Integration of Shape and Surround Across Depth Cue

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Shape perception is easily biased by surround stimuli, such as in illusions of shape contrast where perception is biased in the direction opposite to the geometry of surround stimuli. Here, we address the issue whether the mechanisms that integrate shape and surround use cue-dependent or cue-invariant representations. A central hinged plane and larger flanking plane were defined by binocular disparity or motion. In a 'within-cue' condition, shape and surround were defined by the same cue and in a 'cross-cue' condition they were defined by a different cue (binocular disparity or motion). Observers compared the dihedral angle of the central shape with a constant reference. This way, we could compute a bias. Surround bias differed between the two cue-conditions: contrast occurred in the within-cue condition but assimilation in the cross-cue condition. Additionally, some observers showed assimilation in the motion within-cue condition. A follow-up experiment, where correlated shape noise was added to the stimuli, showed that bias direction does not only depend on cue combination, but also on visual noise. When shapes are noisy, assimilation, not contrast, occurs. We conclude that shape and surround are integrated by different mechanisms, one relying on cue-dependent, the other on cue-invariant representations.