Museum Competition Entry Goes on the Road

BY MICHAEL G. LITTMAN

Do you want to help the public learn about optics? Entering OSA's Science Museum Competition may be your ticket. One of last year's entries is now part of a major traveling exhibit about the brain. Developed by a team at the Franklin Institute Science Museum, the exhibit, "It's all in your head," opened for its first three-month installment in Philadelphia in mid-June. After Philadelphia, the exhibit will tour many major U.S. cities, including Minneapolis-St. Paul, Boston, Chicago, and Los Angeles.

The "See your own retina" device developed for the OSA contest is one of about 50 that make up the exhibit and is highlighted in the section that discusses neurological exams.

The story about how this device came into being reveals the complexities of developing a new exhibit. Three years ago, I was introduced to Bill Booth, exhibits director at the Franklin Institute. I asked him if science museums would be interested in new ideas for optics devices for museums. He assured me that they would and with that I launched the first annual competition at OSA's 1990 Annual Meeting. Bill was a judge and found the experience rewarding, as did the other judges, the entrants, and the OSA members who viewed the entries.

When the brain exhibit was funded by NSF a few months later, Bill suggested adding the retina demonstration from the OSA contest. This device was a retinal entoptoscope that allowed the operator to examine the blood vessels of the eye.

As part of the development process, the device was obtained on loan for evaluation by the brain exhibit team. Unfortunately, the team rejected the device for the exhibit because it did not show the retina itself; rather, it showed the blood vessels of the retina. It was an interesting device, they thought, but not directly relevant to the exhibit. While this process was going on, I was reviewing the entries to the second annual competition and came across one from Murty Mantravadi at Northrop. He proposed a device in which one

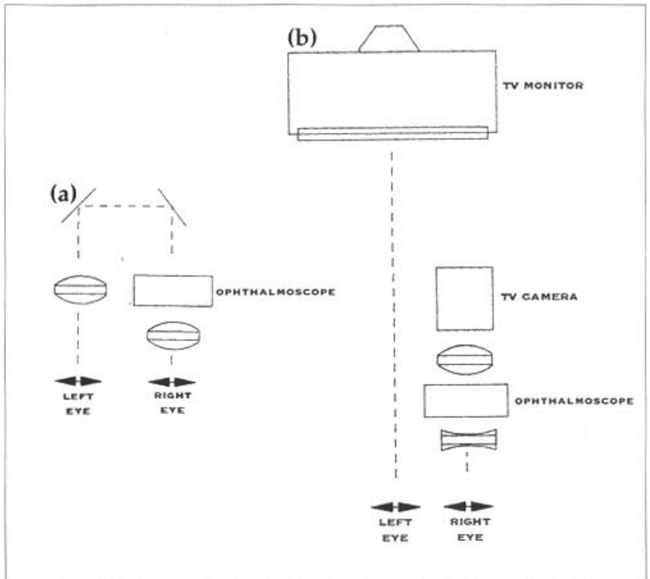

FIGURE 1. (a) ORIGINAL CONCEPT OF THE DEVICE. (b) EXHIBIT VERSION OF THE DEVICE.

