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Object-oriented echo perception and cortical representation in the bat Phyllostomus discolor

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Echolocating bats can identify three-dimensional objects exclusively through the analysis of acoustic echoes of their ultrasonic emissions. However, objects of the same structure can differ in size and the auditory system must achieve a size-invariant, normalized object representation for reliable object recognition. In this talk both the neural representation in the auditory cortex and the behavioral classification of echoes of complex virtual objects that vary in object size are described. Electrophysiological experiments revealed a population of units in the auditory cortex of the bat Phyllostomus discolor which showed an object-size invariant response (14/109 units, 13%). These units respond preferentially to echoes from objects in which echo duration (encoding object depth) and echo amplitude (encoding object surface area) co-varies in a meaningful manner. The electrophysiological results are corroborated by the results of a phantom-target playback experiment, in which it is shown that P. discolor spontaneously classifies most scaled versions of objects according to trained standards. These results indicate that at the level of the bat's auditory cortex, an object-oriented rather than a stimulus-parameter oriented representation of echoes is achieved.
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