User Interfaces: Beyond Keyboards

New Interfaces, Better Software Key to Future Computing

The utility of today's computers, whether desktop, handheld, or embedded, is severely limited by their user interfaces. For the most part, it is not microprocessor performance that is hindering the development of more useful computing devices; it is the physical interfaces and the sophistication of the software. Faster microprocessors are an important enabling technology, but there is much more that could be done without any increase in processor speed. And we will, of course, have much faster microprocessors within a few years, broadening the range of the possible.

The limitations of the ubiquitous QWERTY keyboard are well known. Different layouts help, but not dramatically—and the installed base is an enormous barrier to change. A much more potent approach, which has had minimal commercial success, is a chording keyboard. Each finger stays on a single key, and keys are pressed in combination. This approach enables smaller, simpler keyboards and allows much greater speed—but the learning curve is steep.

Pen input seems an obvious replacement for keyboards in handheld devices, but it has been very slow to take off. (On the desktop, keyboards are much faster input devices.) Apple's original Newton, which tried to achieve the most difficult of pen-input tasks—cursive handwriting recognition—created a massive backlash that set back interest in pen input dramatically. The Newton 2000 is much better, but too few people are paying attention. Palm Computing came up with another approach, using a slightly modified printing alphabet that eliminates subtle differences between letters and enables faster, more accurate writing. The Palm Pilot has popularized this "Graffiti" alphabet, which deserves to become a pervasive standard.

The ultimate input mechanism, in many ways, is speech. Reasonably good speech recognition is achievable today with modest microprocessors, as long as the vocabulary is limited. Unstructured dictation with high accuracy is still far off, but the ability to give commands is here today. During the next decade, speech input will become much more prevalent, but it isn't going to displace keyboards and pens as the primary input devices for most computers.

Output devices are less of a concern. LCD displays for handheld and portable computers are quite nice today, although it would be better if costs were lower and if color LCDs (and their backlights) consumed less power. The lack of reflective color LCDs is a limiting factor in the success of handheld devices, but LCD technology is advancing steadily. Large LCDs are destined to replace CRTs in most applications, but this change will occur slowly because the cost premium remains substantial. Three-dimensional graphics hardware technology is coming along rapidly, as is video. Whether 3D yields valuable new user interfaces remains to be seen, though the prospects are intriguing.

A more radical shift to a virtual display, where you look through a small display device at a virtual screen a few feet away, could be in the offing for some portable systems. Such displays are already used in virtual-reality goggles, and a portable fax reader that uses one is also available.

Wearable computers will become an intimate part of many people's lives—cell phones and pagers are already there. Adding Web and e-mail access is a natural next step. The capabilities exist to go much further, but there are formidable nontechnical barriers. A computer that watches and records everything we do and provides a memory assistant could be valuable, for example, but few people are likely to accept the intrusiveness and perceived loss of privacy. Whether wearable or not, computers with more real-world sensors, instead of just manual input devices, will be a key to increasing the utility of computing devices.

The software element is where the most near-term opportunity lies. Even without any technology breakthroughs in input or output devices, computers could be far more valuable if they were more natural to interact with, were more autonomous, and provided more automation. For example, it wouldn't take any radical new technology for my computer to sense that I had walked into my office for the first time that day and inquire (through speech) whether I want to know about my new mail. All I would have to say is "Yes," and the computer might say, "You have 12 new messages. Shall I delete the ones you usually delete and open the others, starting with the one from your boss?" This may sound like 2001's HAL, but it is not really very difficult to do.

Computers like this would be far more popular than today's systems, which are only a few steps removed from mainframe data-processing machines. Computer-based devices are going to become pervasive—but with today's interfaces, most will be annoying rather than pleasing to use. With more advanced software and modest advances in interface hardware, there is a great potential for computing devices to be far more pleasant to interact with. Computers need to adapt more readily to their users—and people must be willing to learn to use new interface approaches. M

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