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The perception of 3D shape from texture

A new computational analysis is described that is capable of predicting observers' shape judgments from gradients of optical texture over a wide range of conditions. The analysis relies on two separate processes: One that is based on systematic variations in the sizes of optical texture elements, which is only applicable for approximately planar surfaces viewed with large visual angles; and another that is based on systematic variations in the shapes of optical texture elements, which is only applicable for curved surfaces viewed with small visual angles. Several experiments will be reported that examined observers' perceptions for images of planar, concave and convex surfaces with both isotropic and anisotropic textures. These surfaces were rendered with different camera angles and observed from different viewing angles. The results reveal that observers' judgments are often systematically distorted relative to the ground truth, but that these distortions are quite consistent with the performance of our proposed model.