- Tuesday, March 15, 2005
Perception as Probabilistic Inference

How do we perceive objects? I will discuss two lines of research examining the hypothesis that perception is a process of probabilistic inference. The first line of research examines how we perceive 3D object shape. The fundamental limit to visual information about 3D shape is set by perspective projection, which reduces the 3D coordinates of the world to the 2D coordinates of the retinal image. To overcome this limit, the visual system exploits several sources of information (e.g. binocular disparity, motion parallax etc.) to infer 3D shape. How are these sources of information combined? I will discuss experiments testing the idea that these sources of information are combined in a statistically optimal fashion. The second line of research examines how we perceive the spectral reflectance (the physical correlate of color) of surfaces. To recover surface reflectance from an image, the visual system must compensate for variations in the light reaching the surface. (for example, when an object is seen in direct sunlight, in a shadow, indoors or outdoors etc.). Is this compensation a process of perceptual inference? That is, does the visual system infer the location and color of the light source as part of the inference about the scene geometry? Or is such apparent compensation a function of adaptation known to occur in the retina? I will discuss experiments that separately probe early mechanism of light adaptation and mechanisms of perceptual inference.

Jamie Hillis
University Pennsylvania