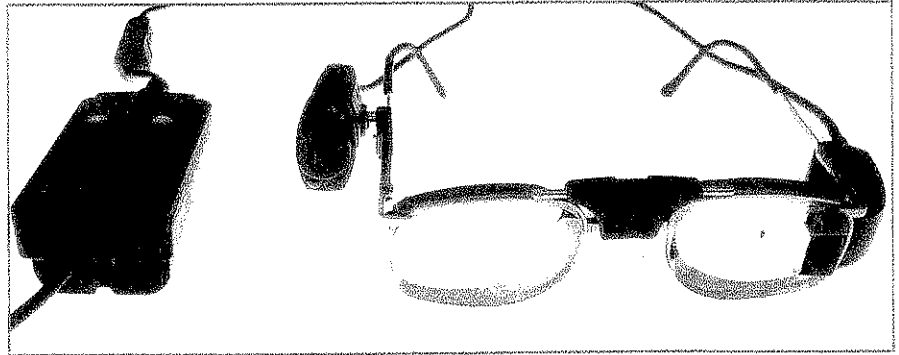


A view of what will come

Diseases such as glaucoma and retinitis pigmentosa progressively destroy eye tissue, causing patients to lose peripheral vision. As a result, they have tunnel vision. Patients who have tunnel vision usually use a long cane to avoid stumbling over obstacles. Devices that offer a minified image of a patient's field of view have been developed, but they cause a significant loss of resolution and a change in perceived visual direction. Therefore, they usually are rejected by the patient.

Toward the creation of a better device, Dr. Eli Peli and colleagues at Schepens Eye Research Institute, a Harvard Medical School affiliate in Boston, are developing a video system with the help of



On these glasses are a tiny camera that captures ambient images and a miniature computer that processes them into information that contains only the edges of the environment. This information is transmitted to an LCD element in the lens of the glasses, which displays images of the edges, enabling patients with tunnel vision to peer at the broadcasted images and to use their natural central vision to see through the glasses.

MicroOptical Corp. of Westwood, Mass. The video system continuously displays images of the periphery of a patient's environment onto a pair of spectacles. A patient can then use his normal central vision to see through the glasses while viewing the displayed edges, a principle that Peli calls "spatial vision multiplexing." He believes that a device based on that principle would not reduce resolution or disorient patients because they can still use their central vision to peer through the display.

The device consists of off-the-shelf parts, including a tiny image processor from DigiVision and a miniature Sony camera that is mounted on the glasses. Working according to National Television System Committee standards, the camera captures video of the patient's environment. The computer processes this information, so that only the edges of the environment are relayed to the display. Using technology developed by MicroOptical, an internal LCD element displays images of the edges at a resolution of 320×240

pixels. The glasses update those images 30 times per second.

To test the device in a search task, the investigators projected letters framed in circles or triangles at a random position on a screen for 12 subjects with tunnel vision to identify. These letters initially appeared in the patients' blind area. When they found and recognized the target, they clicked a mouse button and identified the letter verbally.

The head-mounted display significantly improved the directness of the search and reduced the search time by 22 percent for patients with a visual field between 10° and 15° . Visual acuity was not reduced, so the researchers concluded that the resolution was not compromised.

Recently, the scientists tested how the device might perform in a collision-avoidance task. In this test, patients walked on a treadmill while viewing a virtual-reality shopping mall. Images of Peli in a ski suit periodically popped up in the patients' peripheral vision area, testing their ability to detect the obstacle and deter-

mine the possibility of collision.

Eventually, the investigators want to test the device outside. Peli said that he might employ orientation and mobility trainers of the blind to evaluate the performance of subjects when they are wearing the glasses outdoors. Because these instructors are already certified to protect the blind and evaluate their performance, the need to train researchers and to develop a method of evaluation would be eliminated.

Before placing the spectacles on the market, Peli would like to further improve them. The original device was connected to a shoebox-size controller that the patient had to carry, but the researchers have since reduced the controller size to that of a cigarette pack. Peli said that the device may be ready in five years and may cost \$1000. The investigators also have developed a low-light version of the glasses that employs an infrared camera. □

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