Context Determines Figure-Ground Perception by Suppressing Competition

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Abstract

Is homogeneity of convex, concave, or both regions necessary?

Background

Local convexity believed to be strong figural cue based on research w/ multiregion displays

Kim & Peterson (2001): context modulates effects of local convexity (Henceforth, locally convex = “convex”)

Results

Consistent with biased competition model (Desimone & Duncan, 1999):

- Potential shapes (convex & concave) on opposite sides of edge compete for response of neuron
- Figure cues bias competition (Peterson and Skow, in press; Vecera, 2000)
- But bias from convex is weak
- Context of homogeneous concave shapes further biases the competition toward convex

Discussion

Is the repetition of convex regions sufficient for context effects?

Exp. 1: Test w/ heterogeneous displays

Heterogeneous 4 regions 6 regions 8 regions
% convex region = figure 59 62 59

Convex = figure >50%, ps < 0.01 But NO context effects (p > .80)

Therefore, homogeneity is necessary for context effects

Is homogeneity a cue in the absence of a bottom-up figure bias?

Exp. 3: Test w/ 8 region “stripes” displays zigzag edge used as response landmark: did not favor either side as figure

If choices heterogeneous>figure >>> 50%, that would suggest context effects 3A & 3B: Direct Report: Left/Right judgment

A&B: Alternating stripes: Homogeneous & heterogeneous 5 colors In any display:
1 = homogeneous & 4 = heterogeneous

A: 100 ms; hetero = figure: 50%; p = 0.75
B: 170 ms; hetero = figure: 52%; p = 0.16

3C & 3D: ON/OFF judgment

C: Stimuli: Same as 3A&B (w/ probe)
(Henceforth, locally convex = “convex”)

Homogeneity alone is not a cue

% convex region = figure 59 62 59

Therefore, homogeneity of convex regions is NOT sufficient

B: Homogeneous Concave

Homogeneous Concave 4 regions 8 regions
% convex region = figure 61 82

Convex = figure >50%, ps < 0.001 YES context effects (p < 0.001)

Therefore, homogeneity of concave regions is necessary

Conclusions

- Context underlies strong convexity effects: w/o context local convexity is a weak cue
- When the concave shapes competing w/ convex shapes are homogeneous the bias toward convexity is increased
- Further evidence that figure-ground segregation is an instance of biased competition

We conclude:

- Figure-ground at one end of a continuum of shape perception and attention phenomena

References


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