

Helping the Voiceless to Speak

Cosmologist Stephen Hawking, widely considered to be the most brilliant theoretical physicist since Einstein, seeks answers to the origins of the universe. A Newsweek cover story earlier this year hailed him as "Master of the Universe." Hawking's recent book, "A Brief History of Time," explains the Big Bang theory in simple, elegant language that even a non-technically trained reader can understand.

Hawking, 46, suffers from amyotrophic lateral sclerosis, a progressive neurological disorder more commonly known as Lou Gehrig's disease, which afflicts an estimated 20,000-30,000 people in the United States. Hawking is unable to walk, write or speak. But thanks to sophisticated electronic communication equipment, he can continue his race against time and disease in his quest for the so-called grand unification theory that may reconcile the theory of relativity and quantum mechanics. In his motorized wheelchair, he travels the world, lecturing with the aid of electronic devices that allow him to select words from a pre-programmed vocabulary, type them on a screen and transform his thoughts into digitized speech.

Twenty-two-year-old Christopher Nolan's autobiography, "Under the Eye of the Clock," has been acclaimed as a masterpiece. It won a major literary award in England and quickly became a best-seller in the United States.

Nolan is mute, spastic and brain-damaged. He pursues his craft with the aid of what he calls his "unicorn horn"—strapped to his forehead is a light beam that activates an electronic typewriter.

A generation ago, the brilliant calculations of Hawking and the poetic creations of Nolan would have been lost to humanity forever. Because of their handicaps, they would have been stigmatized as "dumb"—a word that means both "unable to speak" and "stupid, dull-witted." But now, thanks to the magic of electronic technology, these creative geniuses and many others have found their voices.

In the forefront of today's revolution in communications technology for the handicapped is the Prentke Romich Company, founded more than 20 years ago by two Case graduates, Ed Prentke '26 and Barry Romich '67, to help unlock the thoughts and feelings of hundreds of disabled men and women.

From its modest beginnings in a student laboratory at Case Institute of Technology, the Wooster, Ohio-based Prentke Romich Company is now recognized as an international leader in the field of electronic communication aids, serving half of the world's market and racking up annual sales of more than \$5 million, with orders this year up by 35 percent.

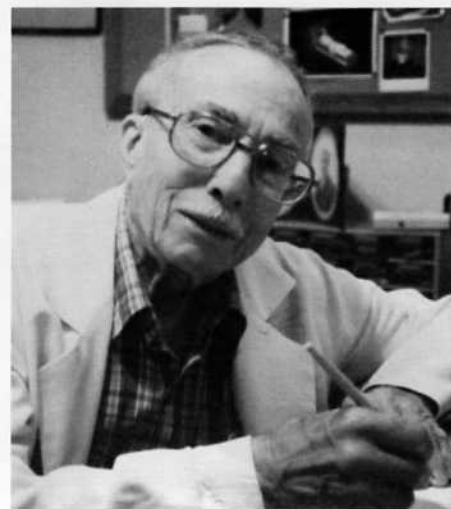
While the company's products are dominant in the English-speaking world, it looks forward to a worldwide market. Already it is licensing a Swedish synthetic speech technology which speaks eight European languages and will allow Prentke Romich to go onto the continent and handle the communication needs of much of the free world. Though no one has yet come up with a computer that speaks Chinese or Japanese, don't be surprised if one is born soon in Wooster, Ohio. Prentke Romich has hired a young Ph.D. from the University of Tokyo and expects to be developing its own Oriental synthetic speech technology in the near future.

In 1986, the firm's president, Barry Romich '67, received the Isabelle and Leonard H. Goldenson Award for outstanding research in technology for cerebral palsy and the developmentally delayed. The national award is presented annually to recognize distinguished contributions in the application of bioengineering sciences to improving the life styles of disabled individuals.

