VISITING SCHOLAR PROGRAM

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Public Lecture Offerings

The Role of Action in Perception of the Natural Environment

As we move through the natural environment, our distance and direction to objects continuously change. How does movement influence perception of the surroundings? Decades of research on perception has measured performance of stationary subjects viewing visual stimuli, and far less is known about perception of freely moving animals that rely on auditory information to guide their actions in the physical world. My lecture will attempt to bridge this gap by considering the behavior of animals engaged in natural tasks in complex environments. I will present a variety of examples but will focus on echolocating bats, animals that produce high frequency sounds and process auditory information carried by returning echoes to guide behavioral decisions for object localization, target discrimination, and navigation. I will present research findings that demonstrate the remarkable spatial resolution of animal sonar, which exceeds that of human vision along some dimensions.

Using Sound to Navigate the World: Echolocation by Bats and Blind Humans

Humans tend to rely heavily on vision to navigate, but blind individuals must make use of other senses. Indeed, some blind humans produce tongue clicks and listen to echoes reflecting from objects in their surroundings, similar to echolocating bats and dolphins. In this lecture, I will present details on the sound features that are used for echolocation by animals and blind humans and the acoustic cues they use to localize objects in the environment. I will also discuss the contribution of spatial attention and memory to the execution of behavioral tasks without vision. By

comparing echolocating animals and humans, we can identify biological specializations and general principles that operate to support spatial navigation.

The Role of Touch in Bat Flight

The sense of touch is fundamental to the control of movement: From simple behaviors such as grasping, to complex motor sequences, such as playing the violin, touch signals guide action. Bats, the only group of mammals capable of powered flight, offer a unique perspective on sensory-guided movement. The scientific name for bat is Chiroptera, which refers to this animal's hand-wing, consisting of five fingers extended across a thin, flexible membrane. Unlike other mammals that contain glabrous skin on the palms of hands, paws and feet, the bat wing membrane is sparsely lined with microscopic hairs that carry airflow information to guide flight control. Experiments have shown that bats fly faster and execute wider turns when steering around obstacles after wing hairs are removed. Bats not only use their hand-wings to fly, but also to grasp objects, handle prey, and cradle their young. This lecture will highlight some of the specializations of bat wing touch sensors that enable agile flight maneuvers and other behaviors.

Classroom Discussion Topics

General

1. What scientific methods and tools are used to study brain and behavior? What are the advantages and disadvantages of each?
2. Compare the sensory systems used by humans and other animals to perform natural tasks. What drives similarities and differences?
3. What are the opportunities and limitations of translating findings from animal research to humans?
4. What is the value of a comparative approach to the study of brain and behavior? In other words, why study many different organisms to understand general principles?