Voice cells for voice recognition

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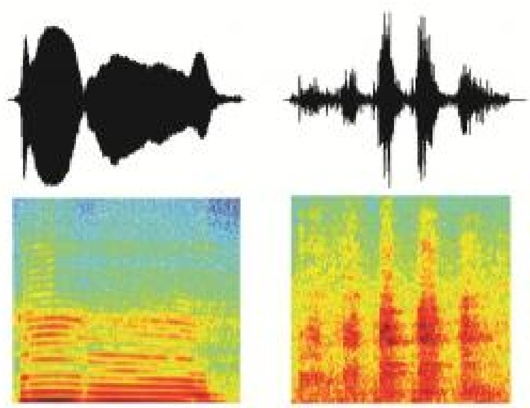


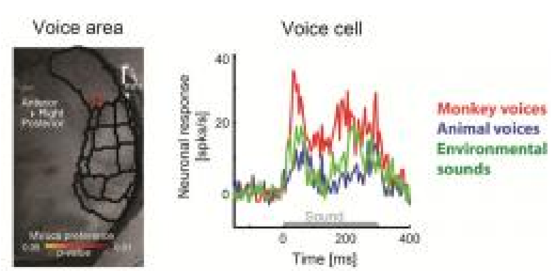
Two rhesus monkey calls (top: sound amplitude over time; bottom: energy for each frequency over time). Credit: Catherine Perrodin/MPI für biologische Kybernetik

(Medical Xpress) -- The human voice is as characteristic as a face – a friend can often be identified by a message on an answering machine, even if he or she forgot to mention their name. The main region for face recognition lies within the inferior temporal lobe in primates. There, groups of clustered nerve cells can be found that respond significantly stronger to faces than to other images. Researchers at the Max Planck Institute for Biological Cybernetics in Tubingen, Germany, have begun to search for similar structures that process voice information in the brain. In the temporal lobe of rhesus monkeys they discovered “voice cells” that respond selectively to calls and sounds from conspecifics.

The eyes are the primary sensory organs used by humans and monkeys.

In social interactions, faces of relatives and friends are instantly recognised and their mood is interpreted. People who cannot recognise faces – a condition called face blindness – cannot distinguish people from one another, yet are able to recognise individual faces of dogs or sheep. "The voices of fellow human beings are similarly unique and of great importance in social relationships. It was to be expected that they are processed differently than other auditory information by individual nerve cells," says Catherine Perrodin of the Max Planck Institute for Biological Cybernetics. Together with Christoph Kayser and Nikos K. Logothetis from the same Institute and Christopher I. Petkov from the Institute of Neuroscience of the Newcastle University Medical School in the UK, the researcher conducted new experiments on the processing of voices. The team extended previous studies in which the brain region that is active during voice processing was made visible through functional magnetic resonance imaging (fMRI). They have now recorded the activity of individual nerve cells in this brain region.

The researchers proved for the first time the existence of "voice cells" in the temporal lobe of the brain. "Voice cells" - analogous to "face cells" - are neurons that react two-times stronger to conspecific voices than to voices of other animals or sounds from different sources. The voice cells were concentrated in specific clusters, but significantly less concentrated than face cells in the main region of face recognition.



fMRI image for one monkey of the auditory cortex (black lines) and the cluster preferring voices (red), with an example voice cell responding stronger to monkey voices than to other sounds. Credit: Catherine Perrodin/MPI für biologische Kybernetik

The comparison of the results of face and voice cells revealed that voice cells responded more selectively to individual voices than face cells to individual faces. The highly specialised voice cells only responded to about one fifth of the conspecific calls presented, while face cells responded to about 40 to 60 percent of the faces in previous visual studies. “This can possibly be explained by the fact that the faces of vertebrates with two eyes, a nose and mouth look very much alike regarding their main features, whereas there is a wider range of variability of voices. Due to their specialised representation of voices, voice cells can work more efficiently,” explains Catherine Perrodin. In the experiments, the researchers used a representative mix of rhesus monkeys voices. For comparison they used voices of other species, such as horses and dogs, as well as environmental sounds, such as bird wings flapping, running water and rolling thunder.

The voice-preferring brain regions in the temporal lobe of monkeys and humans are similar, and seem to function in the same way. The researchers are therefore assuming that their results apply to humans as well. In the next step, they want to examine what parts of the complex information carried by a voice enable us to recognise a speaker and what parts enable us to interpret the speaker’s mood. Furthermore, they want to know if voice cells can process the stimuli from other senses, e.g. visual information. “Until now, voices and oral communication have often been studied in relation to speech only,” says Catherine Perrodin. “But they are also of interest as non-verbal sounds; the meaning of what is being said is additional information.”

More information: Catherine Perrodin, et al. Voice Cells in the

Primate Temporal Lobe, *Current Biology*; August 23, 2011, doi: 10.1016/j.cub.2011.07.028

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