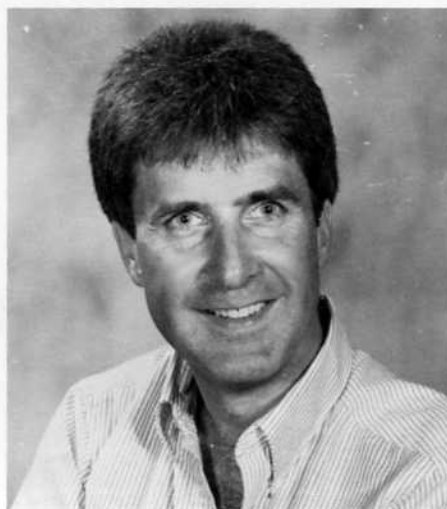
"A mind is a terrible thing to waste," says Romich, quoting the famous United Negro College Fund slogan. "Communication is the essence of human existence. Without it, we are little different from animals."

He is president of the firm which he and Ed Prentke '26 founded shortly before Romich's graduation from Case in 1967. Prentke is now retired from the company but still serves as a very active consultant. (See related story, pp. 10-11).

Barry Romich's commitment to enhancing the achievements of the handicapped goes back to his undergraduate days as an electrical engineer-



Ed Prentke '26



Barry Romich '67

The Touch Talker with Minspeak can be activated by a fingertip, mouthstick or head-pointer.



ing major at Case Institute of Technology. His father, an Ohio farmer, and his mother, a schoolteacher, supported his decision to attend Case, though it was, even in those days, an expensive school, Romich recalled.

"I knew I had to get a job to help pay the tuition. Luckily, there was so much research activity going on at Case that I was able to sample a lot of different areas."

In his sophomore year, 1964-65, he found himself captivated by work under way in the medical engineering research program located in the Bingham Engineering Building.

"I was always attracted to the practical side of engineering and I was lucky to be in the right place at the right time," he said. "This was state-of-the-art research we were doing at Case. People came from all over the world to see what was going on in that program."

Romich began putting his engineering skills to work with Prentke on a power-assisted device to help people who were paralyzed from the neck down.

"The problem was to design an upper extremity orthotic device to allow a person to have some control over arm movements," he said. Clinical evaluation was done at Highland View Hospital where Prentke was the hospital's staff electronics engineer.

The research was not really geared toward manufacturing equipment, but as Romich and Prentke worked together, it became evident that a crying need existed for a variety of custom-designed devices to help the hospital's disabled patients and others similarly handicapped.

"The technology was there but no one was addressing the needs of these people," Romich said. "We saw a need for devices that would allow someone to operate electronic controls that could do something as simple as calling a nurse or turning on a lamp or a TV."

Other devices they put together allowed disabled patients to use a dial telephone—push-button phones were still in the future in the '60s—and another that smoothed out the jerkiness of early-model motorized wheelchairs.

After graduation Romich signed on as staff engineer for the medical engi-

neering research lab while he and Prentke continued tinkering with inventions in their spare time. In 1969, they developed a touch panel that utilized myoelectricity—the minute electrical current generated when a muscle contracts—to allow quadriplegics to operate wheelchairs and other electrical appliances. A splint was fitted to the paralyzed arm; the merest twitch of a muscle activated a myoelectric control and relay switches and the wheelchair was off and rolling.

By 1970, however, Romich's urban life style was taking its toll. Having grown up on a farm in Creston, Ohio, he yearned to return to a more rural environment. Heading south to his roots, he found an ideal job working four days a week as a plant engineer for Rubbermaid in Wooster; the remaining three days were devoted to his basement workshop—"technical headquarters" for the newly formed Prentke Romich company.



The keyboard can be activated by a light sensor

As time went by, Romich found he was doing a great deal of consulting work—for a Philadelphia pharmaceutical company that wanted him to design a physiological testing system for a new drug; for a Los Angeles company that needed electronic controls for its steel stamping mills. With two former Case students, Richard Beery and David Bayer '73, he set up an industrial consulting company whose success allowed him to spend more time in his basement laboratory. Prentke meanwhile was working five days a week at the hospital and commuting to Wooster on Saturdays.

