Echo-level compensation and delay tuning in the auditory cortex of the mustached bat

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During echolocation, bats continuously perform audio-motor adjustments to optimize detection efficiency. It has been demonstrated that bats adjust the amplitude of their biosonar vocalizations (known as ?pulses?) to stabilize the amplitude of the returning echo. Here, we investigated this echo-level compensation behaviour by swinging mustached bats on a pendulum towards a reflective surface. In such a situation, the bats lower the amplitude of their emitted pulses to maintain the amplitude of incoming echoes at a constant level as they approach a target. We report that cortical auditory neurons that encode target distance have receptive fields that are optimized for dealing with echo-level compensation. In most cortical delay-tuned neurons, the echo amplitude eliciting the maximum response matches the echo amplitudes measured from the bats? biosonar vocalizations while they are swung in a pendulum. In addition, neurons tuned to short target distances are maximally responsive to low pulse amplitudes while neurons tuned to long target distances respond maximally to high pulse amplitudes. Our results suggest that bats dynamically adjust biosonar pulse amplitude to match the encoding of target range and to keep the amplitude of the returning echo within the bounds of the cortical map of echo delays.

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