NASA

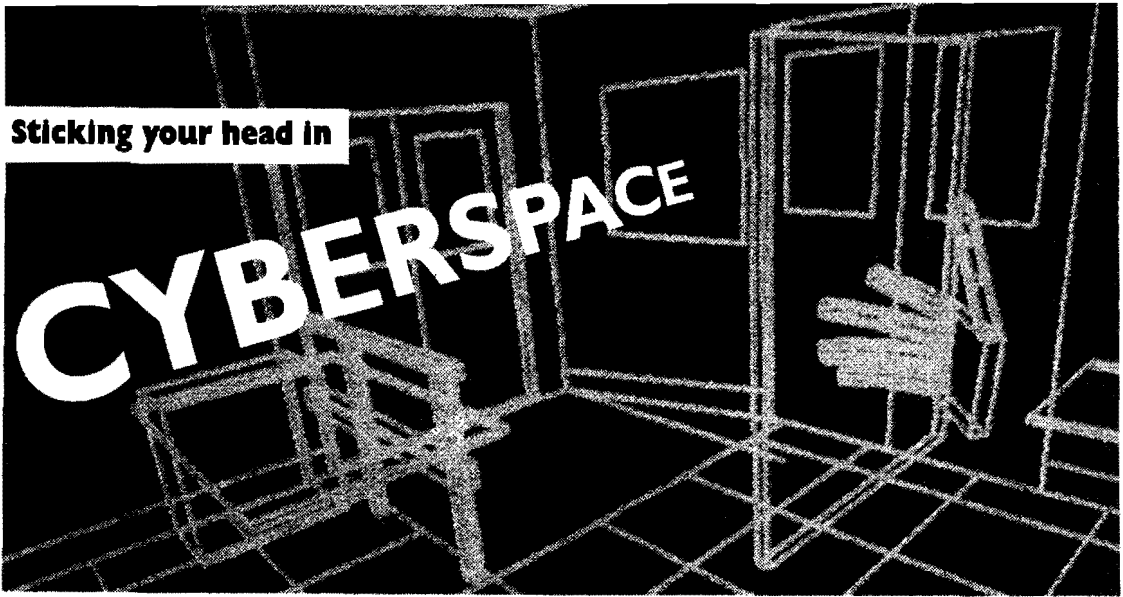# Sticking your head in CYBERSPACE

I have seen the future, and flew in it!

With friends from Autodesk [makers of software for 3-D drafting] I went to NASA Ames Research Center south of San Francisco and tried on Mike McGreevy's "Head-Mounted Display System." It is truly immersion in virtual reality.

The head rig (more ephemeral than a helmet) presents each eye (therefore 3D) with a black and white wireframe scene in which one can move by moving one's body in real reality. Head and body motions are picked up by a magnetic sensor overhead and translated into appropriate movement in the virtual scene. The demo we saw had a virtual version in the display of the actual room we were in, with walls, a ramp over THERE, a partition sticking out THERE, low ceiling, etc. This was handy for preventing the virtual realist from walking into actual walls, but since the people in the crowded room weren't represented in the display, ecstatic explorers in the virtual room kept bumping into people in the real room.

In the virtual space also was a disembodied hand, representing one's own hand, which was instrumented with a DataGlove and a position indicator. So you could reach around in your virtual reality and pick up things, or, by choice, reach right through things. One demo had one's hand reaching into a swirling model of the flow of gases in the Shuttle Main Engine, able to tweak the flow with one's fingers.

The first thing most of us did when we arrived in virtual reality was study our own hand, looking for all the world like stoned kids: "Have you ever really, REALLY looked at your hand!!?"

Also the hand could make gestures that become commands. If you made a fist and pointed your index finger,

Scientific American
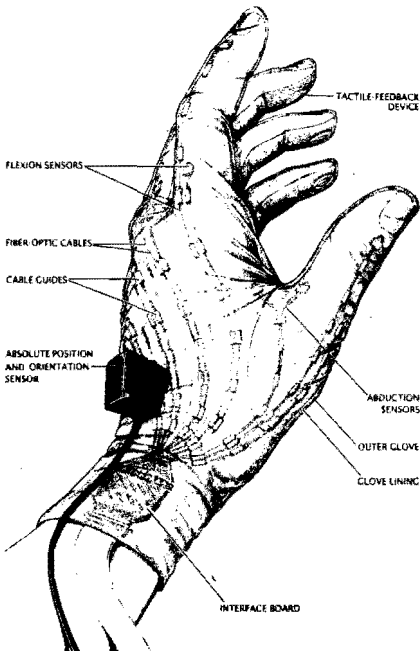
(Right) The almost-universal response to wearing a cyberspace helmet is "Hey, I don't want to take this off!" A visitor to the NASA lab contemplates his cyber-hand.

