Talk 3.4

A computational and neurophysiological approach to integrating visual and auditory information

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Accurate and timely eye movements to sounds can spell the difference between an animal successfully capturing a meal vs. becoming one. Directing gaze to the location of a sound stimulus is a complex information processing task requiring the conversion of auditory signals into motor commands to move the eyes. We are combining computational and experimental approaches to illuminate this process.

Experimentally, we are measuring how information about sound location is encoded in the spike trains of neurons in primate inferior colliculus, auditory cortex, lateral intraparietal cortex, and superior colliculus when monkeys perform saccades to sounds. One of the important questions we are investigating is how eye position affects these representations. In both the auditory cortex and the IC, we have found that most neurons tend to encode sound location in a monotonic format, with a statistically significant influence of eye position on the response patterns of approximately 40% of IC neurons. We have discovered that the representation of sound frequency in primate IC is different from what has been reported in other species.
We have also investigated the coding of visual and auditory space in the lateral and medial intraparietal areas.

Computationally, we are exploring what information can be extracted from the response patterns of neurons at different stages of the pathway. An important question that is addressed is whether shifting receptive fields and other aspects of multisensory integration observed in our data could be explained by existing models of neural computation, or require new models. We are also developing new methods for visualizing and interacting with this multidimensional, time-varying data.