

Color tuning in metacontrast masking

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How is color represented in the cortex?

Retina, lateral geniculate nucleus: Luminance and two chromatic cardinal axes (Encoding by set of three parallel signals).

Cortex: No clear organization, no privileged axes?

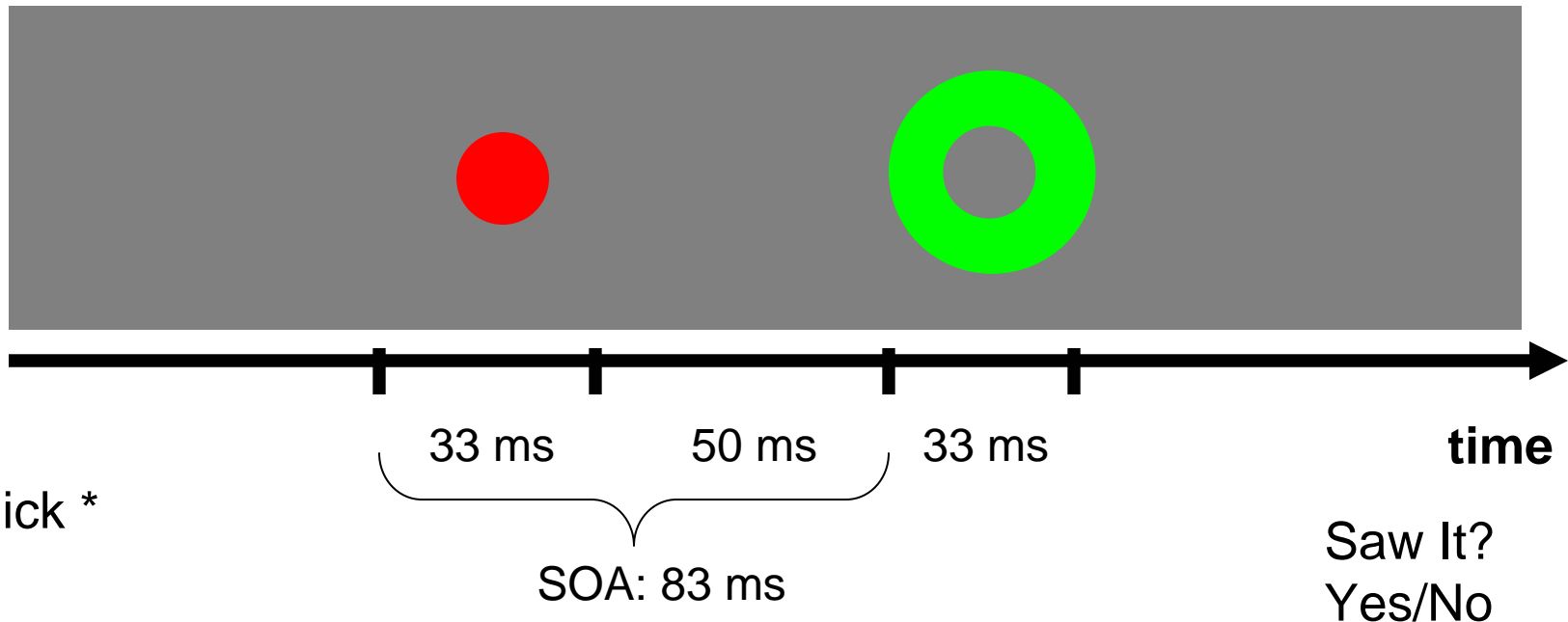
Metacontrast masking

Yellott & Wandell (1976) – color selective masking occurs dichoptically

Anstis & Becker (UCI/OSA 2001) – luminance polarity selectivity.

Beer & MacLeod (VSS 2002) – masking is color-polarity selective.

Metacontrast Masking:

