

## Improving mobility in blind and partially-sighted individuals with smart glasses.

Dr Stephen Hicks, Research Fellow in Neuroscience and Visual Prosthetics, University of Oxford.

Holder of Royal Society Brian Mercer Award for Innovation.

There are over 2 million people living with sight loss in the UK, and more than 300,000 are registered blind. Blindness prevents everyday functions such as reading, recognising people and walking around the environment with confidence but is not usually a total loss of sight.

### Types of sight-loss

The eye is an amazingly intricate sensory organ. It has a sensitive light receiving layer called the retina, a fine focusing lens in the front called the cornea, and of course a large powerful brain to collect, calculate and construct our field of view. There are many ways for sight to become degraded. If the cornea becomes cloudy, as in the case of cataracts, vision can become foggy and dark. Fortunately in many countries this is easily treated by replacing the lens in a simple procedure. Unfortunately, damage to the retina is far more difficult to treat. In the UK the most common cause of sight-loss is age-related macular degeneration. In this case a blind spot forms in the centre of the retina, the region we use for reading, threading needles and recognising faces. This blind spot expands over years to block out more and more sight. In other diseases, such as glaucoma, the outer regions of sight become degraded, leading to tunnel vision and night blindness and ultimately total sight loss. Many other forms of blindness also exist (see Figure 1).

#### Common types of sight loss



Cataract



Diabetic retinopathy



Macular degeneration



Glaucoma

Figure 1: Common types of sight loss (Image courtesy of Dr Stephen Hicks)

### Sight assistance: A new approach

Common to many of these conditions is the residual vision that remains, even when sight becomes too low to be useful. Residual vision can be simply the ability to detect bright lights and see large movements. The key to our project is that we are trying to use this residual vision to allow people to have a more intuitive visual understanding of their immediate environment.

### Improving mobility

For many people with blindness, independent mobility becomes a serious issue. The RNIB estimate that less than half of all people with severe sight loss attempt to leave their houses every day. Bumping into obstacles is not only painful and embarrassing but can also lead to dangerous falls and hospitalisation. The options for helping mobility are few: A long cane can help find walls and trip hazards, a guide dog can lead people through complex situations, but so far nothing can restore the innate sense of the size, shape and position of that sight provides. We have designed our glasses to do exactly this.

We have developed a pair of glasses that produce a bright, high contrast view of nearby objects and obstacles (Figure 2).

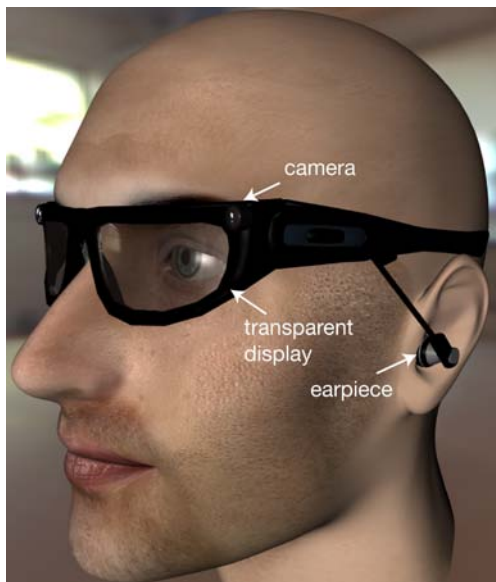


Figure 2: Pair of smart glasses with special built in cameras. (Image courtesy of Dr Stephen Hicks)

The glasses have a special camera built into the frame that uses infrared light to determine the size and position of objects directly in front. This information is processed by a pocket-sized computer which transmits a depth map to small screens in the glasses that makes nearby objects appear bright (see Figure 3).

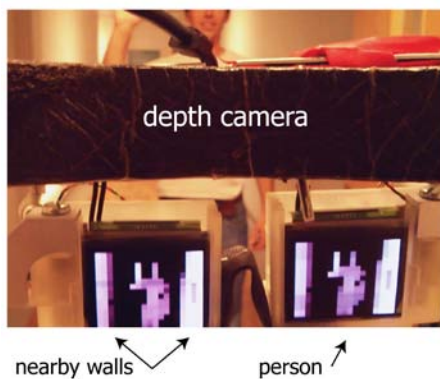


Figure 3: Image showing depth map that make objects appear bright. (Image courtesy of Dr Stephen Hicks)

Through the glasses, nearby people and obstructions become easy to see even by people with a minimal amount of residual vision. We are now working on several improvements such as making the displays transparent so that users can see the world as they normally would and experience the benefit of obstacle detection at the same time (see Figure 4).



*Figure 4: Prototype of transparent smart glasses. (Image courtesy of Dr Stephen Hicks)*

Our research is funded by the Royal Society and the NIHR i4i. We intend to start manufacturing our first version of these glasses shortly after at an affordable price towards the end of 2014.

## Further information

For more information on the smart glasses project visit [Assisted-Vision.com](http://Assisted-Vision.com)

Information on Dr Stephen Hick's research interests visit the [University of Oxford departmental web page](#).

Visit Dr Hick's Google+ profile page - [goo.gl/A95XO6](https://plus.google.com/+StephenHicks), which chronicles developments and updates in the fields of computer vision and wearable displays.