

MIT TECH TALK

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Poet, ophthalmoscope find serendipity

■ By Elizabeth A. Thomson
MIT News Office

An MIT poet has shown that a device for diagnosing eye disease could allow some people who are blind, or visually challenged like her, to access the Internet, read simple texts, or see the face of a friend or loved one.

A recent test of the device over the Internet also raises the possibility of using it in telemedicine. With such a capability, doctors working in one location could observe the retina of a patient many miles away.

Elizabeth Goldring, a poet at the Center for Advanced Visual Studies (CAVS), was first introduced to the scanning laser ophthalmoscope (SLO)

during a visit to her doctor about 10 years ago. At the time she was blind (surgeries have since restored some of her vision).

To better examine Ms. Goldring's eyes, her doctor asked her to peer into the SLO. With the machine he projected an image directly onto the retina of one eye, past the hemorrhages on the front of the eye that contributed to her blindness (at the same time he observed an enlarged image of the retina on a monitor). The idea was to determine whether she had any healthy retina left. It turns out that she did, and was able to see the image he projected—a stick figure of a turtle.

But the turtle wasn't very interesting, Ms. Goldring remembers. So she asked her doctor to write the word

"sun" and transmit that through the SLO. "And I could see it!" she said. "That was the first time in several months that I'd seen a word, and for a poet that's an incredible feeling."

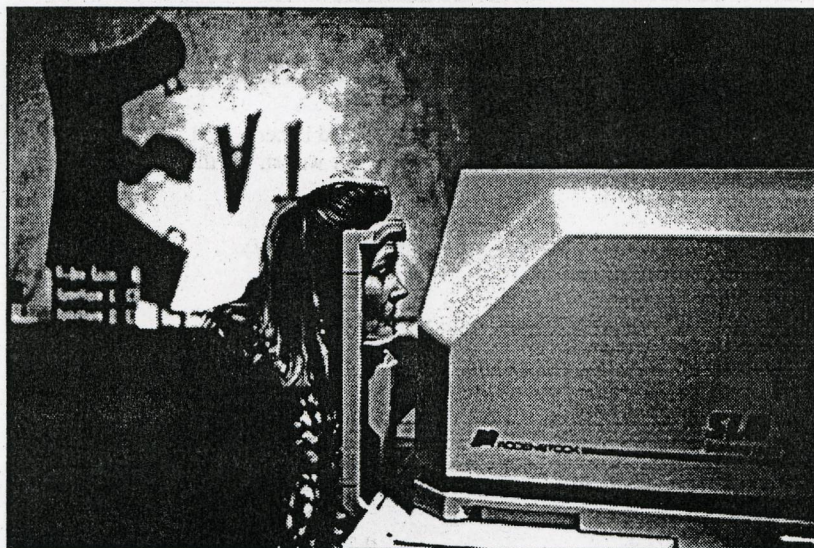
Realizing the potential of the SLO for nonmedical applications such as viewing simple texts, Ms. Goldring contacted Robert Webb, the inventor of the SLO and a senior scientist at the Schepens Eye Research Institute in Boston. Their collaboration has since led to stunning demonstrations of the power of the tool, including one in 1990 when Ms. Goldring saw the face of a close friend for the first time. (Although surgery has given her back some vision, faces still appear to her as "moons" with slight demarcations for where the eyes, mouth, and nose should be.)

Ms. Goldring has also designed a "visual language" for the SLO consisting of short words that incorporate graphics and symbols that illustrate the words' meanings and make them easier to see. She is using this language to create short texts, such as poetry and poem animations, that can be enjoyed by people who are visually challenged.

INTERNET DEMONSTRATION

Most recently Ms. Goldring, Dr. Webb and other researchers including Dean William J. Mitchell of the School of Architecture and Planning demonstrated that the SLO can be hooked up to the Internet, the world-wide network of computers. The event involved a teleconference over the Internet between Ms. Goldring at the CAVS and a group of people at Dean Mitchell's office down the street.

Using software that provides live video over the Internet, the people at
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Poet Elizabeth Goldring, who is visually challenged, peers into a scanning laser ophthalmoscope which uses a laser beam to project words onto her retina. On the wall behind her is an inverted image of what she is seeing, the word "Eat," in which the first letter is rendered in a visual language she has created to enhance understanding. The upper and lower arms of the letter "E" are lips and the middle arm is a tongue.
Photo by Donna Coveney

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Dean Mitchell's office were able to observe Ms. Goldring's retina on a computer screen as she, in turn, looked at words from her visual language through the SLO. The group, which included Dr. Lloyd Aiello, Ms. Goldring's ophthalmologist, essentially watched Ms. Goldring's retina read. (Dr. Aiello is chief of the William Beetham Eye Unit at the Joslin Diabetes Center.)