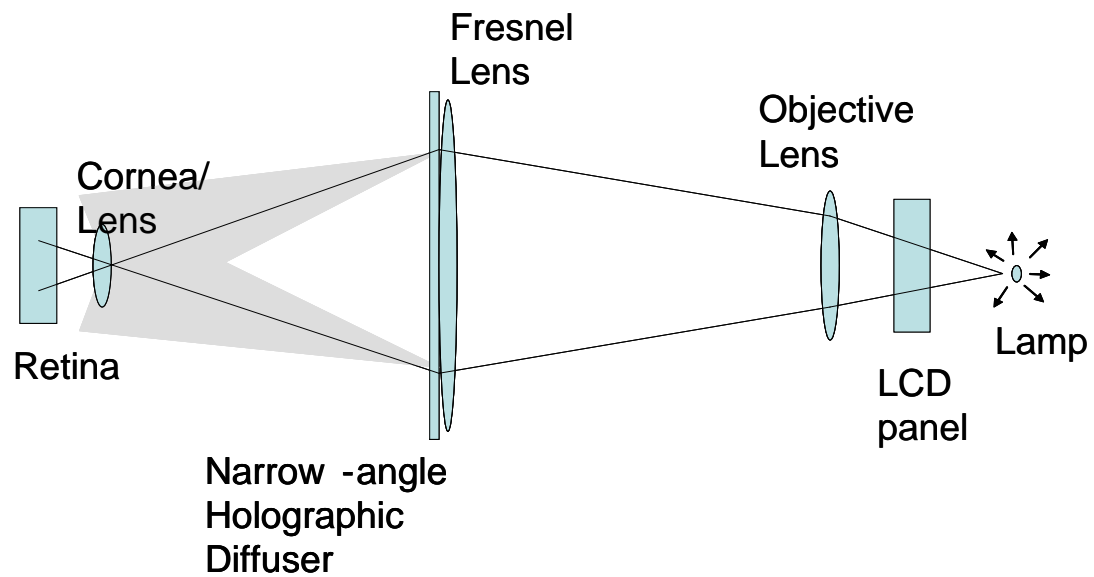


Yes/No, 127 conditions, randomized QUEST staircases,
6 naïve subjects, 8 hours/subject

Display: 17 x 13 deg
Test diameter: 1.5 deg
Ring diameter: 3.0 deg

Luminance (background): 4000 cd/m²

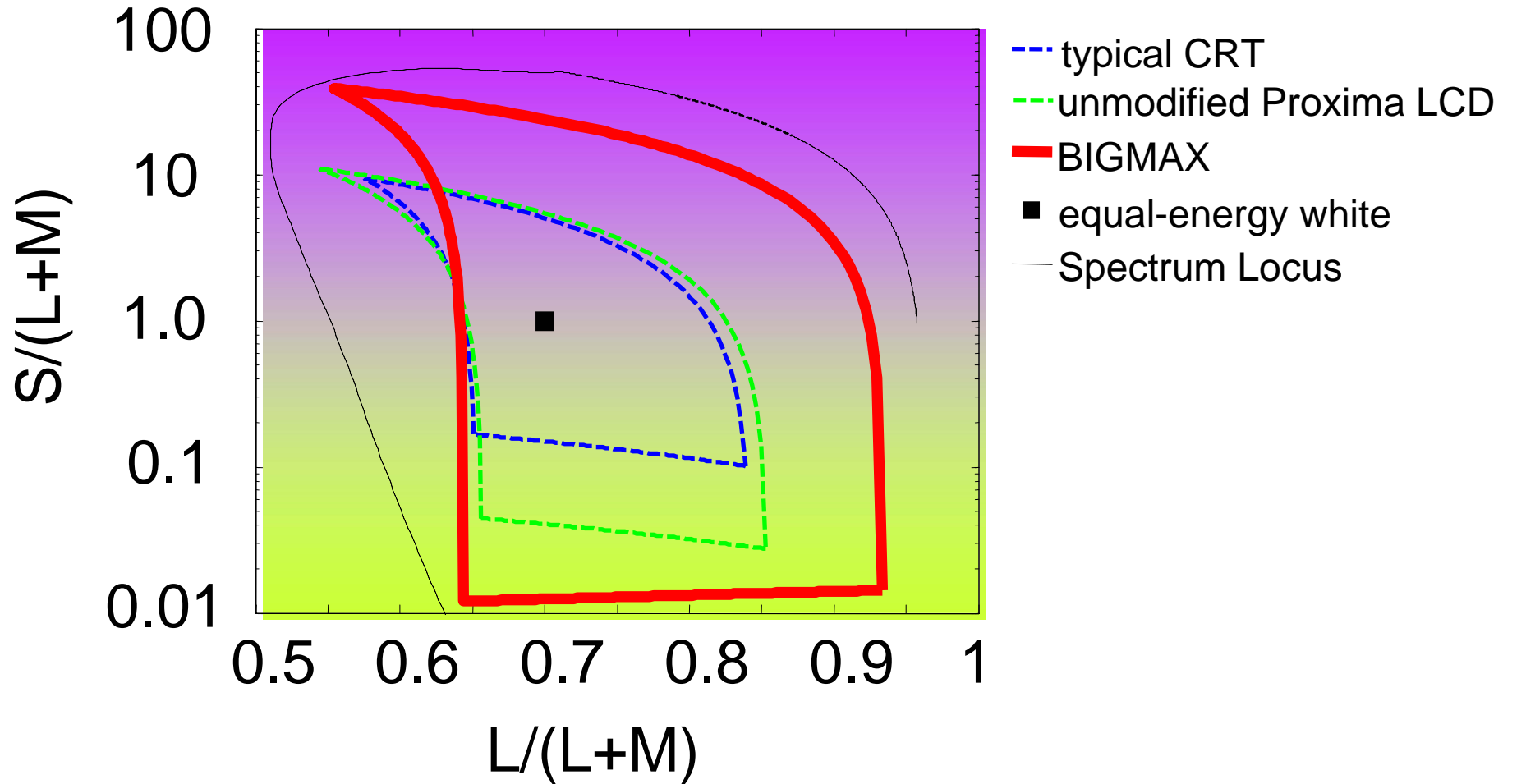
Extended Maxwellian View (BIGMAX™)



