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**The echolocating bat controls the direction and distance of its
acoustic gaze**

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Echolocation is an active sensing system that depends upon the dynamic interplay between auditory information processing and adaptive motor control. The echolocating bat produces ultrasonic vocalizations and uses information contained in the returning echoes to build a three-dimensional auditory representation of its surroundings. The timing, bandwidth, and duration of echolocation signals used to probe the environment directly impact the information available to the bat's acoustic imaging system. In turn, the bat's auditory representation of space guides its actions—ear movements, head aim, flight path, and the features of subsequent sonar vocalizations. This talk will summarize the bat's adaptive vocal behavior as it engaged in complex spatial tasks. The bat's 3D flight path was recorded with high-speed stereo IR video; its sonar signals were recorded with a microphone array that permitted reconstruction of the emission pattern. The sonar emission pattern of the big brown bat, *Eptesicus fuscus*, is directional, but broad enough to collect echo information from objects within a 60-90 deg cone, which would enable simultaneous inspection of objects in the frontal plane. Here, we report that bats encountering a complex environment shifted the direction and distance of their sonar gaze to inspect closely spaced obstacles and targets sequentially.