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Title: The Role of Symmetry in Veridical 3D Shape Perception

Abstract: “Veridical perception” refers to the claim that we see things the way they actually are “out there.” From both mathematical and computational points of view, the veridical perception of 3D objects and scenes, based only on the information available in 2D retinal or camera images, looks like an impossible task. Formally, inferring a 3D shape from its 2D image is an *ill-posed inverse* problem. The only known way to solve such problems is to impose a *priori* constraints (aka priors) on the family of possible interpretations. If these constraints are effective, the interpretation is both unique and veridical. In my talk, I will describe the *a priori* constraints that are used by the human visual system. These constraints represent regularities that occur in all natural objects, and as such, they all can be treated as forms of *symmetry,* where by symmetry we mean self-similarity. I will explain the details inherent in these computational models of veridical shape and scene perception, in which symmetry priors are essential. I will also present psychophysical results showing that human observer see 3D shapes and scenes veridically. The talk will conclude with an explanation of the fact that veridical representations of our physical, cognitive and social environments are essential for the success of goal-directed (purposive) actions, the kind of actions human beings plan and carry out all of the time.