

Integration of Dynamic Emission and Reception in the Biosonar System of Horseshoe Bats

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Bats have evolved unique mechanisms by which to navigate and hunt in their environments. Some species of the microchiroptera, such as the family Rhinolophidae, which live in particularly challenging, cluttered environments, have been observed to move peripheral pinna and noseleaf structures during echolocation very rapidly, e.g., within a tenth of a second. With these behaviors the bats could create time-variant properties in their biosonar systems and provide additional degrees of freedom that could be used to enhance the encoding of sensory information. To make full use of this opportunity, a tight sensorimotor integration is likely to be required. In order to explore the possible role of sensorimotor integration in a dynamic biosonar system, we have developed biomimetic robotic models to replicate the effects of the dynamics of the baffle structures. Data obtained with this system indicates that a coordinated emitter and receiver dynamics introduces time-variant effects which encode target information which can inform classification. Ongoing research seeks to transition insights from work from the biomimetic design paradigms to neuroscience recordings based on data from the auditory brainstem and superior colliculus.

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