**Michael Beauchamp**

Functional magnetic resonance imaging (fMRI) is a new technique that allows human brain activity to be measured non-invasively with high spatial and temporal precision. Using fMRI, we study the neural mechanisms underlying cognition and perception. The two main themes of our research are *visual motion perception* and *multisensory integration*. Our visual system is remarkably adept at extracting information from the moving objects that surround us every day. For instance, we must calculate the speed and direction of an incoming ball in order to catch it, or determine if the driver in the car next to ours is waving at us in a friendly fashion or shaking their fist in an angry fashion. Different regions of human lateral temporal cortex are important in processing different kinds of visual motion. Area MT serves as a first-stage of motion processing. Higher areas in superior temporal sulcus are particularly important for processing biological motion, while areas in middle temporal gyrus are most responsive to the motion of man-made manipulable objects, such as hammering or sawing.

The goal of our research is to determine how the brain translates the rapidly-changing visual information into meaningful actionable concepts such as "wave" or "fist-shake", "hammer" or "saw". This research is important for understanding the difficulties faced by patients who have difficulties interpreting biological motion, such as autism spectrum disorder, and may also have implications for patients with language learning impairments, such as those who have difficulties with the rapid processing required for reading.

In addition to visual information, our brain also receives input from other sensory modalities. For instance, even if we cannot see our mobile phone blinking, we can hear its ring or feel its vibration in our pocket. These different modalities are encoded by our brain in very different ways. The auditory system is most concerned with the frequency (high or low-pitched sounds), as is the tactile system (slow stroking vs quick vibrations). In contrast, our visual system is organized by the spatial location of stimuli--a stroke may damage our ability to see objects on the left side of the room but not the right side. Although each sensory modality is organized fundamentally differently, our brain must integrate the information provided by the different modalities in order to make decisions. For instance, is the phone ringing or not? Our research has shown that regions of superior temporal sulcus are especially important for this process of multisensory integration. In superior temporal sulcus, different sensory inputs converge into patches of cortex, allowing multisensory integration to occur.

Project 1: For project, see joint project with Shouval lab