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Listen carefully in the dark

Bats are blind, but they see with their ears. Scientists may soon help humans do the same thing, says S.Ananthanarayanan.

Bats emit high frequency sound signals and listen for echoes to locate objects that lie in their flight path. With the intensity of the echo as well as the use of both ears, bats are able to pinpoint obstacles, or even prey, with great precision.

Why high frequency?

The way a bat locates an object is with the use of both ears. When an echo comes in from one side, the sound striking one ear comes in a fraction of a second before it reaches the other ear. The way this time difference is made out is because the sound waves coming in a bit later get 'out of step'. As we know, sound moves in waves, of alternating compressions and rarefactions of the air. If sound comes in at one ear a little later, then the timing of the 'drumbeats' on the two ears would differ. The bats' brain is sensitive to this difference and is able to work out the correct position of the source of the echo.

For this difference to be appreciable in the small distance separating the bats' two ears, the wavelength of the sound needs to be small. A low musical note is around 330 cycles per second. With sound moving at around 330 metres a second, the note would have a wavelength of about one metre. The bats' sounds are at over 30,000 cycles per second and the wavelength is around a centimeter.

Different sets of sounds

Bats actually use a variety of sounds in navigation. The high frequency 'probes' are sent out in short bursts, the bursts getting more frequent as the target comes nearer. The frequency also get higher for smaller targets, where the bat needs more 'resolution'. It is incredible how the bat is able to snap up flying insects when flying at full speed in pitch darkness!

We can use echoes too

Scientists are now trying to make a similar echolocation ability available to humans. We use this very ability routinely when we locate the source of a sound, as behind, or to one side. But because we use frequencies in our normal hearing range, this ability is not on much use. In a recent study at the University of Leeds, high pitched sound, like the bat uses, were generated and echoes translated to sounds within human hearing range. The sounds were then fed into earphones. In laboratory simulations, people were able to adapt very fast to making out objects with the help of the sounds. In the study at Leeds, people were soon able to locate a simulated object the size of an insect using only the echoes in the headphones!

The ability could have a number of uses, like helping motorists keep their ‘ears’ to the road even while looking at a roadmap or tuning the stereo. Or even to help the motorist drive in poor light, or in military applications.