Computers

Ivars Peterson reports from Washington, D.C., at the Conference on Human Factors in Computing Systems

A computer at your fingertips

Imagine communicating with a computer in sign language, using gestures and finger pointing to tell the machine exactly what to do. There would be no keyboard or other device that the user must handle — only an empty, illuminated desktop on which the user's hands rest, an overhead video camera and a display screen. Such a system is the basis for VIDEODESK, created by Myron W. Krueger of the Artificial Reality Corp. in Vernon, Conn.

Krueger's system allows an image of the user's hands to play or work with objects on the display screen. For example, in a fingerpainting exercise, fingers trailed across the desk generate swathes of color on the screen. In another program, hand gestures define a ball, then moving the hands deforms it into a variety of shapes. A third program features an alphabet on the screen. Pointing to letters allows a message to be "typed" on the screen. Five fingers fully extended erase any image. In each case, the hands remain on the desk and an image of the hands interacts with pictures on the display screen.

Krueger designed, built and programmed the electronic technology needed to make VIDEODESK work. His system analyzes the video image and recognizes contact between the image of the user's hands and objects on the display screen. An earlier effort, VIDEOPLACE, in which the silhouette image of a user is combined with a computer-generated picture seen on a large projection screen, is based on a similar technology (SN: 6/22/85, p.396).

"For many people, a keyboard is a big barrier to computer use," says Krueger. VIDEODESK allows such people to communicate with a computer in a more natural way. In addition, hand gestures can be very expressive — conveying more information more quickly than a set of keystrokes. Krueger has developed a similar system for engineers interested in visualizing and studying the flow of hot gases through a jet engine. The engineers use their fingers to define exactly where and over what regions they want to see flow patterns.

Hearing what you're doing

Normally, computer users expect their computers to be quiet — except for an occasional beep when an error surfaces, the hum of a fan or the click of keystrokes. Graduate student William W. Gaver of the University of California at San Diego, on the other hand, has deliberately programmed his Macintosh computer to be noisy. He provides sound effects to go with operations such as erasing a computer file, moving information from one place to another or checking how much of a computer disk is filled.

Gaver's experimental SonicFinder program includes a variety of everyday sounds. When he instructs the computer to perform a certain function, it also emits the appropriate sound. Erasing a file sounds like a heavy object dropping into a trash can. Copying a file sounds like water pouring into a glass. The pitch goes up as the copying nears completion. Shifting a file evokes a scraping sound. The arrival of mail — an electronic message — produces a characteristic thunk depending on the message size. "Such sounds have a short duration, yet they convey a great deal of information to the user," Gaver says.

As it stands now, Gaver's sound-effects program doesn't really add any new information. "But it makes the [computer] world more real," he says. "I use it all the time. If it's not on, I feel as if I'm walking around with chalk in my ears." It also means that a computer user doesn't have to pay attention to the computer screen all the time to keep up with what's happening.

"This is just a prototype," says Gaver. He is thinking about how the system can be extended to provide information not otherwise available to a computer user; for example, when two operations are going on at the same time.

Earth Sciences

Richard Monastersky reports from Baltimore at the American Geophysical Union's spring meeting

Uncommon traits of Alaskan quakes

The series of moderate to large earthquakes that shook the Gulf of Alaska last November and March are causing seismologists to question some of their long-held ideas about the seismic potential along the quake-prone Alaskan subduction zone. This region, where the Pacific plate slides underneath the North American plate, has hosted many large earthquakes, including the 1964 killer that devastated Anchorage and other areas of southern Alaska. But what is strange about the recent quakes is they occurred in the Gulf, solely within the Pacific plate. This stands in contrast to normal subduction-zone earthquakes, which strike at the boundary between the two plates, reports Harvard University's Adam Dziewonski. As well, the faults that produced the quakes were not typical subduction-style thrust faults — ones that have planes dipping away from the horizontal. Instead, the movement was along faults with vertical planes running in a north-south direction.

The recent seismic action occurred several hundred kilometers south of the Yakataga gap — a quiet section along the subduction zone that seismologists have targeted as the likely site of a large earthquake expected within the next 20 years. However, Dziewonski says the Gulf earthquakes may have released some of the seismic strain building up within the nearby gap, lowering the chances of a large quake in this area.

GPS steps forward with a small stumble

Various groups of scientists report that with the new technology of the earth-space Global Positioning System (GPS), they are making giant strides in the field of measuring long distances with great accuracy. At the same time, one experiment seems to have uncovered a GPS pitfall that cannot yet be explained.

The GPS relies on a network of permanent and portable receivers on earth that monitor a series of microwave signals emitted by orbiting satellites. At present it can measure distances to within a few parts in 10^8, which amounts to an error of a few centimeters in 1,000 kilometers, says William Melbourne of the Jet Propulsion Laboratory in Pasadena, Calif. Although other techniques, such as Very Long Baseline Interferometry, are more accurate, GPS receivers have the advantage of being relatively inexpensive, small and quite mobile.

Exploiting these features, Melbourne and a host of international colleagues recently finished the first stage of the largest GPS experiment to date — an effort to measure the tectonic motion of crustal plates in South and Central America. The researchers placed temporary receivers on the mainland as well as on small islands in the Pacific — a feat that would have been impossible with other techniques, says Melbourne. By comparing measurements taken in January with some planned for two years from now, the researchers hope to gauge how quickly the oceanic plates under the eastern Pacific are moving when they run into the continental plates and dive into the earth's interior.

The accuracy of GPS measurements has improved significantly since the initial tests five years ago, and the system has proved reliable in many experiments. But one recent GPS venture in California's Long Valley caldera yielded curiously inaccurate measurements, says Jet Propulsion Laboratory's Tim Dixon. The caldera — a volcanic crater — is currently shifting as a pool of magma grows several kilometers beneath the surface. Researchers had hoped to use GPS to monitor the caldera movement with respect to a station 70 km away. But they got measurements 10 times less accurate than expected. For GPS, "This is the only fly in the ointment," Dixon says. He and others say it will be important to understand the problems at Long Valley before placing full confidence in the system.