High luminance: 100, 000 cd/m²

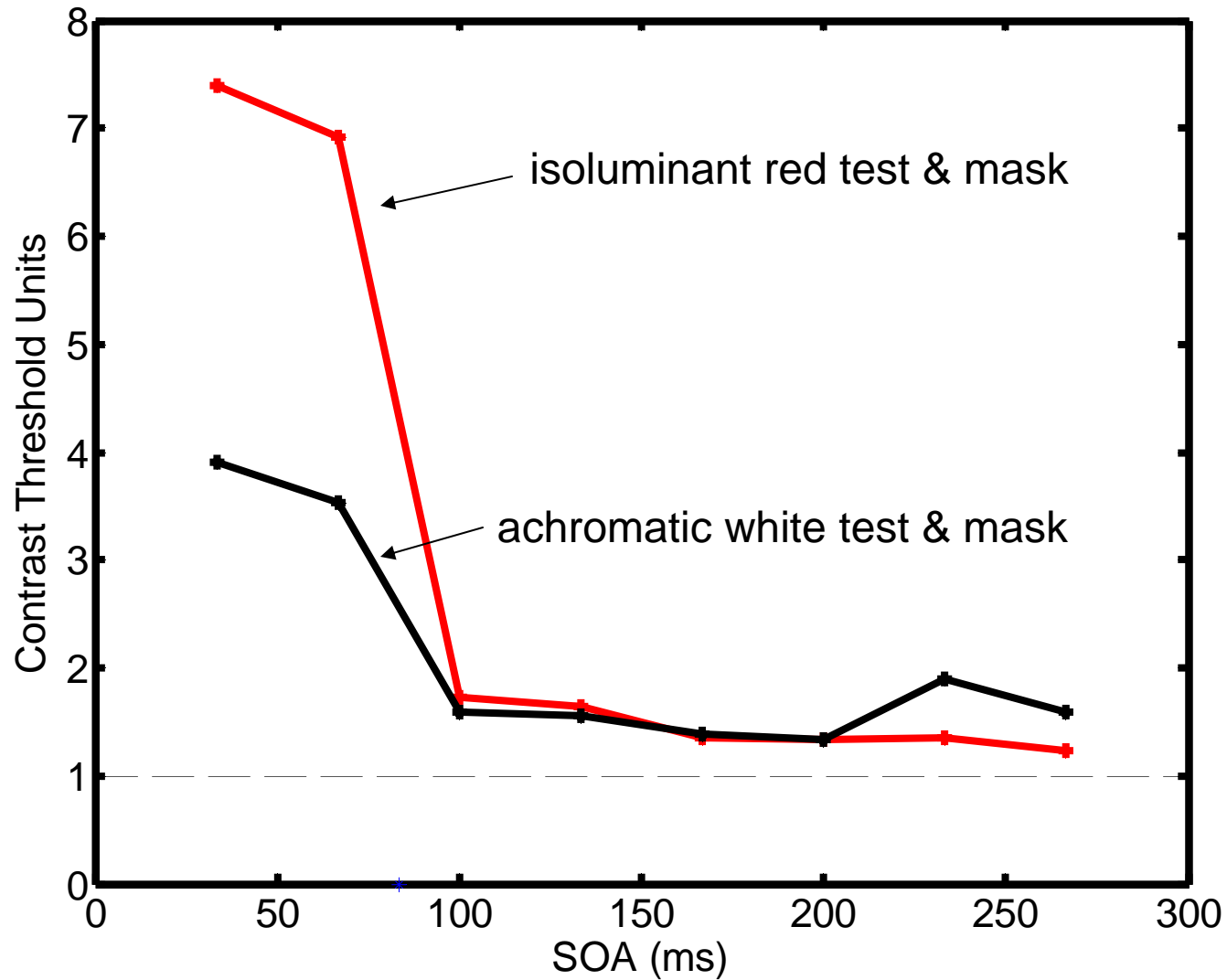


Improved gamut with additional dichroic filters