The breakthrough came in 1975, when Prentke Romich received an order for 200 automatic telephone dialing devices from the Veterans Administration Prosthetics Center in New York City.

"Several years earlier, Ed and I had developed a device that allowed severely handicapped people to dial a telephone by blowing or sucking on a tube," Romich said. "The control was very simple and it is now completely obsolete. But it was a real breakthrough at the time."

It was also a breakthrough for the fledgling firm. The financial security guaranteed by the order allowed Romich to devote himself full time to "what I really wanted to do."

"We had built fewer than 40 telephone dialers over the years; now we had to switch into high gear and make 200.

"For the first time ever we had money rolling in for work we had already completed. We took some of that money to put into the development of other products," he said.

Their timing couldn't have been better. In 1973 Congress had established the Rehabilitation Services Administration to provide federal money for handicapped services. According to Deborah Asbrand, writing in *Electronic Design News* for March 3, 1988, disability activists credit the 1973 act with restoring civil rights to the handicapped—who number an estimated 35 million Americans.

"Equally important," Asbrand wrote, "the legislation forced rehabilitation technology out of the research and development laboratories and into clinical settings where it could be applied."

Romich and Prentke were perfectly positioned to take advantage of the new interest in rehabilitation engineering. Romich enjoyed conquering the

technological challenges while Prentke determined needs and tested the devices' practical applications at the hospital.

From 1975 on, the firm's products grew in many areas but the most significant development was in the field now known as augmentative communication—electronically assisted devices to help the voiceless speak. As early as 1969 the two had done some pioneering work in the field when they put together a writing system for a man who'd suffered a stroke. It utilized a used teletype machine.

"It was crude linguistically and it was crude technically as well, but it was a start," Romich said.

By now, that humble invention has evolved into what the company says are the most advanced communication aids for non-speaking people on the market today—Touch Talker and Light Talker with Minspeak and Express software. These sophisticated computerized aids make it possible for anyone who wants to communicate to do so.

Touch Talker is appropriate for persons who can use a keyboard with their fingers, a mouthstick, or a headpointer. Light Talker uses a light sensor to activate the keyboard via the slightest motion of the head, finger or knee, by the flick of an eyebrow or by puffing or sipping.

The heart of the Prentke Romich system—"and the secret of our suc-

cess"—is "Minspeak," a software program developed and patented by Bruce Baker, a linguist from Pittsburgh. Prentke Romich leases the exclusive rights to Minspeak.

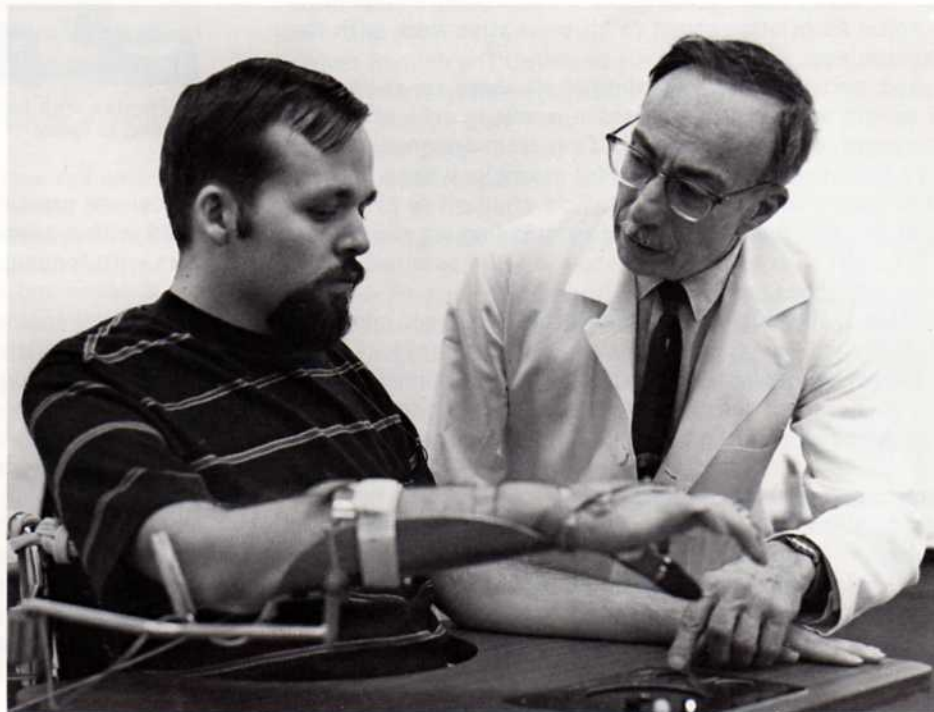
The system is so simple to use it can be taught in a matter of minutes to anyone—a mentally retarded person or a preschool child who does not read. Even the famous "talking chimpanzees," Washoe and her offspring at the Yerkes Primate Research Center in Atlanta, have been taught to use Minspeak.

