

21ST

CENTURY TECH

CHAPTER
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How Input/Output Will Work

The most obvious change in computing in the coming centuries won't be in the way data is juggled by as yet unknown technologies. Nor how that data is saved or sent across the new Internet. The most obvious changes will be in how we get to that data and how it gets to us.

Right now we are our own obstacles to using computers. Portability of computers is determined, not by the amount of memory, storage, or computing capacity, but by the size of our fingers and the amount of detail our eyes see. Computers have had to exist in the human world and adapt themselves to human limitations. Even the slowest Internet connection can still stay ahead of the ability of most of us to plow through all the data that connection affords as we look for the nugget of information in all that data. There's no lack of vision for a future with better ways of communicating with our machines, but there is a lack of willingness to abandon old habits for new. In the day of the portable monitor, we still like hard copy. When it's possible to contact nearly anyone with email, we still make phone calls. But computing is poised at the threshold of a new ease of input and output that will wind up with us communicating with our computers instead of simply controlling them.

At this point, the most obvious of these new wonders is speech recognition. At its current state, speech recognition software still requires some conscious thought about how we speak. I'm not sure if I can dictate as unconsciously as I can type. I suspect that speech will be one of many options we'll have for inputting information to a computer. It will become more important as we become detached from our computers. It will be used for the casual command uttered to the ubiquitous pancomputer as we eat breakfast in the kitchen, drive in the car, and for the control of devices, such as TV remote controls, whose buttons and menus befuddle even those who consider themselves electronically literate. The usefulness of speech recognition will increase as artificial intelligence allows us to speak as we usually do, with ambiguous sounds, slurs, and misstatements.

Visual recognition is already here in the form of systems that claim to match a live video image of your face with a digitized record of it. Computers will be more helpful when they can recognize a host of objects, including my misplaced glasses. Even with speech recognition, describing an object to a PC in words is not as easy as showing it to a computer.

By giving a computer the senses of hearing and vision, we're making the computer as aware of the world surrounding us as we are ourselves. Why stop there? Machines are not limited to our human senses. Computers can already sense temperature, wetness, and pressure. It's not much of a jump to have a pancomputer sensing when I have a fever, when I'm sweating, and when my body is tossing in my sleep—and then to know it should call my doctor, or maybe my doctor's computer, without waiting for me to wake up. But we're still in the realm of human senses. How much better could my sensitive PC watch over me if we give it the senses of magnetic resonating or a CAT scan? A computer could sense radio waves and digital communications signals to look for news topics or new songs that match its personality profile for me. It should, of course, have a sense of snow so it will know when to turn on the ice melters. It should have a sense of measurement so it knows to order my new pants a size larger or make adjustments in my diet. All computers, or the pancomputer, should also be able to sense the infrared signals that constantly spread from a finger ring, in which I store my appointments, contacts, and to-do list. That way, if I'm in the presence of an unknown computer, it will have all the information about me it needs to screen my phone calls, deliver email, remind me of an appointment, and confirm my own computer's opinion that the spot on my lung has a 96.3 percent probability of going malignant.

So far this has just been the input side of things. What can we expect in the way of output? First, a speaking voice that doesn't sound like the robot on *Lost in Space*. Or that *does* sound like the robot in *Lost in Space*, if that's your kicks. Or that sounds like you. Imagine the advantages of having a personal impersonator if I get a call from someone I don't really want to talk but can't ignore. (You know how it is.) But a voice mimic's no help with the ubiquitous video phones, and new 3D videophones. Still no problem, because my home computer—better, my computer home—has the ability to completely synthesize video to create a counterfeit image of me. After all, in the entertainment industry of the future, there are no small roles because there are no actors. 3D animation will have video-quality attention to detail and realism—no small accomplishment, consider the high resolution, high-definition video available on every screen in the house. (The distinctions between television, computer monitors, or for that matter, with the art hanging on your walls will long have disappeared.)

I suppose this is as good a time as any to say that I've never bought the idea of 3D holographic projections of the type that first introduced us to Princess Leia. There seems to have been no improvement in holograph projections since they first appeared in the '60s. Perhaps there's some technology yet to be discovered that will create convincing 3D projections. Researchers at Stanford University have created a three-dimensional, full-color, solid-state video display. Of course the display, created by crisscrossing laser beams, is the size of a sugar cube and does a better job projecting mathematical shapes than facial forgeries. If Lucas couldn't do a good job of it, I wouldn't bet on holograms any time within the next couple of centuries.

What I would bet on is some entirely new display/input device, something that looks like a handkerchief folded in your jacket pocket. Pull it out still folded, and it displays a

palm computer for times when it would be rude to have the pancomputer read your schedule to you aloud. Unfold it once and you have a open-book display that could be anything from *Moby Dick* to a video phone—or both, each on facing pages. Unfold it one more time, and it flattens out into a PC display equally adept at showing you your spreadsheets or streaming the latest movies from the Internet.

Even such sci-fi concepts fall short of what new types of output computers are capable of. Today *force feedback* technology is mainly a phenomenon of computer games. The same technology could create a braille reader that would give the blind access to all the text displayed on a monitor. That's a modest accomplishment. More impressive will be when computer input/output technology is used to replace failing retinas and cochleas. Reuters reports that a paralyzed man from Georgia received a tiny brain implant he learned to use to control a computer. The 53-year-old man was the second person to receive the implant, about the size of the tip of a ballpoint pen, but only the first to successfully communicate with a computer using his thoughts. Meanwhile Caltech researches have invented *neurochips*. The neurochips connect a network of living brain cells wired to electrodes built into a silicon chip. Sounds pretty mind-boggling. Or Borging.