Max luminance with filters: 20,000 cd/m²

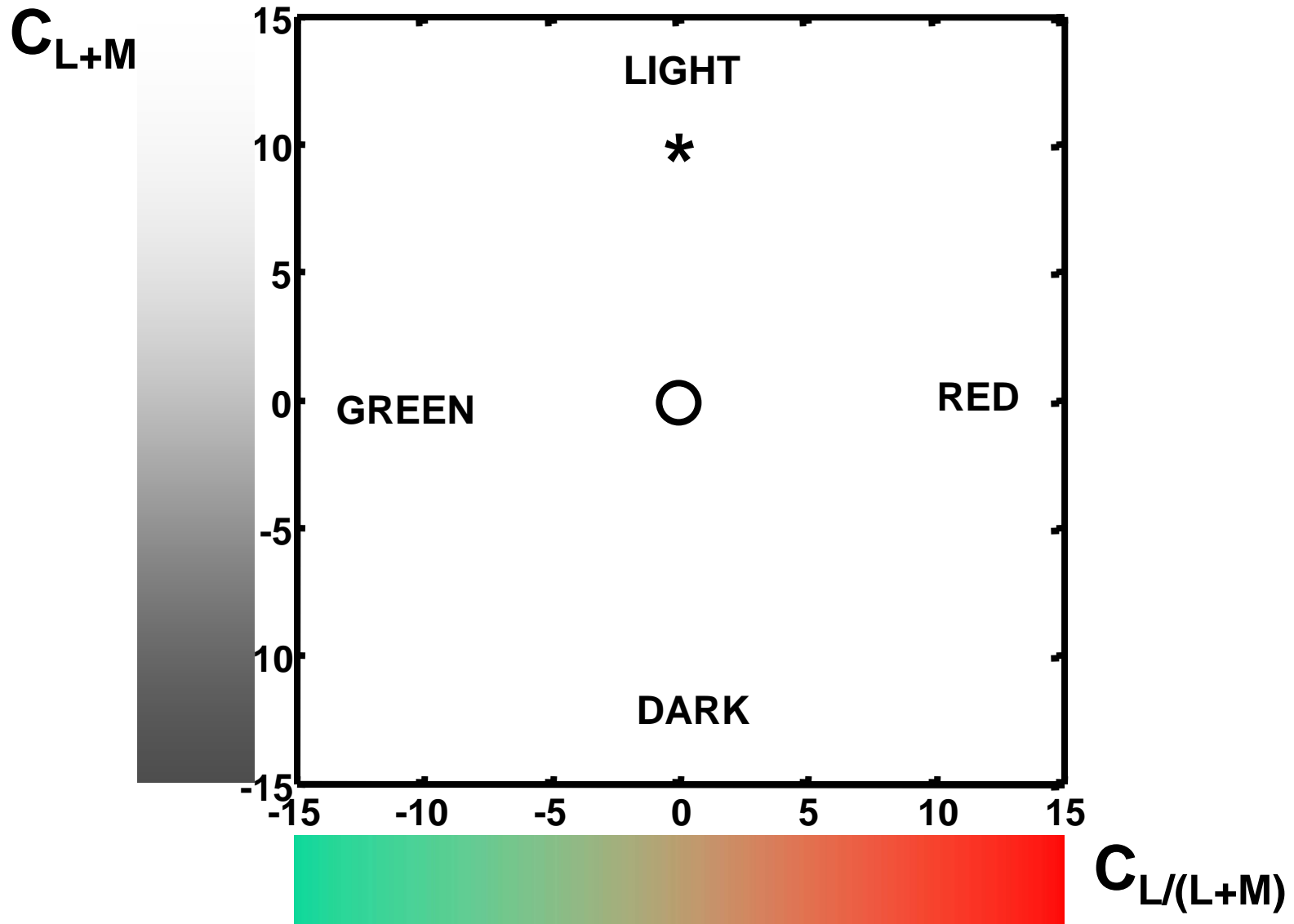
Preliminary experiment – determining SOA



