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Natural scene statistics predict that the figure-ground cue of convexity influences depth perception

Dr. Johannes Burge

Center for Perceptual Systems
University of Texas, Austin

ABSTRACT OF THE TALK

The shape of the contour separating two regions strongly influences judgments of which region is "figure" and which is "ground". Convexity and other figure-ground cues are generally assumed to indicate only which region is nearer, but nothing about how much the regions are separated in depth. To determine the depth information conveyed by convexity, we examined natural scenes and found that depth steps across surfaces with convex silhouettes are likely to be larger than steps across surfaces with concave silhouettes. In a psychophysical experiment, we found that humans exploit this correlation. For a given binocular disparity, observers perceived more depth when the near surface's silhouette was convex rather than concave. We estimated the depth distributions observers used in making those judgments: They were similar to the natural-scene distributions. Our findings show that convexity should be reclassified as a metric depth cue. They also suggest that the dichotomy between metric and non-metric depth cues is false and that the depth information provided many cues should be evaluated with respect to natural-scene statistics. Finally, the findings suggest an explanation for why figure-ground cues modulate the responses of disparity sensitive cells in visual cortex.