(Left) The DataGlove translates hand and finger movements into electrical signals. Fiber-optic cables running along the fingers produce a signal when they are flexed. The dark protuberance on the back of the hand beams a signal which indicates the position of the hand proper in the room.
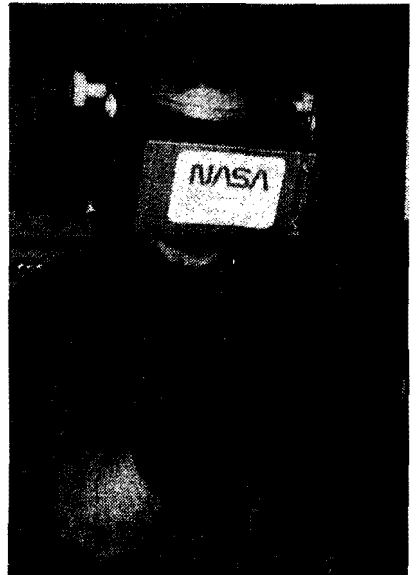
Stewart Brand

you FLEW toward wherever you were pointing. Point up, for example, and you ascend through the virtual ceiling. If you look down while doing that, you see the room getting smaller and smaller below you in the distance. Then you could swoop back down into it, soar around, fly through the floor, etc.

I lost my body almost instantly, except as a command device (ultimate mouse), and thoroughly enjoyed life as an angel. Oh wings of desire.   —*Stewart Brand*

The experimental NASA helmet consists of a counter-balanced stereo viewing screen (what the viewer sees is displayed on the monitor in the background) and an electromagnetic location pole.

'TRODES

Known as 'trodes in futuristic cyberpunk literature, electrode implants in the brain already have a half-measure of reality in several current experiments. The most promising is a device for severely speech-disabled people who also lack the motor control needed to operate a keyboard. A person plugged into this selects letters on a screen by means of looking at them, or what is called in the trade "gaze access." Earlier attempts at visual cues involved tracking the physical movement of the eye, but this didn't work well because one couldn't move one's head or wear glasses while doing so. In "gaze access," a shallow electrode is placed near the part of the brain processing visual information, and the resultant signal is analyzed by computer.

Neural pathways connecting the eye to the visual areas of the brain's cortex strongly favor the very center of the eye's visual field, which is used to discern fine detail. By selecting the strongest signal detected, the apparatus decides where the person is looking. This method can drive various controls, including a word processor.

To use a 'trode-driven word processor, one gazes at a screen which displays the alphabet. Since the eye responds better to moving or flickering images, the letters alternate in red/green colors at a distinctive fre-

quency. To pick a letter you stare at it. The signal travels from the back of your eye to your brain, then through the electrode to the computer and finally is displayed on the screen as an asterisk next to the presumably correct letter. Gazing at the "delete" symbol undoes an erroneous response. A message is spelled out by looking at the displayed screen's letters in sequence. Stored in a temporary buffer, the text can be sent through a speech synthesizer to produced a spoken message.

One is not confined to mere speaking with one's eyes. With the system in place, any commercial software product can be driven with a mean look.

The chief experimenter to contact for further information is Dr. Erich Sutter at the Smith-Kettlewell Eye Research Institute, 2232 Webster Street, San Francisco, CA 94115; 415/561-1620.
    —Kevin Kelly
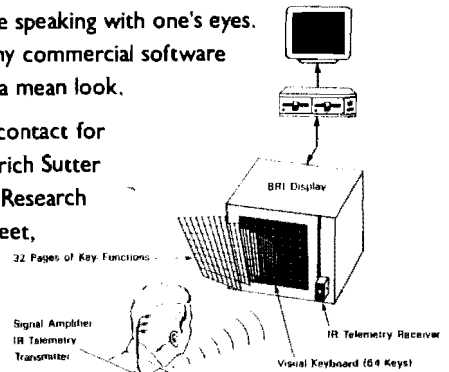
Electrodes are planted in the skull just outside the brain's membrane in order to filter out the electrical interference from neck and face muscles.

Lance Meagher, a severely disabled doctor in Oregon, has had a degenerative brain disease (ALS) in his cortex for the past twelve years. He can now spend up to ten hours a day writing on his 'trode-driven word processor. Meagher hopes to resume aircraft flying someday.

VIRTUAL WORLD SICKNESS

I always get a nice rush when I hear about the emergence of the first ailment of a wholly new concept. It means that the idea has some reality. A dream is not real until it has disadvantages, tradeoffs, and side effects. Listen to this report in the Feb. 20, 1989, issue of *The New York Times* titled "Sickness in the Cockpit Simulator." Artificial reality has arrived.

"The incidence of an illness known as simulator sickness appears to be growing among military pilots who spend long sessions at sophisticated computerized airplane simulators. Although the causes remain poorly understood, the illness appears to be related to conflicting sensations.

decade as simulators proliferated and became more elaborate. Navy surveys of 10 different simulators show symptoms of simulator sickness in 10 percent to 60 percent of pilots; an Army survey of its AH-64 Apache helicopter simulator, one of the newest and most sophisticated, showed a 44-percent rate of incidence.

[...] "The malady is both polygenic and polysymptomatic; that is, it has many causes and produces many different symptoms in different individuals. But most experts agree that the root of the problem is "cue conflict," which occurs when the body's senses receive information in conflict with each other or with the mind's expectations based on experience.