At the same time, the software is so sophisticated it has a maximum vocabulary of 30,000 characters and can be utilized by college professors and other highly intelligent professionals.

The keyboard consists of a variety of "icons"—pictures that stand for words or concepts. Keyboard overlays range from eight to 128 squares, depending on whether the user is a young child or an adult with a large vocabulary. Messages are stored by means of the pictures and recalled by a touch, a light sensor or a control switch. They are simultaneously typed out on a screen and translated into synthesized speech. The number of pictures in the message and its complexity vary according to the needs of the user.

Though Minspeak is patented, Prentke Romich's own inventions and devices are not.

"We have not felt it is in the best interests of our clients to patent any-



A 1969 Prentke Romich device helped Thomas Ward operate his wheelchair via an arm splint and the myoelectricity generated by minute muscle contractions.

thing," Romich said. "Besides, when the business was small, we were often the only maker of the device." The company does use other people's patented technology, however, paying them royalties and using their material, often on an exclusive basis.

In 1985, the burgeoning company moved into its present headquarters, a rambling remodeled warehouse nestled on a hill amid tall pines and flowering shrubs just outside the city of Wooster. It currently employs around 75 people—some 55 in the plant itself and another 20 in the field. There are no time clocks to punch—in fact, working

hours are so flexible that one employee, a farmer, takes off whenever he needs to plant or harvest his crops.

Not surprisingly, turnover is low at Prentke Romich. "When people feel good about what they are doing and realize how their contribution is helping others, they feel good about themselves and that helps them to do a better job," Romich said.

Doing a better job" is what Prentke Romich is all about.

"Our technology expertise is significant but it is not unique," Romich said. "What sets us apart today, why we are

dominant in our field, is that we support our products with a high level of service."

That includes everything from a network of trained speech pathology consultants throughout North America, England and Australia to an 800 phone number that lets anyone experiencing difficulty with a Prentke Romich product call the company at any time for free advice. Since so much of his firm's business is in the field, Romich pilots his own company plane—a light twin-engine Piper Seneca III six-seater—which is parked at the Wayne County Airport. That way, he can reach his

"T.G.I.M.," Says Energetic Octogenarian

The sign on Ed Prentke's door reads "T.G.I.M."—"Thank God It's Monday!" At 84, Prentke has no thought of retiring—in fact, he loves his work so much he gets to his office-cum-laboratory at 6:30 a.m. every morning.

Honored by Brandeis University in 1982 as a "Renaissance tinkerer" and a "technological wizard," Prentke has created hundreds of devices that help to make life a little easier for the handicapped.

The Brandeis Distinguished Service Award, a national honor that recognizes exceptional achievement in the field of medical technology, is only one of many Prentke has collected in his retirement career as a clinical engineer and resident inventor at Cleveland's Metropolitan General Hospital. At least a dozen plaques from the Greater Cleveland Hospital Association attest to his innovative work with the handicapped.

