

## DIGITAL TOOLS



# KEYS TO THE KEYBOARD

**T**HERE IS AN ALTERNATIVE, HIDDEN HISTORY TO THE computer industry, and it's right there at the end of your fingertips. The secret story is this: Most of the pivotal moments in technology involve the industry trying to figure out to what extent we can supplement, or even replace, the traditional typewriter keyboard.

What, after all, is Apple's rumored tablet computer other than a very elaborate way of replacing the mechanical keyboard of a notebook with a virtual glass one, like the one on an iPhone? In order to predict how far we will allow devices like mobile phones to become our main computing device, we need to first predict how comfortable we could become with something smaller than a full-size keyboard.

Indeed, the keyboard, along with its trusty sidekick, the mouse, is the tail that wags the dog of hardware design. Coming up with an alternative has been a goal for researchers for some time now. Short version: There is nothing on the horizon that can beat the keyboard, though some clever researchers are trying some ingenious approaches, involving voice, mind and muscles.

First, a brief homage to the keyboard. It's true that the technology has a steep learning curve, something that often limits its usefulness. But for people with a minimum of training, the keyboard-mouse combo performs a number of sophisticated tasks quickly with a modicum of effort.

Add a combination of advanced spell checking and of "predictive typing," of the sort we expect when entering queries at Google and Bing, and you have in the keyboard a simple and effective interface.

One obvious alternative is to talk to the computer the way we talk to other people. While voice recognition software has made dramatic progress, it's problematic even when it hears your words accurately. Plus, talking bothers neighbors.

Another keyboard replacement involves various brain scan-

ning technologies, such as when wheelchair-bound people can control a computer with an eyeball flick. A far-out variation of this has the computer responding to your mere thinking about a letter. But the process is slow and cumbersome, on account of the neurobiological irony that thinking about something—like visualizing tapping your finger on a desk—is often harder than doing it.

A third approach, being tried in various labs, takes advantage of cheap semiconductor-based cameras, like those in every new laptop cover. The sensor, or an array of them, would record the movement of your hands while they type against a keyboard projected by laser on your desk, or even in the space in front of you. Image-processing software would be able to convert those hand motions into something the computer would understand.

The award for thinking creatively about keyboard replacement goes to a group of Microsoft researchers that includes Daniel Morris and intern Scott Saponas. It's one of a number of efforts around the country involving muscle sensing. When you perform certain gestures with your hand—such as touching your thumb to your index finger in the "okay" sign—there are electrical signals associated with that gesture that pass through the nerves in your upper arm as they carry commands from your brain to your hand. These signals have been detected in the lab for decades, using relatively large sensors and some sticky gel.

The Microsoft researchers are using tiny, cheap sensors, each the size of a fingernail, that can easily fit on an armband. The electrical signals from each of them are weak and noisy, but that weakness can be overcome with the processing power of today's computers.

Imagine a repertoire of simple hand gestures: say, touching your thumb to each of your four fingers. The system at Microsoft will soon be able to detect up to eight such touches a second. You'd wear a simple armband and control what is on a screen in front of you simply by touching your fingers together. Someone could add a second armband and a greater range of gestures.

Morris says the Microsoft effort is currently just a research project, and in its earliest commercial incarnations would likely be a simple controller for a music player or cell phone. It will be a while before a jogger will be able to strap on an armband and compose e-mail while running. Says Morris: "Mobile text input—that would be incredible."

It sure would. Surfing the Web while wiggling your fingers would bring a whole new meaning to the phrase "touch typing." **F**

**The computer keyboard mimics an ancient mechanical device, the manual typewriter. How about something radically different for input?**

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