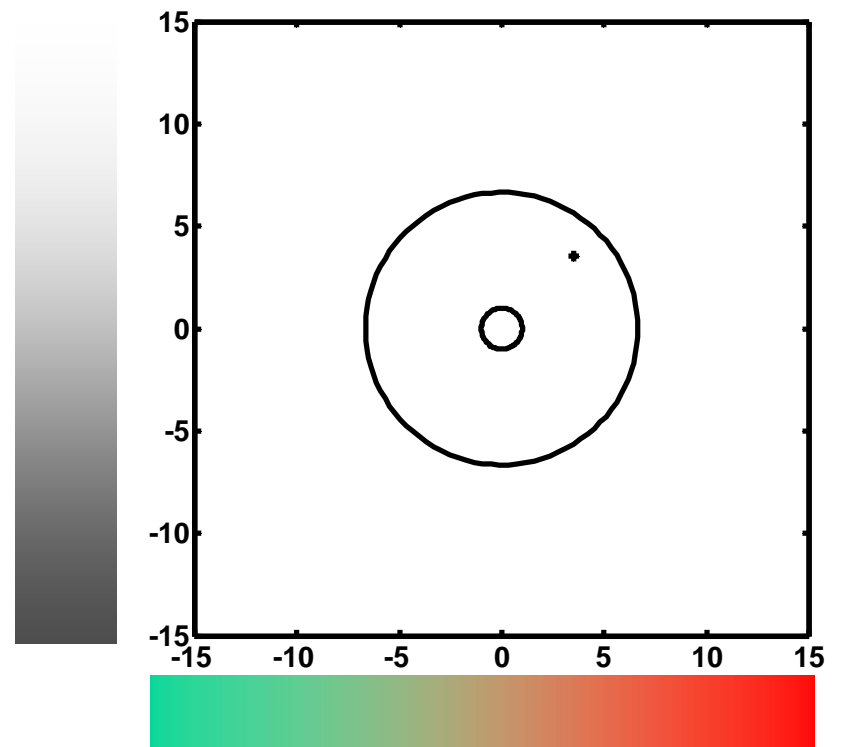
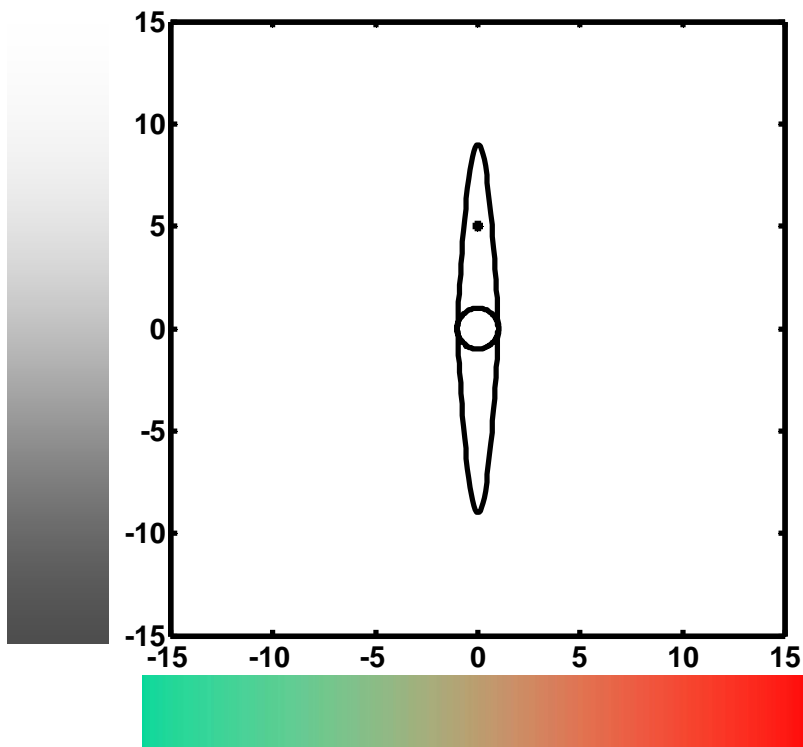
Use 83 ms onset asynchrony

Demo

Threshold elevation plot (luminance/red-green plane)

