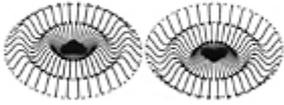


Perception: Seeing the World or Seeing Our Theories? Donald D. Hoffman



Vision seems effortless and direct. We simply open our eyes and observe the world. With a glance we can perceive the shapes of complex objects, whether those objects be familiar or whether, as in the figures below, they be less familiar. But this apparent ease and directness is deceptive. Note, for instance, that although the lines in the figures below must in fact all lie in the plane of the page, they appear instead to undulate in three dimensions. Your visual system has invented the undulations in depth. Note also that although the two figures are identical (except that one is rotated 180 degrees), their organization into hills and valleys is nevertheless quite different. For the figure on the left the dashed contours lie in valleys, whereas for the figure on the right they lie on hilltops. Not only does your visual system invent the depth you see, it organizes its invention according to rules which, evidently, depend on the orientation of the figure.

These figures are a problem for the "directness" of perception. Direct misperception seems a contradiction. But are these figures just special cases? Or is perception more generally, in more ecologically natural situations, also a process of quick, clever, and perhaps unconscious, invention? In this talk we explore the structure of current theories in robotic and human vision looking for answers to these questions. In the process we discover that all theories of specific perceptual capacities (such as stereovision, edge detection, and the perception of surface colors) share a common formal structure. Consideration of this formal structure does indeed provide guidance for the resolution of these questions. It also allows us to examine with greater precision the problem of the relation between the observer and the world.