[...] "Time lags in the system throw some people off, and a disparity between the motion experienced in real aircraft and that of the simulator can also produce simulator sickness. This may explain survey results showing that experienced pilots, who have a more deeply ingrained memory of aircraft behavior, more often experience symptoms than aviators with limited flying time.

[...] "The syndrome has become more prevalent as simulators have improved, leading some researchers to believe that the closer a trainer mimics reality, the more disturbing the disparities become. As long as a visual display remains cartoonlike pilots do not take

Virtual Reality at Work

WHAT THE ASTRONAUT SEES

The New York Times/Steve Hart

"The problem has become severe enough that the Army, Navy and Marine Corps now restrict their pilots from flying real airplanes for periods ranging from 6 to 24 hours after a simulator session because of flashbacks, visual distortions and physical disorientations reported by pilots.

"People who've spent a lot of time on simulators have difficulty driving home," said Herschel Leibowitz, a psychologist at Pennsylvania State U. who is considered an expert on simulator sickness and related problems.

[...] Simulator sickness was first documented in the late 1950s, but its incidence has mushroomed in the past

it seriously, but when it becomes compellingly real, conflicts arise."

It's that last statement that does it for me. Reality as a binary state: either, or. One wonders, to paraphrase the beer commercials, how real real has to get!
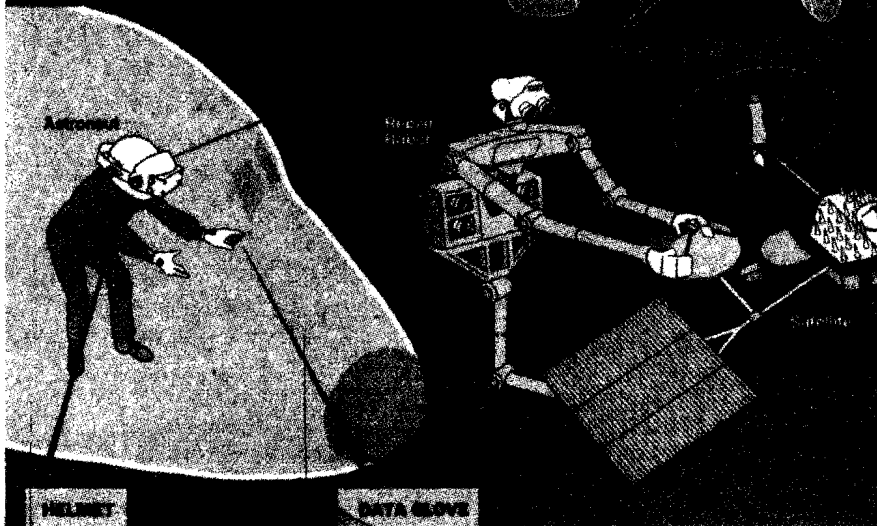
—Kevin Kelly

I can see it coming. Kids will be competing to see how many violently different realities they can handle simultaneously, and us old fogies who can only manage one or two per day will be truly old and in the way. Don't jostle me, boy.

—Stewart Brand

AUTOCEREBRESCOPE LANDSCAPES

An autocerebrescope is sort of an ultimate biofeedback machine, one that would allow you to watch your own mind in real time. It is an imaginary, though not unlikely, machine devised by philospher Daniel Dennett. I immediately wanted this thing to work in cyberspace. What you do is put on a heads-up helmet and walk into your brain as it is going, and poke around watching it purr or tick or hum or whatever it does. Minsky, in *The Society of Mind,* finds this kind of fiddling extremely dangerous, and I bet it is. You can imagine getting stuck in some amazing feedback vortex, where you are mesmerized by something that won't let your mind go away to the point where you need to go to wake up. *OOO*ooo . . .

"Him? Oh, he's on a Catch-22 cruise. He went down to watch his stem and never came back." Nonetheless, it would be a world fit to explore. Perhaps you'd have to have a buddy system going, where you never go alone, and going alone becomes the ultimate metaphor for foolishness. "He's so dumb he watched the back of his eyeballs by himself."

The autocerebrescope cyberspace would not merely model the brain. Rather it would be an interactive cyberspace that would visualize mind functions and lay them out in a variety of landscapes. Folks might have their own interpretation of what their mind looks like. Gardens. File cabinets. Frontier towns. "Would you like to come up to my apartment and see my mind? Excuse the mess in my id, please." Visiting other minds might be like sex, but there are (masturbatory?) thrills that must only be found in roaming through one's autocerebrescope cyberspace.   —Kevin Kelly

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OFFICE TREADMILL

I'm not sure whether this apparatus is a sensible solution for desk-bound knowledge-workers or a devilish purgatory for having an obsolete body. The inventor offers a push-pedal version as well as bibliographies of research which suggests more office efficiency while exercising. Let us know whether this contraption brings you to 2001 or to 1984.   —Kevin Kelly

Information free from: Active Offices Systems, 9913 Grayson Avenue, Silver Springs, MD 20901; 301/593-4304. ■