# Artificial vision: A big step forward

If you sat in the dark, and an electrode strategically stimulated your visual cortex (the back of your head), you would see a tiny light floating out in front of you. If two electrodes strategically stimulated your visual cortex, two tiny lights would dance in front of you. If three electrodes stimulated your visual cortex, three lights would flicker in front of you, and so on, until the lights studded your visual field like a skyful of stars.

These light impressions, the result of excitation of the visual cortex, are called "phosphenes." If the visual cortex in a blind person is properly stimulated, he or she can see phosphenes too.

By exploiting the phosphene capabilities of a blind person, American and Canadian scientists have now made what appears to be the biggest advance so far in restoring vision to blind people. W. H. Dobelle, a biophysicist, M. G. Mladejovsky, a computer scientist, Theodore S. Roberts, a neurosurgeon at the University of Utah and J. P. Girvin, a neurosurgeon, all at the University of Western Ontario, report their findings in the Feb. 1 SCIENCE.

Their work has been enthusiastically appraised by G. S. Brindley of the Institute of Psychiatry in London. Brindley is the pioneer in the field. He and his co-workers laid the groundwork for the Americans' and Canadian's advances. Brindley began work on a phosphene-based visual prosthesis in the early 1960's.

The Utah and Ontario scientists started their research in 1969. In 1970 they traveled around the United States and Canada exploring the phosphene vision of persons undergoing operations on their visual cortexes (to remove tumors or to correct other problems). After studying the phosphene capabilities and differences of 37 individuals, they undertook experiments on two blind patients. One was a 43-year-old electronics technician and piano tuner, blind for 28 years from cataracts and glaucoma. The other was a 28-year-old graduate student in social work, blind for seven years (he lost his vision in a Vietnam landmine explosion).

In each patient they temporarily implanted electrodes on the visual cortex. By stimulating pairs of electrodes at a time, and using sophisticated computer technology, they determined the relationship of phosphenes to each other and ultimately unscrambled the patient's particular phosphene map. In other words, each phosphene that a patient saw was mapped on a television screen in relation to another, until an entire visual field was built up—a matter of a couple of hours.

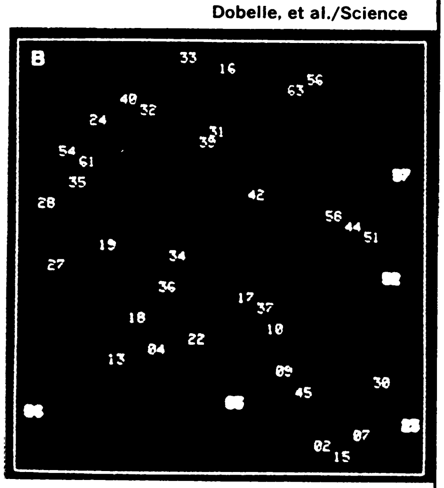
"This unscrambling," Dobelle says, "was a major problem. It is virtually impossible to do that in a short period of time without a computer."

Now that they knew the phosphene makeup of each patient's visual field, the Utah and Canadian investigators tried stimulating strategic electrodes (strategic phosphenes) in order to present patterns, including letters of the alphabet, on the phosphene map (visual field). The patients saw the patterns and letters and confirmed it by drawing pictures of what they had seen.

"We are excited," Dobelle admits, "but we have a hell of a long way to go before phosphene manipulation can be turned into artificial vision equipment for blind people."

*Patient blind for 7 years recognized backward L, produced by stimulating 5 of 39 electrodes in back of head.*

Dobelle, et al./Science




## Radar map of Mercury: Craters, rolling hills

Optical astronomers have been able to offer relatively little information about what to expect when the Mariner 10 spacecraft flies close to Mercury on March 29. Much of the existing information on the appearance of Mercury (SN: 10/6/73, p. 220), difficult to see because of its proximity to the sun, has come instead from radar beams, reflected from the planet back to huge antennas on earth.

Shalhav Zohar and Richard Goldstein of the Jet Propulsion Laboratory have been probing planets, moons and asteroids since 1963 with the aid of the huge, 210-foot antenna at Goldstone, Calif.

Mercury, they have found, appears to be a cratered world with hills and valleys, but the evidence so far shows few if any of the titanic ups and downs that scar the surface of earth's moon.

During July and November of 1972 and July of 1973, times when Mercury was near the earth, the JPL team took about two dozen of what Goldstein calls radar "snapshots" of areas around the planet's equator. The first 14 covered 14 different equatorial sections, each about 600 kilometers long and extending from 12 degrees above the equator to about 4 degrees below. This covers a little more than half of Mercury's approximately 15,300-kilometer circumference. The 1973 observations finally provided some duplication, enabling the researchers to "see" some features from slightly different angles.

Mercury's equator, they have found, abounds in what seem to be rolling hills and dales, varying about one kilometer in height. At least five of the fourteen areas produced reflections from circular features that are probably craters averaging about 50 kilometers across and 700 meters deep. Two of the observations revealed what could be giant craters as much as 300 kilometers across, but the JPL scientists "treat this possibility with some reserve."

Radically steep mountains seem to be a rarity. A single observation showed a promontory some 1.3 kilometers high, but even it rose from a base about 120 kilometers across.

In 1969, observations at JPL, at relatively low resolution, were able to reveal vast "rough spots," about the size of continents, in areas away from the equator.

In general, says Goldstein, Mercury seems to be rougher than Venus, but it is hard to be sure from radar studies.

When Mariner 10 flies by Venus on Feb. 5, and later by Mercury, the radar watchers will be able to see just how right they were—or weren't. □