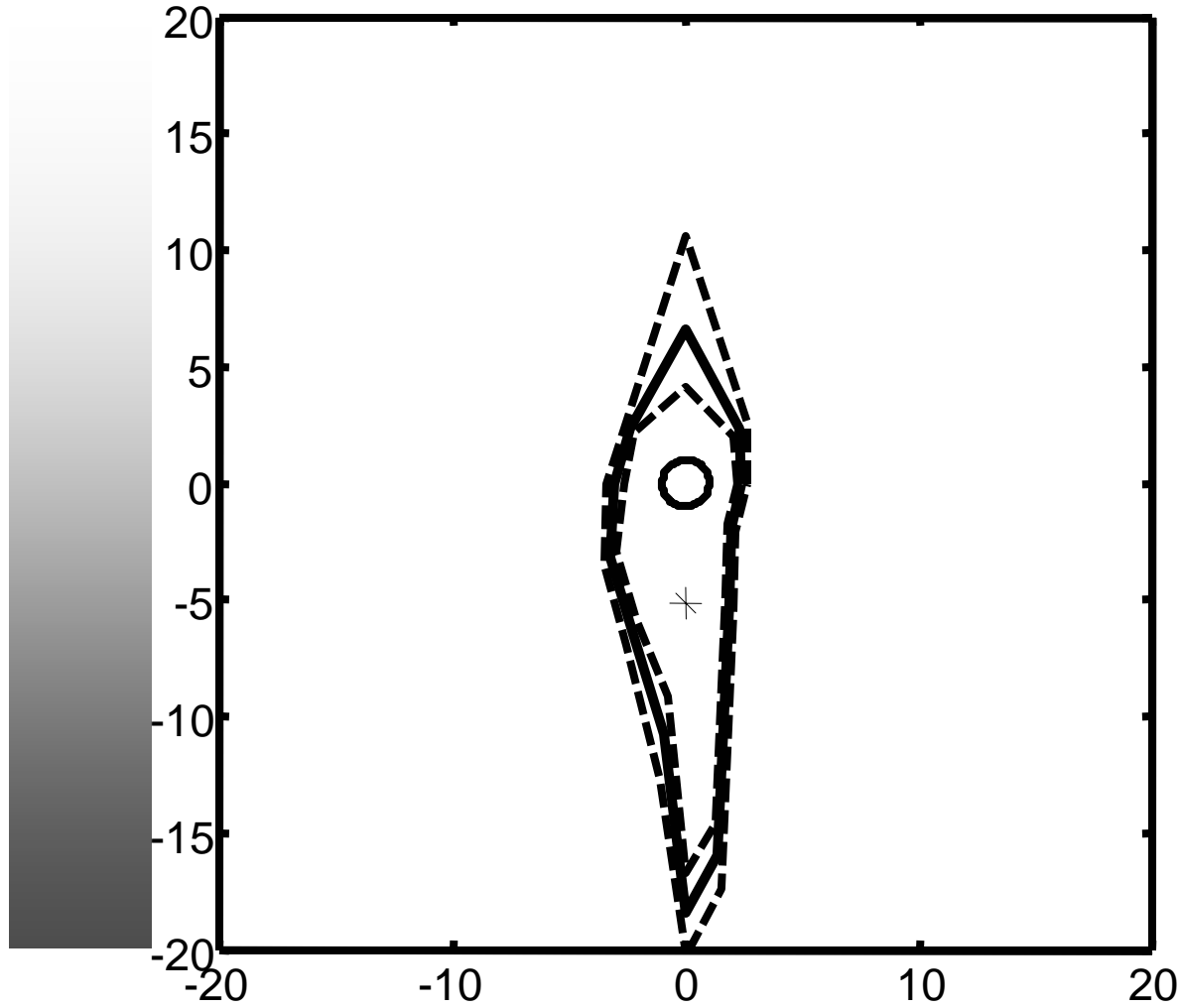


Predictions: Cardinal axis model with adaptation

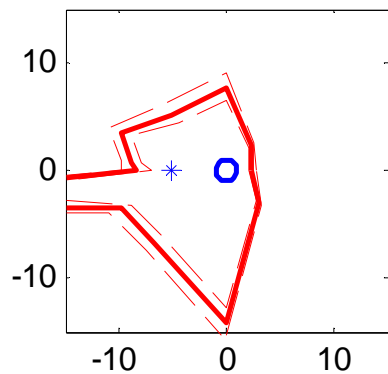
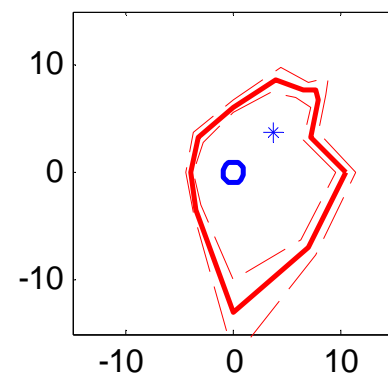
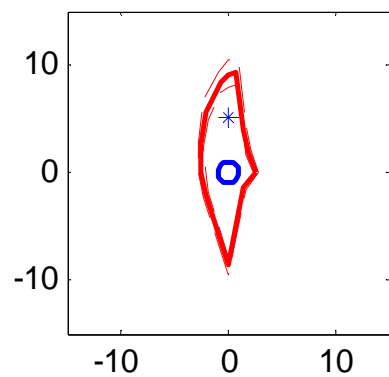
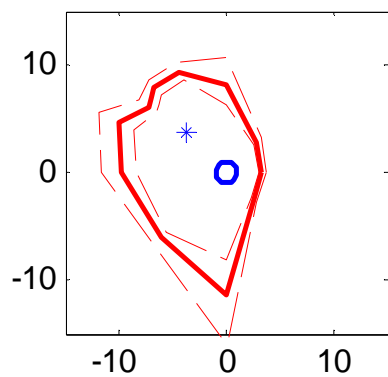


