Virtual ears and the cocktail party effect

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The 'cocktail party effect' describes how our brains develop the ability to focus on particular sounds among a background of noise.

(PhysOrg.com) -- Oxford University research has helped understanding of the so-called 'cocktail party effect' – how our brains develop the ability to pinpoint and focus on particular sounds among a background of noise.

The study, published in the *Journal of Neuroscience,* has implications for the emergence of hearing abilities in children and for restoring hearing after fitting hearing aids and cochlear implants.

Humans begin to develop their hearing at a very early stage. Even a 28 week old foetus will respond to sound, and newborn infants can distinguish different types of speech sound. Our hearing continues to develop throughout childhood, including the ability to distinguish between sounds coming from different directions and to understand speech in difficult acoustic environments, such as a busy room with many echoes.

Nerve cells in the superior colliculus, one of the brain regions responsible for processing sound, mature during infancy, gradually developing a preference for specific sound directions. Which of these nerve cells are active therefore signals where sounds are located, forming an auditory map of the environment.

Researchers led by Professor Andrew King, a Wellcome Trust Principal Research Fellow at the University of Oxford, have developed a method that enables the changes in the selectivity of the nerve cells for different directions of space to be to separated out from the development of the auditory map.

The technique, used on ferrets, involves using 'virtual ears' which can enable an infant ferret to hear sounds as if it were an adult.

The researchers in the Department of Physiology, Anatomy and Genetics placed tiny microphones inside the opening of the ears of adult ferrets to capture the sound as modulated by an adult head. This sound, when played back over headphones to an infant ferret, appears to be coming from outside the ferret's head, but mimics what an adult would hear.

By measuring the responses of nerve cells in the brain, the researchers were able to see how the infant brain differs from the adult and to show that the development of the selectivity of the nerve cells for sound location and their assembly into the auditory map are influenced by independent factors.

'Our research showed that the region of space to which the nerve cells respond is determined by the shape of the ferret's ears and their distance apart, both of which change with age,' says Professor King. 'On the other hand, the gradual development of the auditory map is influenced by the experience of the sounds that are heard.'

Professor King believes that this has implications for a child's ability to learn how to hear after a hearing aid or cochlear implant has been fitted. Other work from this group has shown that even the adult brain is remarkably able to adapt.

'We have shown that the neural circuits of our hearing apparatus can adjust to a loss of hearing in one ear,' says Professor King. 'Clearly, the adult brain is still plastic and able to adapt, so fitting hearing aids and cochlear implants in adults is worthwhile.'

Provided by Oxford University