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The trouble with computers

Computing: They may be powerful, but computers could still be easier to use. Might new forms of interface help?

IT HAS been called a revolution, and rightly so. Over the past 25 years computers have become a feature of everyday life in rich countries and, increasingly, in poor ones too. Today's machines are fast—a typical desktop now has ten times the number-crunching power of the fastest machine on earth in 1983—and widespread, given that the world's 3 billion or so mobile phones are, in effect, pocket computers. But although computers have become cheaper, more capable and more commonplace, they have made much less progress when it comes to ease of use. Their potential remains tantalisingly out of reach for people who find their control systems, or "user interfaces", too complex. And even people who have no difficulty navigating menus, dialogue boxes and so on, might use computers more productively if their interfaces were better.

Consider the Nokia 6680 mobile phone, says Adam Greenfield, an expert in computing culture at New York University and the author of "Everyware", a book about the future of computing. He found that 13 clicks were needed to change its ringtone. "It's an interface designed by engineers for engineers," he says. Steven Kyffin, a senior researcher at Philips, a consumer-electronics giant based in Eindhoven in the Netherlands, concedes that computer programmers and engineers, himself included, are often guilty of designing complicated systems packed with too many features. "We're compelled by complexity," Mr Kyffin says. "There's a point where humanity just can't handle it." Tellingly, the field of interface design even has an unwieldy name: it is known as "human-computer interaction", or HCI.

Part of the problem is that programmers have traditionally had more power than designers. Programmers put in place the myriad features they want; interface designers then struggle to wrap them all up in a product that is simple to use. The results, all too often, are clunky interfaces. But the balance of power may now be shifting to the designers. Ken Wood, deputy director of Microsoft's research laboratory in Cambridge, England, says his company is putting greater emphasis on interface design. Three years ago, he says, none of his lab's budget was earmarked for pure HCI research. Today, a quarter of the lab's budget goes on it.

Making computers simpler to operate would help the people who use them and the companies that produce them. Ease of use is one area where technology firms can differentiate themselves and gain competitive advantage. Just look at Apple, which is able to charge a premium for its products thanks to their elegance and simplicity. Its Macintosh computer, launched in 1984, helped to popularise the window, menu and mouse-based graphical interface—a huge step forward from the system of cryptic typed commands it replaced. Graphical interfaces became common in the 1990s, but there has been very little progress since.

What comes next? In March this year Microsoft assembled a group of HCI experts to discuss this question at a conference near Seville called HCI 2020. Andrew Herbert, managing director of Microsoft's Cambridge laboratory, told attendees that interface simplification is vital if the computing world is to be opened up to new consumers such as the elderly, children and people with little computer experience. Microsoft says new features in its Windows Vista operating system, such as 3-D graphics intended to make navigation easier, demonstrate its commitment to greater ease of use.

The view from Hollywood

But tweaking an existing window-based interface is hardly a radical step. For a more dramatic vision of what may be to come, look no further than "Minority Report" (2002), Steven Spielberg's futuristic thriller starring Tom Cruise. Set in the year 2054, it depicts people operating computers using hand gestures detected by sensors. Gesture-based computing might sound odd—do you really want to dismiss a document on your computer by airily waving it away?—but computer mice were derided in 1983.

Today's gesture-based systems take many forms. iO, a company based in Treviso, Italy, sells the Sensitive Wall, a large screen for banks and showrooms that senses movement within a metre or so. Passers-by can wave their hands to flip the pages of a virtual brochure through a shop window, or view promotional images from different angles. "The idea is to have the digital world melt into the physical world," says iO's Daniele Modesto.

The "multi-touch" interface devised by Jeff Han, a researcher at New York University's Courant Institute, is more elaborate. It is based on a large touch screen (pictured) that can sense more than one touch at a time. This makes possible two-handed gestures such as selecting an area ▸▸

of an image, rotating it or zooming in and out. He believes this sort of approach will have far wider appeal than today's windows and mouse-based systems, and he has founded a start-up, called Perceptive Pixel, to commercialise the technology.

Another version of a multi-touch screen, developed at Microsoft, shows how the technology could be integrated into a home, office or shop, in the form of a table. The Microsoft Surface, a horizontal touch-screen computer with neither keyboard nor mouse, will go on sale in November. Its gesture-based interface allows images and documents to be manipulated; the table-like computer also recognises other devices (such as digital cameras or mobile phones) when they are placed on top of it, and can download images from them automatically.

