

From Sensation to Conception

In recent years, my lab has focused on three (related) research topics: visual working memory, sensory cue integration, and abstract mental representations of objects and events. In this talk, I'll concentrate on the latter topic. Two research projects have studied abstract (i.e., modality-independent) mental representations of objects shared by vision and haptics (active touch). One project proposed a theoretical framework for how modality-independent object representations can be inferred from sensory signals, and found evidence favoring the framework by comparing its predictions with behavioral data. A second project used human brain imaging (fMRI) to obtain data indicating that neural region lateral occipital cortex (LOC) encodes object shape in a modality-independent manner, and also encodes object shape in a part-based format. A third project used our theoretical framework to argue that object representations are 3D, object-centered, and arise from an inference process. We found that an implementation of our framework produces viewpoint-dependent visual recognition (despite the use of object-centered representations), and predicts people's visual shape similarity judgments significantly better than a wide variety of other computational models. Finally, a fourth project provided behavioral evidence that perceptual training on a timing task produces benefits that transfer to motor production timing, suggesting that there is an abstract mental representation of time shared by perception and motor action.