Title: “3-D Vision and the Brain”
Host: Dale Connelly
Specialist: Ed Conner, Ph.D.
Professor, Department of Neuroscience
Director, Krieger Mind Brain Institute

“You’re listening to Brain Talk, from the Johns Hopkins Brain Science Institute.”

Dr. Conner: “If I ask someone to describe a teapot, they would tell me that it’s got a spherical body, and a disc shaped lid, and a “s” shaped spout on one side and a “c” shaped handle on another side. And that three-dimensional description of a structure of a teapot is actually a remarkable thing.”

Dale: “Dr. Ed Conner is a professor of neuroscience at the Johns Hopkins School of Medicine. He studies high level visual processing in the brain, including how we recognize something is 3-dimensional in shape. Today on Brain Talk, 3-D Vision and the Brain.”

Dr. Conner: “There are the three-dimensional cues that we use to turn what are 2-D images on the eyes into knowledge of 3-D structures in the world. There are size cues, there are perspective cues, there are texture cues, and of course the special cue called binocular disparity.”

Dale: “Dr. Conner says that 3-D movies, like Brad Pitt’s film World War Z, play on the visual cue binocular disparity.”

Dr. Conner: “That is slight differences in the images between the two eyes and the brain in primary visual cortex, the first part of the cerebral cortex that processes visual information, puts together information from those two eyes and triangulates the depth of everything relative to wherever we’re looking.”

Dale: “So interpreting a 3-D image is a complex activity for the brain. Neuroscientists have calculated that vision information about depth is captured first by the primary visual cortex. It was once believed that this depth information was only sent on to higher levels of the brain in order to figure out where things sit in space, but recent research work in labs like Dr. Conner’s shows that higher levels of the brain are more actively involved in 3-D perception than previously thought.”

Dr. Conner: “What our research shows is that in higher level centers of the brain there are neurons that put together all these low level depth cues in order to generate information about three-dimensional parts, and particularly surface fragments.”

Dale: “Even state of the art computers systems can’t do this kind of calculating to help produce 3-D imaging. For that to happen, neuroscientists need to understand more about how our brain neurons work to construct visual images. Dr. Conner says “One of the challenges is that the brain is constantly processing massive amounts of information coming in through the eyes.”

Dr. Conner: “Besides primary visual cortex there are on the order of 30 or 40 other distinct regions that process visual information in distinct ways for different purposes. Having to do with object vision, seen vision, navigation, deciding where you are going to look next, helping you reach towards things, helping you grasp toward things.”

Dale: “According to Dr. Conner millions of neurons are involved in creating our 3-D vision. Understanding process patterns in humans could lead to a significant breakthrough in computer vision. For the medical world this could be very useful.”

Dr. Conner: “Most of the excitement, right now, is focused on interfaces for the purpose of motor control; that is brain/computer interfaces that would allow paralyzed people to control their own limbs or to control artificial limbs.”

Dale: “To learn more about neuroscience and vision log on to brainscienceinstitute.org. I’m Dale Connelly and this is Brain Talk from Johns Hopkins University.”