NEWS

Published online: 1 August 2007; | doi:10.1038/news070730-4

Owls' ears map the world

Stealthy birds are better at detecting horizontal shifts in sound sources.

Heidi Ledford

Barn owls are better at tracking sounds that move horizontally than those that move vertically, researchers have found. The technique used to make the discovery could one day be used to assess hearing and cognitive skills in humans who cannot communicate.

A barn owl's pupils dilate when the bird detects an interesting sound.

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The work, published in *PLoS ONE*[1], relies on a phenomenon noted by Ivan Pavlov, of salivating dog fame, in the 1920s. Pavlov saw that animals respond to stimuli such as sudden movements or novel noises with a set of automatic responses, including muscle tensing and pupil dilation.

Avinash Bala, a neurologist at the University of Oregon in Eugene, and his colleagues have used this response to monitor when barn owls (*Tyto alba*) recognize a new sound.

The researchers played the owls sounds whose positions differed either horizontally or vertically, and measured the birds' pupil dilation using a beam of infrared light bounced off the cornea.

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Owls were about twice as sensitive to horizontal shifts compared with vertical changes. The birds could detect a change in location as small as 3º when the source was moved horizontally, compared with 7.5º when the source was moved vertically.

Humans' pupils also dilate in response to environmental changes, and Bala hopes to use the technique to see if patients who cannot communicate because they are comatose, paralysed or mentally ill can distinguish between different noises, or recognize speech. "Tests such as these will allow us to ascribe the damage to particular parts of the brain," says Bala.

Sounding out the surroundings

The researchers also mapped which neurons in the auditory centre of the owls' brains fired in response to the sounds.

The activity pattern of the neurons matched the location of the sound, the team found. Sounds from above, for example, cause neurons towards the top of the auditory centre to fire, whereas sounds from lower down trigger neurons towards the bottom. "The owls basically have a topographic map of space in their brain," says Bala.

This approach gives better resolution than tracking the owls' head movements or flight, says neurobiologist Masakazu Konishi of the California Institute of Technology in Pasadena. Plus, he adds, it avoids interference from neurons that fire during movement.

The drawback is that it's not clear how the findings relate to owl behaviour. "This is not the natural behaviour that an owl performs while hunting by air," says Konishi.

It's not clear why barn owls' hearing should be better in the horizontal dimension. Barn owls' rodent prey would be expected to run away horizontally rather than vertically, but these dimensions will shift for an owl flying with its face to the ground.

Neurobiologist Andrew Moiseff of the University of Connecticut agrees that the technique is useful for physiological measurements, but he too warns against translating the results directly to barn owl hunting skills.

"This doesn't necessarily mean that they're better hunters in a horizontal direction," says Moiseff. "This is one part of a very complex behaviour."

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References

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ISSN: 1744-7933

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