

Telescope embedded in glasses lens promises to make driving easier for visually impaired

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Glasses embedded with a telescope promise to make it easier for people with impaired vision to drive and do other activities requiring sharper distance vision. Schepens Eye Research Institute scientists describe the advantages of these innovative glasses over earlier devices in an article published in the May/June issue of *Journal of Biomedical Optics*, mailed in print form to subscribers this month.

"This new design has several advantages," says the inventor of the glasses, Dr. Eli Peli, who is a senior scientist at Schepens Eye Research Institute, a professor at Harvard Medical School, a low vision expert, and the senior author of the paper. "One major advantage is the appearance of the glasses. Because they look almost like normal everyday spectacles, it is more likely that visually impaired people will use them," says Peli, who adds that the glasses are easier to use than existing telescope models because of a wider magnified view and easier access to that view. Most importantly, shifting the magnified view up leaves the unmagnified view of the road unobstructed, which is important for safety and facilitates navigation.

Tiny telescopes (known as Biotics) mounted on glasses to help people with visual impairments have been in existence for about 60 years. They are permitted for use in driving by 39 states. These telescopes enable a visually impaired driver to read road signs and see other objects essential for safe driving, while also viewing the larger scene in front of the vehicle. In previous designs, the telescope is mounted through the top of the regular lens or above the frame. In both cases, the telescopic

eyepiece is above the wearer's pupil, requiring the driver to tilt his/her head up and down rapidly to view alternatively the magnified and unmagnified scenes. Drivers use the telescope only for a very small fraction of the driving time, looking through the regular spectacle lens most of the time.

While these bioptic telescopes are useful and helpful, many potential users have resisted them because of their strange appearance, and because the magnified view through the telescope is narrow.

In the newer glasses, Peli and his co-inventor Dr. Vargas-Martin from the University of Murcia, Spain, designed a wide-field telescope made of straight and curved mirrors built completely within the spectacle lens,

The *Journal of Biomedical Optics* article describes the process that Peli and his team went through as they created and tested various prototypes of telescopes leading to the design that would be most effective and comfortable for patients with low vision. They started with a telescope made with mirrors and lenses to prove the image shifting principle. To embed the whole telescope inside the spectacle lens they had to obtain the magnifying power from curved mirrors instead of lenses, as mirrors maintain their power when embedded inside the spectacle lens, while the lenses lose their power when not in the air. Regular spherical mirrors can not be tilted without loss of focus, so they constructed a version made with tilted parabolic mirrors. The latter worked well and was in focus, but the images were distorted enough due to the parabolic shape to cause a disturbing effect during head movements. The latest design they constructed is based on spherical and flat mirrors with the flat mirrors implemented as tilted beam splitters that use polarization to reduce light loss.

Says Peli, "The short height of the actual magnifier, its position, and inclusion of a small tilt of the last flat mirror (the one closest to the

user's eye), enables the wearer to simultaneously view the magnified field above the unmagnified view of the uninterrupted horizontal field.

Not only will the new glasses improve the cosmetics and usefulness of this type of device, the in-the-lens design will make it possible to mass-produce the telescopic magnifier as a standard spectacle lens blank and allow an individual's prescription to be added using the standard procedure for grinding regular spectacle lenses. This process should also reduce the price of bioptic telescopes

The next step for the team is to find a corporate partner to manufacture the lens blanks and distribute them to the public.

As the population ages and millions of American face limited vision because of eye disorders, such as age-related macular degeneration, the need for this type of vision aid will increase dramatically. The telescopic glasses may also find use in other markets. It may be used as hands-free opera glasses and may be of interest to hunters, police or military personnel who would like the ability to quickly and easily achieve a hands-free magnified view.

Source: Schepens Eye Research Institute

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