Luminance - Red/Green Plane (N=3)

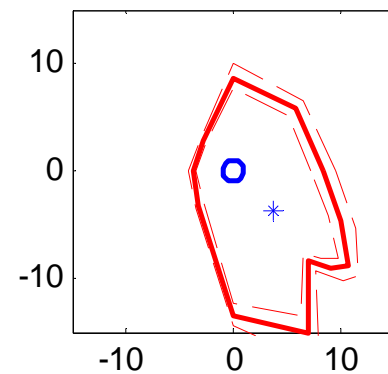
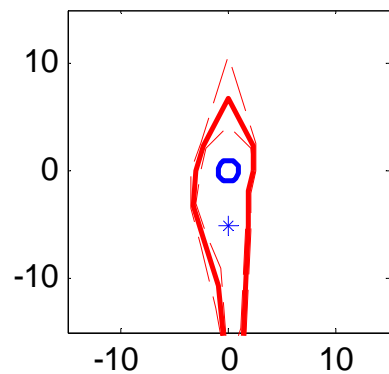
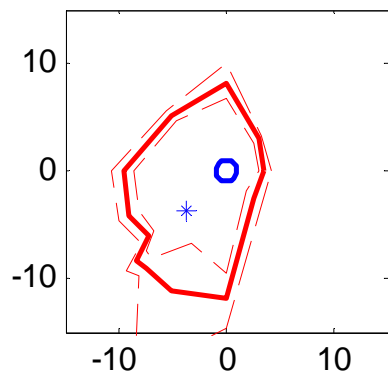
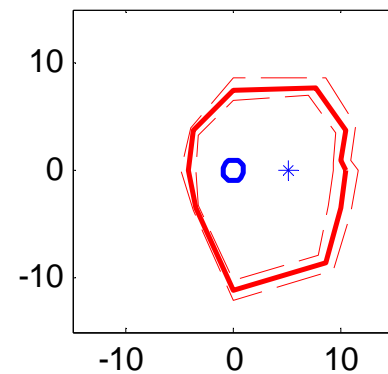
C_{L+M}



