

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.

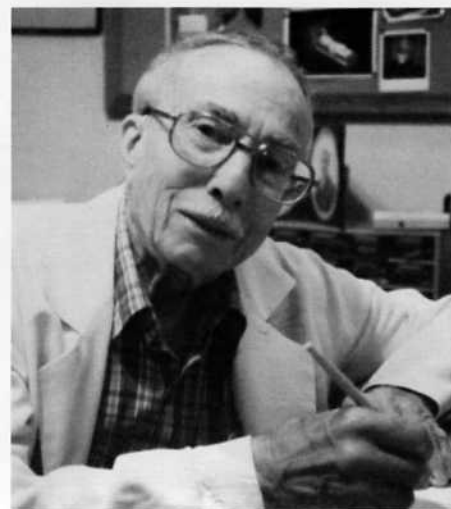
While the company's products are dominant in the English-speaking world, it looks forward to a worldwide market. Already it is licensing a Swedish synthetic speech technology which speaks eight European languages and will allow Prentke Romich to go onto the continent and handle the communication needs 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.

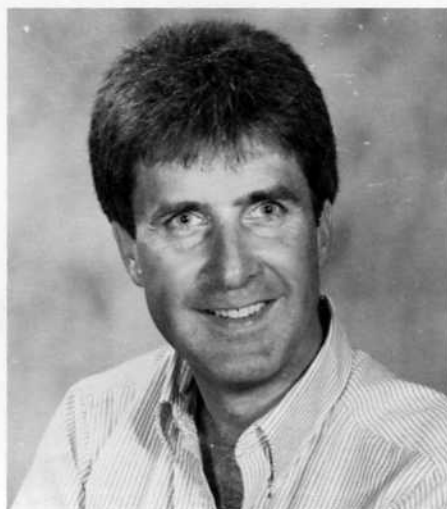
"A mind is a terrible thing to waste," says Romich, quoting the famous United Negro College Fund slogan. "Communication is the essence of human existence. Without it, we are little different from animals."

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-

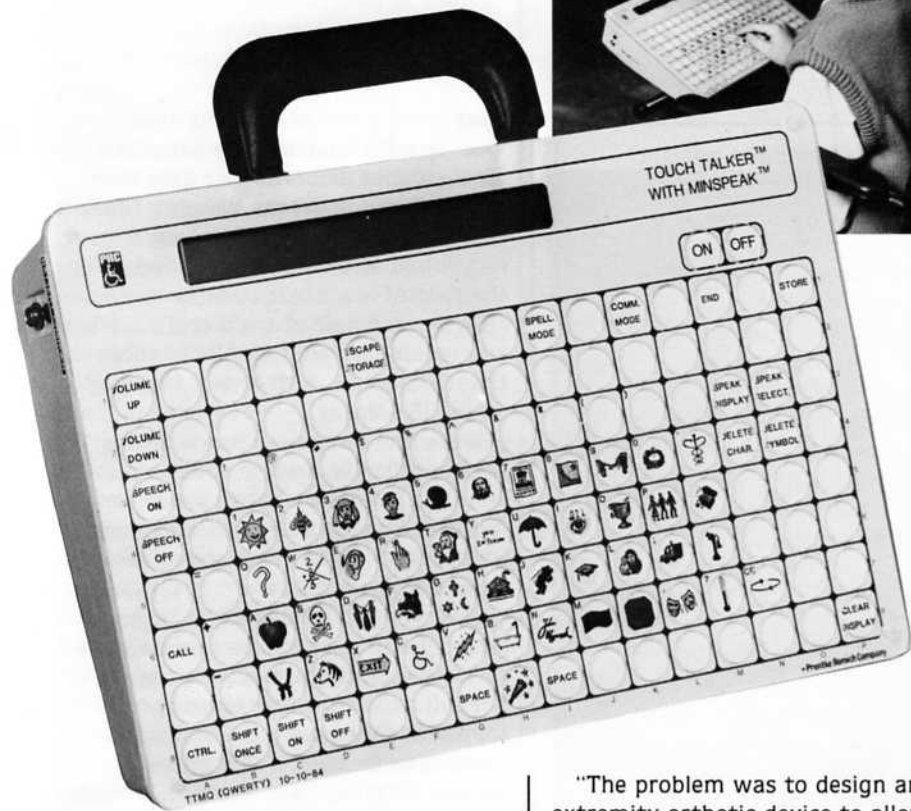


Ed Prentke '26



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.

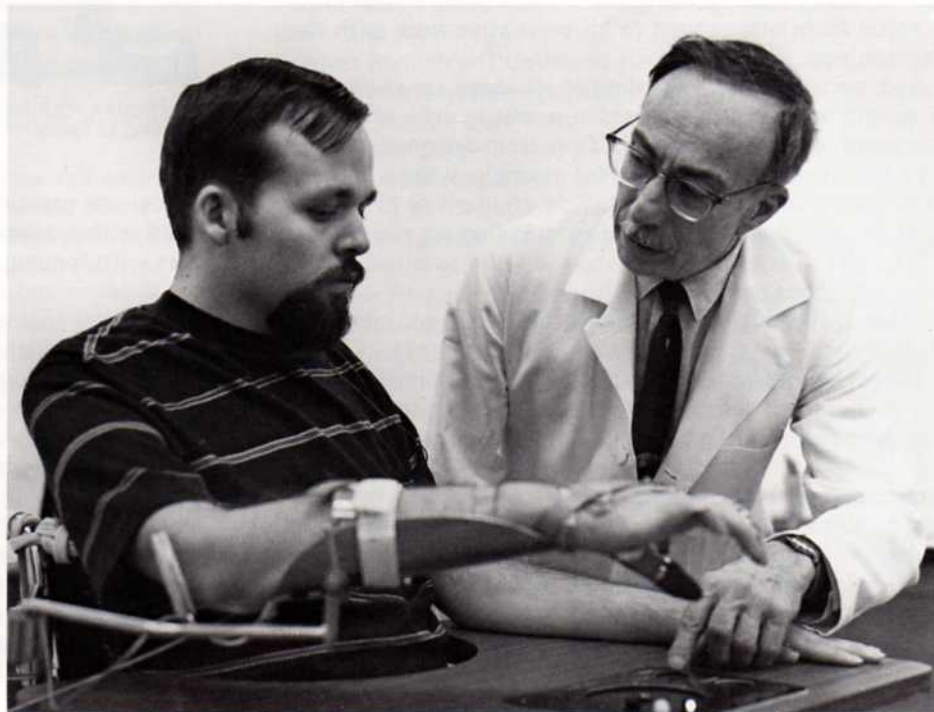
The system is so simple to use it can be taught in a matter of minutes to anyone—a mentally retarded person or a preschool child who does not read. Even the famous "talking chimpanzees," Washoe and her offspring at the Yerkes Primate Research Center in Atlanta, have been taught to use Minspeak.

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.

