Cortico-cortical recurrent processes mediate convex figure context effects and cortico-thalamic recurrent processes resolve figure-ground ambiguity

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Unambiguous Cortico

Masks appearing while feedback ongoing will disrupt feedback

Exp 1

100 ms masked displays. RV vs. color balanced.
Region 4 Homogeneous: 6 regions, 2 regions: 200 ms, 6 region: 150 ms. Same stimuli with 0.5" side 8 region displays.

Neither Homogeneous

- Homogeneous concave regions necessary: Background prior

Both Homogeneous

Ambiguous

- Both homogeneous; 2 regions: 100 ms
- Only Concave Homogeneous; 8-region displays only

Unambiguous

- Only Concave Homogeneous

Experiment 1 - 2

Are Context Effects &/or Ambiguity Resolution Mediated by Feedback?

Method

Backward masks add noise to substrate for feedback

Exp 1: Both homogeneous; 2 & 8-Region Displays (between subjects)

Exp 2: Only Concave Homogeneous; 8-Region Displays only

Experiment 3

Dichoptic Presentations

Concave Homogeneous illustrated

Both Homogeneous tested also

Experiment 1 - 2 Results &

Convexity Context Effects

Convex & Concave Both Homogeneous

Is that important?

Homogeneous concave regions necessary: Background prior

Goldreich & Peterson, 2012

Ambiguous

- Both homogeneous

Unambiguous

- Only Concave Homogeneous

Is Feedback Cortico-cortical or Cortico-thalamic?

V1: First neurons that respond to input to both eyes

Respond > 60 ms after stimulus onset

Use Dichoptic Presentations

Remove mask interference in monocular pathways & first corticothalamic FB

Method

Display & Mask SOA

100 50 150 200

Display-Mask ISI

0 50 100

Context Effects & Ambiguity Resolution Mediated by Feedback

Ambiguity Resolution Takes >50 ms

Context Effects

Exp 1 Both Homogeneous (Ambiguous)

Exp 2 Concave Homogeneous (Unambiguous)

Experiment 3

Dichoptic Compared to Exp 1-2 Monoptic &

Results: Exp 3 Dichoptic Compared to Exp 1-2 Monoptic &

Unambiguous

Ambiguous

Monoptic

Dichoptic

Same Convex Object reports higher

Dichoptic than Monoptic

Cortico-thalamic FB resolves Ambiguity

No mask interference in monocular pathways or corticothalamic FB until >60 ms after mask onset

If Corticothalamic feedback, context effects should emerge in a shorter display-mask SOA in Exp 3

Mask interference in the cortex is unchanged by dichoptic presentations

If Cortico-cortical FB, context effects should emerge at same display-mask SOA in Exp 3


DOI: 10.3389/fpsyg.2023.1243405