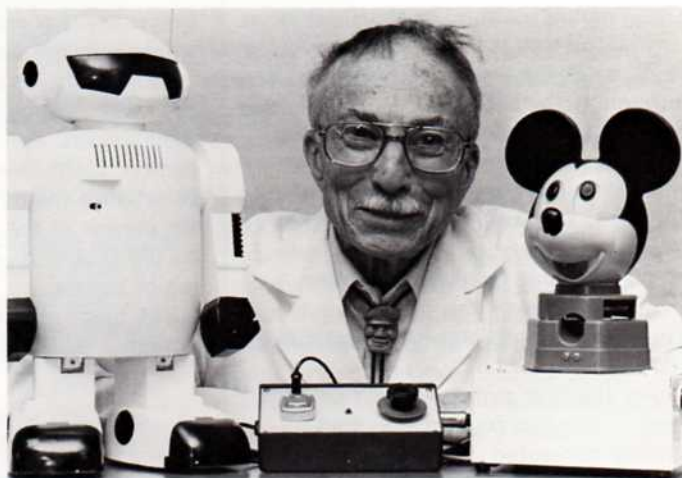
And, perhaps most rewarding of all, there are the smiles of delight when a disabled person is able to achieve a little more with the help of one of Ed's custom-designed gadgets. On a recent summer morning, for example, when a reporter came to call on him in his cubbyhole of an office at the hospital, Prentke had just finished lengthening leg supports for a little girl with cerebral palsy so she could continue to ride with her father on his bicycle.

"That's why this job is so much fun. You never know what each day will bring," he said with an impish smile.

His devices range from the simple to the sophisticated. Two recent inventions encourage children with communication disorders to learn to speak. One, a grinning Mickey Mouse, dispenses gumballs whenever a child makes a noise; a microphone hidden in Mickey's interior picks up the sound and an electric circuit spews forth the candy when it hears a sound. A similar principle activates a toy robot Prentke modified; so long as a child keeps making sounds, the robot will march steadily toward him.

Prentke's laboratory contains drawers overflowing with odds and ends of spare parts that he utilizes in his hand-made devices, thereby saving the hospital untold amounts of money.

A Cleveland native, Prentke attended East Tech High



Ed Prentke with two of his inventions that encourage children to speak

School and graduated from Case School of Applied Science in 1926 with a degree in electrical engineering. He still remembers with fondness some of his teachers—such men as Dayton C. Miller and John Martin in physics and Russell Putnam in electrical engineering were among his favorites.

Known even then by his classmates as a tinkerer, he helped make ends meet in college by servicing radios and repairing vacuum cleaners. After graduation he went into radio servicing fulltime and soon opened his own store. Eventually he added record players and, because photography was his hobby, he also stocked camera supplies. Gradually, the photographic end of the business took over and in the 1940s, Prentke opened a camera shop at E.101 Street and Euclid Avenue.

During World War II, he taught electronics at Case, writing his own course material and devising his own experiments. He also taught at Fenn College and the Cleveland Institute of Electronics.

Prentke turned his tinkering talents to work for the handicapped in 1964 when one of his neighbors, a physician at

clients faster and enjoy the journey as well.

The company also will help find advocates and support groups for potential clients who cannot afford their products.

"You always do what's best for the client and then figure out how to pay for it," Romich said.

Once a month, staff meetings are held for every employee. "We often bring in people who are using the devices that we make so people who work on just one small part of the system can see how everything fits together," he said.

They meet people like 7-year-old

Joey, a stroke victim who uses his Light Talker to communicate with his family, friends and teachers in school and who loves to write and draw. Then there is 12-year-old Eric, who used his Touch Talker to yodel in his school play. And they learn about 20-year-old Wes, a college student whose first sentence on his Minspeak system was "My voice was born today!"

The newest addition to the staff, in fact, is one of its clients, Lake Kissick, born with cerebral palsy which has left him unable to speak. Seven years ago he found his voice through the Light Talker and Minspeak; he now has his own consulting business and edits a newsletter for disabled persons.