Dean Mitchell, Dr. Webb and Dr. Aiello also turned a video camera on each other's faces, and successfully sent that information over the Internet, through the SLO, and onto Ms. Goldring's retina. It was the first time that Ms. Goldring had seen any of their faces.

"There seems to be some potential for people with low vision to see over great distance," Ms. Goldring concluded at the end of the demonstration.

Dr. Webb credited Ms. Goldring's persistence and ties to MIT for the success of the demonstration. "MIT is a uniquely appropriate place for this sort of thing to happen," he said. "Here at the hospital I have limited technological resources, whereas MIT has substantial technological resources in many directions."

Ms. Goldring, too, said that MIT is appropriate for her SLO work, noting that the CAVS itself is "dedicated to shared research among artists, scientists and engineers." (Ms. Goldring has been exhibits and projects director at CAVS for several years.)

The SLO link to the Internet was a direct result of Ms. Goldring's MIT connections. It began, Dr. Webb recalled, when Ms. Goldring asked him how to connect the SLO to a Macintosh (such a connection would make it easier to transmit images). "I told her I couldn't really help her, and she'd have to find the local guru for Macs," Dr. Webb said. "She did just that, and he [Rob Smyser, manager of the Computer Resource Laboratory] solved the problem."

Soon afterward Dean Mitchell dropped by the CAVS to see Ms. Goldring's work with the visual language and the SLO-Mac setup. Together they recognized the potential for the Internet, which in turn triggered the demonstration.

Regardless of the success of the demonstration, both Ms. Goldring and

Dr. Webb acknowledge that the SLO has limitations. For example, it's very tiring for a visually challenged person to use the machine to read—Ms. Goldring had to take frequent breaks during the demonstration. Commented Dr. Webb: "Visually challenged people will never be able to read the Wall Street Journal with it."

With those limitations in mind, however, Dr. Webb noted that the machine could still be used "to allow, say, a grandparent to see his new grandchild's face."

VISUAL LANGUAGE

The visual language Ms. Goldring is developing is designed to "help people keep the visual sense stimulated even when it's been damaged," she said, which is important because "if you don't use it, you lose it."

"I know it's something I want," she continued, "so I assume there are other people who would want it, too."

This language consists of word images, or words that often incorporate graphics to make them easier to see. For example, ordinarily the word "sun" is difficult for the visually challenged to read because of the letters' uniform curves. Replacing the U with a graphic of the sun helps solve this problem because it "separates the

curves," Ms. Goldring said. The graphic also quickly emphasizes the meaning of the word.

Because it is difficult for the visually challenged to read large amounts of text, Ms. Goldring is primarily using the visual language to create poetry and poem animations. "Poetry can be a succinct way of saying a lot," she said. She noted, however, that UROP students working with her in developing the language have used it to create a recipe for ziti and instructions for escaping from a fire. "So I recognize there are other texts you can do [with the language]," she said, "but I think poetry has the best chance of stimulating the visual sense."

UROP students involved in the work are Sinyan Law and Christopher Graczyk, both seniors in architecture; Kazuhiro Ninomiya, a junior in biology, and Peter Cho, a sophomore in mechanical engineering.

The latest demonstration of the SLO has shown its potential for a variety of new applications, but there are several questions and problems that remain to be answered.

For example, the researchers don't know the percentage of people who could potentially benefit from the device. "It may be uniquely useful for

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POEMS BY ELIZABETH GOLDRING

These poems by Elizabeth Goldring were published in her book *Laser Treatment* (Blue Giant Press, Boston, 1983). They were not written for the scanning laser ophthalmoscope.

Laser Treatment

*He is nailing light
into my eye
one nail at a time
219
says I'm doing fine*

*He etches an eye
on my eye:*

*eclipses blisters
sun spots grey
suns spiders*

*cobblers
jewelers
thieves
go blind*

eye's a navel

*in Guadalajara
boulevards are
strings on a package*

—West Newton
January 1980

Disappearance

*things
are disappearing
branches from trees
pieces of words
lines in faces*

—West Newton
Spring 1979

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only a few kinds of visual deficits," Dr. Webb said. "We need to do a study to find out how generally useful this approach would be."

Also, the SLO is currently too bulky and expensive (the central piece of the device costs \$100,000) for use by the general public. That doesn't preclude a smaller, more affordable version, but it will take considerable

reengineering. Dr. Webb suggested that other collaborations with MIT might help solve these problems.

It's interesting to remember that all of this started because of a poet who wouldn't take no for an answer. "By the force of personality, Elizabeth has done something that has sent ripples through the world-wide SLO research community," Dr. Webb said. "I keep telling her that the SLO won't work

for a particular application, and she keeps showing me that it can."

Work on the visual language is supported by the MIT Council for the Arts. The initial work that led to the SLO project was funded by the Diabetes Research and Education Foundation. In addition, Cannon Inc. lent MIT the SLO used in the demonstration (it has since been returned), and Apple provided computers for the demonstration.