Touch screens make computing feasible in new places, especially public ones, by doing away with keyboards, which can get gummed up with grime or spilled drinks. iSuppli, a market-research company based in El Segundo, California, estimates that the wholesale touch-screen market will expand by 17% this year to reach $2.8 billion. The incorporation of touch screens into portable devices is one driver of this growth. Apple's iPhone, launched in June, is a mobile phone with a gesture-sensitive multi-touch screen. Objects can be moved on the screen by dragging them with a finger, made bigger or smaller by spreading or pinching them with two fingers, and discarded with a flick off the screen's edge. Touch screens have particular appeal in portable devices because virtual buttons and other controls appear on screen only when required. The lack of a physical keyboard leaves more room for a bigger screen.

Another alternative to the mouse as a pointing device is to use a gaze-tracking camera, which works out where you are looking and moves an on-screen pointer accordingly. A foot-pedal or keyboard switch then replaces the click of a mouse button. So far such systems appeal chiefly to disabled people who cannot use a conventional mouse. Antonio Tessitore of Villa Literno, Italy, had to give up his job after developing a degenerative muscular disease. Last year he began a new full-time job at a charitable association, using a gaze-tracking system that, he says, allows him to operate a computer with "no limitations". Manu Kumar, a researcher at Stanford University in California, is developing a gaze-tracking system called GUIDe aimed at a broader market: people who share documents. It works out which parts of documents people pay the most attention to, and highlights them accordingly. Other HCI researchers are using microphones, webcams and other sensors to try to work out what people are doing.

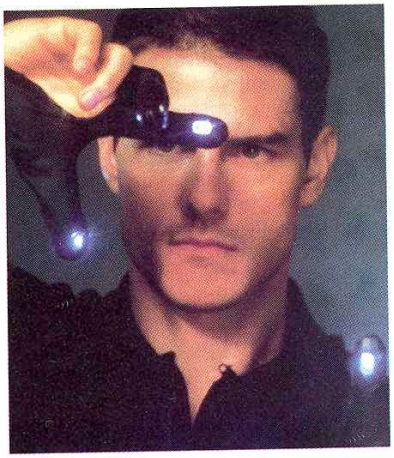
But making computers simpler to use will require more than novel input devices. Smarter software is needed, too. For example, much effort is going into the development of "context aware" systems that hide unnecessary clutter and present options that are most likely to be relevant, depending on what the user is doing.

Giving you what you want

The trick, says Patrick Brezillon of University Paris VI, is to get computers to "size up the temperament of users" and then give them what they want. This can be done by analysing the frequency of keystrokes, the number of typos, the length of work breaks, internet-search terms and background noise, among other things.

All sorts of things can be done with this information: playing soothing music for agitated users, proposing a break if the number of errors goes up, or suppressing notification of incoming e-mails to avoid breaking someone's concentration. Albrecht Schmidt, an HCI expert at the Bonn laboratory of the Fraunhofer Institute, one of Europe's largest research organisations, says a mobile phone could even change its behaviour depending on its location. One of his prototype systems shuffles the queue of voice-mail messages to give priority to messages from friends when the phone is out of the office.

The problem with all of this is that people may not want computers to make assumptions about their needs and preferences—not least because those assumptions may be wrong. But proponents of context-aware computing say it is merely the next logical step from existing systems such as spam filters. The next generation of e-mail filters, say HCI researchers, will be "gradation" filters that delay notification or delivery of certain e-mails to avoid bothering the recipient.



They said mice were silly, too

Henry Holtzman, a researcher at the Massachusetts Institute of Technology, says vehicles provide the most promising environment for context-aware interfaces. Since the position of the driver is fixed, cars can be fitted with sensing equipment that would be obtrusive in other contexts. Stopping mobile phones from ringing in heavy rain, or during a sharp turn, he suggests, might prevent accidents. But, he adds, if such decision-making by computers is to be accepted, people must be convinced to trust it.

That could be difficult. Anind Dey, a researcher at Carnegie Mellon University's HCI Institute in Pittsburgh, Pennsylvania, is designing a vehicle-navigation system that tailors driving directions for individual drivers. Cars fitted with sensors and cameras collect data on the driving styles of test participants, including their acceleration and braking patterns, assertiveness in changing lanes, and so on. The navigation computer then picks a route that accommodates each driver's strengths and weaknesses. The system works fine—but when drivers are told what is happening, they get angry. This suggests, says Mr Dey, that contextual computing needs to be discreet: such systems are, in effect, judging people and trying to influence their behaviour. Systems that manipulate people, he says, may have to keep quiet about it to work.

Many futurists and computer experts believe that the logical conclusion of all of these new input devices, sensors and smarter software to anticipate users' needs, will be for computing to blend into the background. In this "ubiquitous computing" model, computers will no longer be things people use explicitly, any more than they "use" electricity when turning on a light or a radio. Mr Greenfield says a digital "dream world" that provides "one seamless experience of being immersed in information" hinges on one big if: computers and their interfaces must become so good that, like electricity, they rarely require concentrated attention. The trouble with computers in their current form is that they are still all too conspicuous. ■