NIGHT VIEWING GOGGLES FOR NIGHT-BLIND TRAVELERS

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INTRODUCTION

A pair of Night Viewing Goggles (Fig. 1), developed by the Electron Tube Division of International Telephone and Telegraph Corporation [a] for military use, was tested on one category of low vision, using one case study. It is hoped that funding will be forthcoming in order that more scientific field testing may be performed. The following case study will tell what the experimenters (E), at the Western Blind Rehabilitation

FIGURE 1

[a] 7635 Plantation Road, Roanoke, Va. 24019.

Center, feel is a justification for further research and development. E's feel that, with certain modifications, these goggles will prove invaluable for all low-vision night travelers whose rod vision has deteriorated.

The goggles themselves consist of various electronic wafers in combination with very specialized optics mounted in a molded plastic headset. The wafers include a photocathode deposited on a fiberoptic input window, a microchannel-plate current amplifier, and a green phosphor screen fabricated on an output window of twisted fiberoptics. Images that are focused on the fiberoptic input window are converted, by means of the photocathode, to electron images, which are in turn amplified by the microchannel plate. The image is rendered visible by the phosphor and then is inverted for viewing by means of a fiberoptic twist in front of the output window.

There is a relatively simple way of understanding how the Night Viewing Goggles work. The scene being viewed is focused onto the wafer by a series of lenses. At this point, the image is electronically converted to an electron image. This electron image is then amplified and converted back to a visible image in the green-yellow portion of the spectrum. The image is then inverted for viewing by means of a 180 deg. twist in the fiberoptics. Finally, the image is viewed on the output window in much the same manner as one would view the image on a TV screen.

THE TESTS

The subject (S) has been diagnosed from birth as having retinitis pigmentosa and has bilateral cataract extractions. His visual acuity was last measured at 20/200. His peripheral field is measured at approximately 4–5 deg. S may be considered totally night-blind as he is only able to see direct (projected) lights. He is unable to detect curbs without the use of a cane.

The actual testing of the instrument was carried out in a rural-residential setting behind the Veterans Administration Hospital in Menlo Park, California. The time was 7:20 P.M., November 19, 1971. The lighting consisted of three street lights at intervals of approximately one block. The experimenters and subject were positioned approximately one-half way between two of these lights. The only other lighting consisted of one house light, starlight, and moonlight, The light level was approximately one footcandle.

For the first part of the experiment S was positioned on one side of the street while E stood on the other side, approximately 25 ft. away, asking S to describe various arm positions and to count the number of fingers E would hold up. S experienced some difficulty at first, but when the ambient light level was increased with a flashlight, thereby increasing the contrast at the output window of the device, S was able to see the experi-

menter. As S proceeded through the test, it was found that he was able to see enough detail to determine whether E's hand faced palm forward or knuckles forward. He also counted fingers with the hand held off to one side of the body or held in front of the chest.

After spending approximately 20 minutes doing these types of tasks, S was asked to walk along the side of the road and describe the scene. He was able to detect trees, fences, and a car parked in a driveway at a distance of 15 yards. The return trip to the car was done using the cane only. During the return trip, it was quite evident that S was no longer able to see anything except direct lights.

Late that evening, S tried a relatively simple trip in a typical residential area in Menlo Park. Again, S was able to see cars in driveways, trees, obstacles in his path, and intersecting sidewalks. Again, on the return trip using only his cane, he saw only direct lights which helped in guiding him back to the starting place.

Since the goggles were considered a success as a low-vision aid, it was decided to make a comparison study with the same subject under daylight conditions. A third test was conducted with approximately the same distance between the subject and the experimenter. S counted fingers, but only with backgrounds of higher contrast, such as a green bush or dark green grass. However, S was unable to count fingers with a background of lower contrast, such as sun-browned grass.

A final test was conducted indoors using a green chalkboard as a background. S counted fingers at artificial light levels equivalent to those in the average living room. However, without the chalkboard as a background, S experienced considerably more difficulty. It was concluded that the ITT Night Viewing Goggles significantly aided this low-vision traveler in these travel situations.

As a followup, the Army Night Vision Development Center, Ft. Belvoir, Va., loaned the Western Blind Rehabilitation Center a set of goggles for a period of 1 month. Unfortunately, during part of this month subjects with suitable vision were not available. However, a screening evaluation for five subjects was set up during the last 10 days. The tests were conducted in a dark room approximately 10 x 30 ft. Subjects stood approximately 15 ft. from the test objects, consisting of various eye charts on a light colored wall. Three students read numbers of Feinbloom 300, while the others could not see even the output screens on the goggles. The best visual acuity for all five subjects is listed in Table 1.

CONCLUSION

It was concluded that the Night Viewing Goggles show potential for night blind travelers. The experimenters are currently attempting to arrange for further testing, particularly with a monocular device. They

are also researching the long-range development costs that would be involved in making the design modifications, and are seeking some projections concerning the unit cost if research shows that the devices are a significant travel aid for night-blind travelers.

TABLE 1.—*Description of Subjects' Vision*

Subject	Visual acuity	Visual field	Cause of blindness	Able to benefit from goggles
1	OD LP OS 10/180	Less than 20° central	Glaucoma Diabetic retinopathy	Yes
2	OD LP OS 10/160	2° central	Glaucoma	No
3	OD 5/180 OS LP	Less than 5° central	Secondary to trauma	Yes
4	OD 5/200 OS 5/225	7° central 3° temporal	Retinitis pigmentosa	No
5	OD LP OS 10/180	Temporal Hemisphere OS	Macular degeneration	Yes