studies have shown that more bacteria lurk between the keys of regular keyboards than on toilet seats. The cleankeys keyboard, which can easily be wiped off with disinfectant after use, is proving popular with doctors and dentists who would otherwise need to change gloves every time they tapped a keyboard. Marsden is also a co-developer of Swype, a new system that speeds up on-screen text-messaging using a pointer, and he is in discussions with cellphone companies about licensing the technology.

These new advances will likely have a positive impact on Madentec's revenue, which in turn will allow the company to devote more resources for serving people with disabilities. Assistive technology will always remain the core of Madentec, which won a prestigious ASTech Societal Impact Award from the Alberta Science and Technology Leadership Foundation in 2008.

"It's easy to get up in the morning when this is your job," says Marsden. "You have a lot of rewards but it's not like it's a mass market and you'll take off and make millions. It's enough to have a viable business and help a lot of people."

It has been an amazing journey, launched by a student's joyride down a sidewalk ramp.



After 28 years covering everything from crime to politics with the Edmonton Journal, Mike Sadava has embarked on a freelance career.