"Lake is a real high achiever, a model for other disabled people," Romich said. Kissick, in fact, refers to himself as "physically challenged" rather than "disabled." Kissick, who gets around in a powered wheelchair, will be responsible for "advocacy," Romich said. "He will help other people work through the process of independent living and employment and also interact with the professional people from all over the world who visit here.

"There may be a limit to what technology can do but there's no limit to what people can do," he said. "We're not selling a product, we're selling personal achievement."

Highland View Hospital on Cleveland's east side, asked for his help in designing some experiments he was conducting on hand muscles.

The physician, Dr. Charles Long, had a grant to study which hand muscle was responsible for which activity; the end result of the research taught surgeons how to transplant the different tendons in the human hand.

Prentke's role was to build amplifiers, power supplies and assorted electronic devices for recording muscular activity.

"Previously, physicians had had to rely on studying cadavers to learn about muscles," he said. When that research project came to an end, the hospital offered Prentke a full-time job. While working with Dr. Long, Prentke had come in contact with a number of paralyzed patients at the hospital. It was clear to him that he could put his mechanical and electrical engineering skills to good use to help them lead fuller lives.

Thus it was that at a time when most men his age were looking forward to polishing up their golf games in a warm climate, Ed Prentke was launched on a brand-new career.

One of the first devices he created was christened Paratrol—for patient-activated remote appliance control—so paralyzed patients could call a nurse or switch on a lamp or turn on a radio or TV.

"It was an elementary form of what we now call environmental controls," Prentke said. "It was connected to the nurse-call system and was operated by a footswitch that I modified to work with a very light touch—an elbow, the side of the head, whatever."

A later version of that device allows a person to sip or puff on a plastic mouthpiece to select channels on TV. Similarly they can dial a telephone by blowing and sucking.

Another Prentke invention was a lapboard control with microswitches so a patient whose arms were paralyzed could drive his electric wheelchair with the aid of a balanced forearm orthosis—something like a lightweight splint strapped to his paralyzed arm.

Soon after Prentke embarked on his new career, he met Barry Romich, then an electrical engineering undergraduate employed by Case Institute of Technology's medical engineering research program. They hit it off immediately.

"Barry was very bright, very eager, very interested. We worked well together and we seemed to have the same interests," Prentke said. "We both had little laboratories in our apartments. He was the theoretical man; I was the experi-

mentalist. He designed things and I built and tested them."

The working relationship between the young student and his mentor was cemented in 1966 when they formed a company to design and build electronic devices for the disabled in their spare time.

"We got orders one at a time from individuals who needed solutions to

their particular unique problems. And we custom-built them one at a time," Prentke said. One of their major successes was an automatic telephone dialer; an order for 200 of these helped launch the young company on the road to its present leadership position in the field.

When Romich left Cleveland for the Wooster area, Prentke commuted every weekend to the Prentke-Romich "technical center"—Barry's basement—to continue their work. That pattern continued for many years as the company grew by quantum leaps, expanding both its product line and the numbers of devices it manufactured.

In 1979 Highland View Hospital merged with Metropolitan General Hospital on the west side of Cleveland. Prentke, who was then 75, had to give up riding his bicycle to work, reluctantly conceding that the 22-mile bike ride from his home in Shaker Heights was too far. That same year he also "retired" from Prentke Romich—the weekend commuting on top of his full-time weekdays job at Metro General was getting to be a bit of a drag. Nonetheless, he still remains an active consultant for the company.

And the beat goes on at Metropolitan General where each day brings a fresh challenge. Recently, for example, he built a model of a magnetic resonance imager to teach children and adults what to expect when they undergo such tests.

Like Romich, Prentke does not believe in patenting any of his work.

"Our job is to help the people who need us," he said. "We're not in this business to make our fortunes. As Barry says, if anyone can make it better and cheaper than we can, more power to them."



Prentke's model of a magnetic resonance imager