How blind can 'read' shown in new research

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This is Ella Striem-Amit of the Hebrew University of Jerusalem. Credit: The Hebrew University of Jerusalem

A method developed at the Hebrew University of Jerusalem for training blind persons to "see" through the use of a sensory substitution device (SSD) has enabled those using the system to actually "read" an eye chart with letter sizes smaller than those used in determining the international standard for blindness.

The eight congenitally blind participants in the Hebrew University test group passed the conventional eye-exam of the Snellen acuity test, technically surpassing the world-agreed criterion of the World Health Organization (WHO) for blindness and moving them to the level of (lowvision) sighted. These results were published recently in the PLoS One Journal in the US.

The Snellen test is a standard visual test in which the patient views a chart which contains the letter E facing four different directions and in various sizes. The patient sits at a specific distance of 20 feet (6 meters) and has to determine the direction of the E's, and according to the smallest size he can read, his visual acuity is determined.

Normal vision is considered 20/20, referring to both the distance and size of the symbols on the eye chart. The congenitally blind participants in the Hebrew University test group reached a median level of 20/360, meaning they could identify letters from a distance of 20 feet that a normally sighted person (with normal vision) would be able to identify from 360 feet. The 20/360 result is better than the World health organization criterion for blindness, which is 20/400.

The Hebrew University researchers -- Dr. Amir Amedi, of the Edmond and Lily Safra Center for Brain Sciences and the Institute for Medical Research Israel-Canada at the Hebrew University, and Ph.D. student Ella Striem-Amit -- have been using a sensory substitution device developed by Dr. Peter Meijer of Holland and called "The vOICe." The device converts images from a miniature camera into "soundscapes," using a predictable algorithm, allowing the user to listen to and then interpret the visual information coming from the camera.

Remarkably, proficient users who have had a dedicated (but relatively brief) training at Dr. Amedi's lab were able to use SSDs to identify complex everyday objects, locate people and their postures, read letters and words, and even identify facial expressions.

Recently, the ability to extract and "translate" fine visual detail in this manner was demonstrated in an experiment led by Striem-Amit in which, for the first time, congenitally blind vOICe users were subjected to an ophthalmologist's standard visual acuity test, using sounds. Surprisingly, not only were the blind SSD-users able to tell which way the "tumbling E's" were turning using sounds, but most of them could perform the test at small letter sizes, below the standard World Health Organization's blindness threshold.

Such visual capacities greatly surpass even those possible by the most advanced cutting-edge retinal prostheses ("bionic eyes") available today. In fact, even though retinal prostheses may improve their resolution in the future, and have the advantage of providing the sensation of sight, they will not be accessible to a large population of blind individuals. Retinal prostheses target only very specific blindness etiologies, leaving many others without medical cure.

This factor, as well as the invasiveness and high cost of retinal prostheses make non-invasive and very cheap SSDs, such as The vOICe or other novel SSDs developed in Amedi's lab, attractive alternatives, which can be available already today to the 39 million worldwide blind population, the majority of whom live in developing countries, who could already enjoy the adventure of learning to "see" in high resolution, using sound.

Provided by Hebrew University of Jerusalem