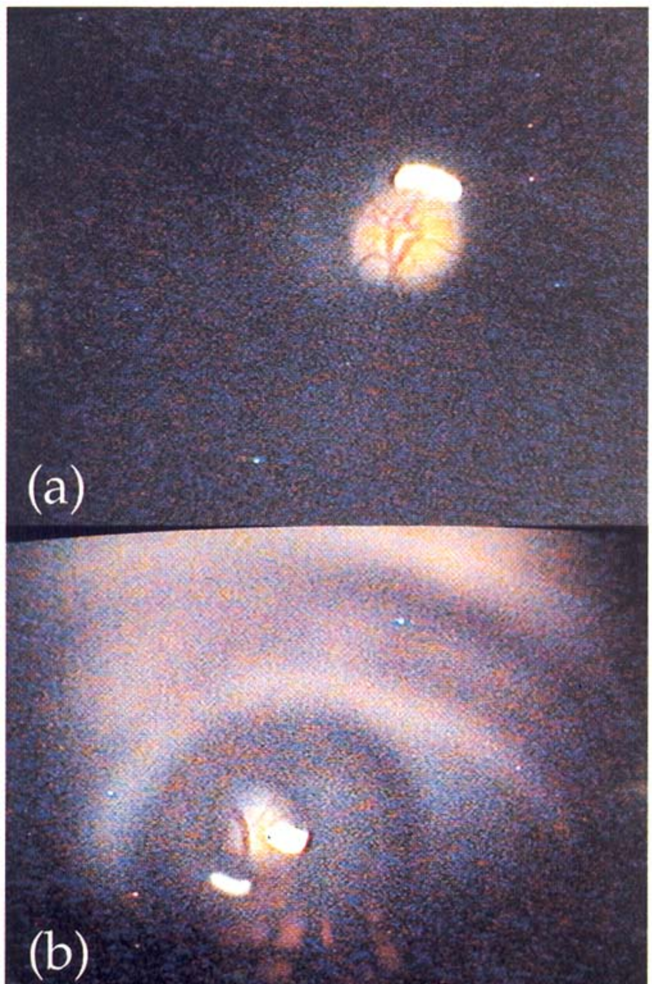

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FIGURE 2. (a) THE AUTHOR'S EYE THROUGH THE DEVICE. (b) THE AUTHOR'S OPTIC DISC USING THE DEVICE.

eye is used to examine the retina of the other via mirrors and a coaxial light source. I relayed the idea to the brain exhibit team and they liked it enough to encourage me to build a prototype (see Fig. 1a). None of us was really sure that the device would work, but it did. After the team saw my prototype, we decided to proceed.

I enlisted the assistance of Princeton undergraduate Amy Park and refined the idea so that the device would be acceptable in the museum environment. We had to address issues such as visitor throughput (the original idea allowed only one person to experience the device at a time), ease of use, safety, and maintenance. Maintenance is actually a very important factor since the museum environment is harsh and broken devices detract from any exhibit.

While the final device looks quite simple, as shown in Figure 1b, it actually went through at least 30 different variations and represents a compromise to satisfy many design constraints. There were forms of the device that gave a wider field of view (essentially, an indirect ophthalmoscope), less corneal reflection, and crisper images. Each was rejected for reasons such as problems with ease of use or the need for excessive light intensity.

Safety was one of the most important factors. We decided to incorporate an actual direct ophthalmoscope into the device rather than make our own because it is an FDA-approved device certified safe for use with the eye. As a further precaution, brain exhibit team leader Roberta Cooks and I flew to Boston to visit Rob Webb of the Eye Research Institute to discuss device safety. As a result of this visit, we decided to add a filter that blocks wavelengths shorter than 520 nm so that the device is safe for continuous use for periods of several hours.

The final version is a fixed-focus Galilean telescope that spans a modified Welch Allyn direct ophthalmoscope. The telephoto lens of a small color CCD camera is the positive lens of the telescope. The operator looks into the negative lens of the telescope with one eye and sees his/her retina in a TV monitor some five feet away. Figures 2a and 2b how the author's optic disc using the device. The monitor needs to be far away so that the pupil of the eye does not constrict too much. The telescope is focused roughly at infinity, which gives a clear view of the retina for individuals with normal vision. The Galilean configuration increases the depth-of-field so that the device also works with people with myopia and hyperopia. It also works with people with contact lenses and glasses, although the reflection from glasses can be a problem. The light level is low enough so that the user's eye is not significantly bleached by its operation. The entire unit is on a rotary platform that allows the user to pan his/her own retina. It also can be used with either eye.

Come to Philadelphia this summer and see the device and the exhibit, or wait for it to come to a city near you. Also, consider developing your own ideas about devices to boost optics and enter them in OSA's museum competition. Entries will be accepted up to the postdeadline submission (see page 69). See the ad in the OSA Annual Meeting/ILS-VIII Supplement for further details. We need more participation to keep this important activity alive.

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