Collision Detection as a Model for Sensory-Motor Integration

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Visually guided collision avoidance is critical for the survival of many animals. The execution of successful collision avoidance behaviors requires accurate processing of approaching threats by the visual system, and signaling of their characteristics to motor circuits in order to execute appropriate motor programs in a timely manner. Consequently, visually guided collision avoidance offers an excellent model to study the neural mechanisms of sensory-motor integration in the context of a natural behavior. Neurons that selectively respond to approaching threats and brain areas processing them have been characterized across many species. In locusts in particular, the underlying sensory and motor processes have been analyzed in great detail: these animals possess an identified neuron, called the LGMD, that responds selectively to approaching threats and conveys that information through a second identified neuron, the DCMD, to motor centers generating escape jumps. A combination of behavioral and in vivo electrophysiological experiments has unraveled many of the cellular and network mechanisms underlying this behavior.