How Sounds Give Eyesight to the Blind

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Source: Amir Amedi Lab

Sensory substitution devices (SSDs) might finally become attractive for the blind: The “EyeMusic” system translates camera views into musical soundscapes that the brain can interpret as pictures.

A team of Israeli researchers led by Amir Amedi at the Hebrew University in Jerusalem has published an article in **“Restorative Neurology and Neuroscience”** about the development of a sensory substitution device that, by translating the views of a camera into musical soundscapes, is able to stimulate the visual cortex of test persons, giving them an approximate imagination of the actual camera view.

Such SSDs have existed for quite some time. But until now, they were expensive, cumbersome, lacking color information, and often were accompanied by unpleasant sensations.

Amedi and his colleagues managed to create this next-generation SSD out of nothing but a small camera attached to glasses, earphones and a smartphone. They claim that their system also is capable of transporting information about both shape and color, while delivering an overall pleasant and easy-to-learn experience. After only a few hours, test subjects were reliably able to identify certain shapes and colors.

“EyeMusic” reduces the camera picture into an image measuring 40 pixels in width by 24 pixels in height. This picture is then transformed into sounds when the system reads the pixel columns from left to right and sets the pitch of the musical note according to the pixel’s height in the column (it’s coordinate on the y-axis).

Color is represented by the special timbre of musical instruments. Brass instruments, for instance, represent the color blue, strings yellow, and the human voice stands for white. Silence means black. All notes that occur in one column of pixels will be played at the same time for 50 ms. One picture (40 columns) thus takes two seconds to be played.

The system does, however, comes with a reduced resolution of 960 pixels compared with other SSDs like **“The vOICe”** that is capable of several-thousand pixels. But the addition of color can make up for this disadvantage in a lot of cases, since color information helps to identify and distinguish shapes. An easy example: Try to find the red apple among a bunch of green ones in a picture without color information. Still, the researchers stress that some tasks like the detection of facial expressions might remain a field where higher resolution is needed.

Interestingly, the test results and the learning curve showed no significant differences between blind people and those who actually could see but were blindfolded for the tests. The method not only is noninvasive, it also seems to work for all kinds of visual impairment. Thus, the approach might even be superior to retinal implants scientists all over the world are working on.

By Ute Eppinger