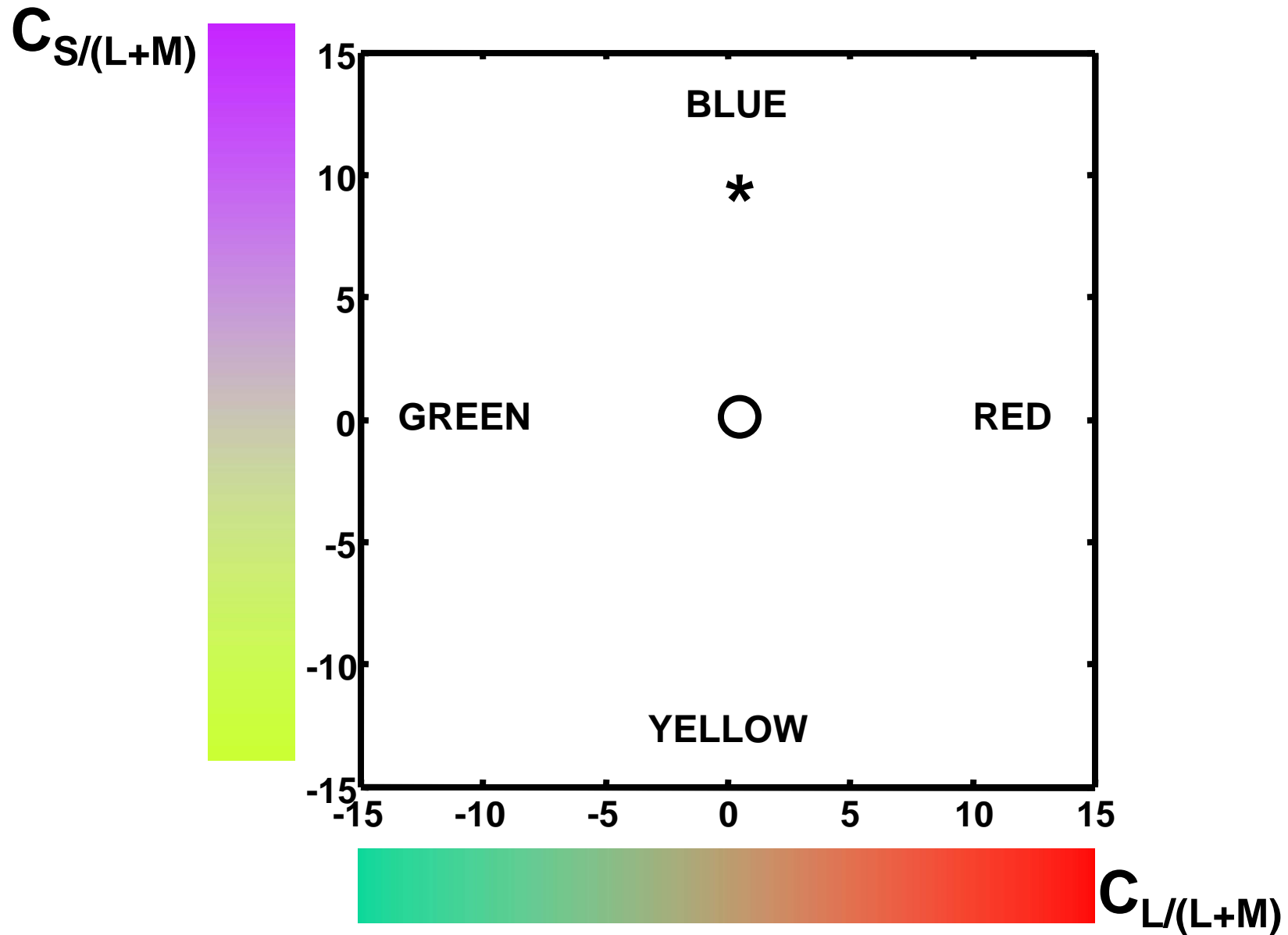
$C_{L/(L+M)}$

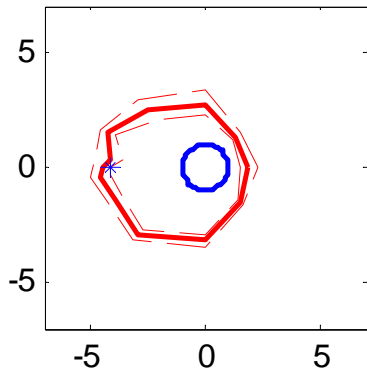
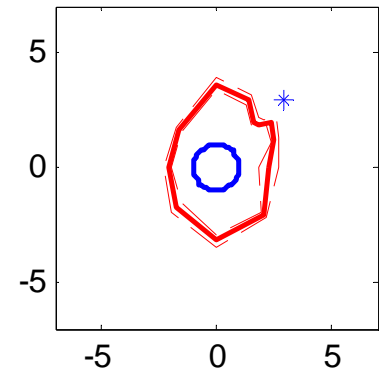
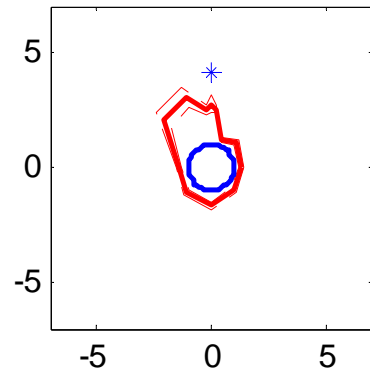
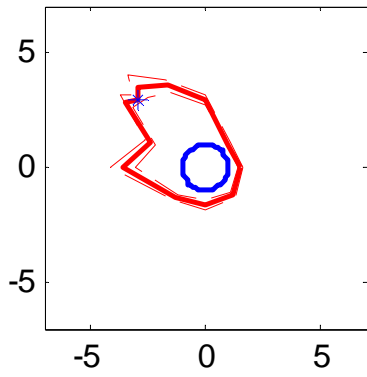


Luminance
Red/Green
Plane (N=3)

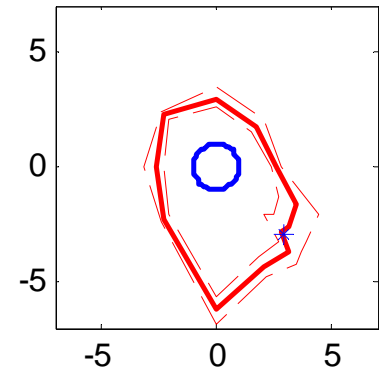
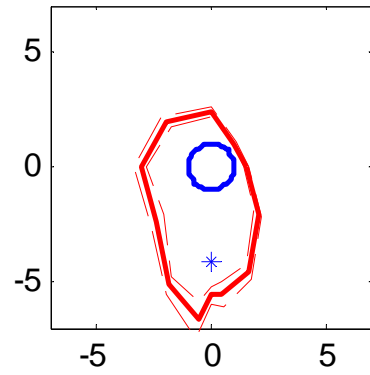
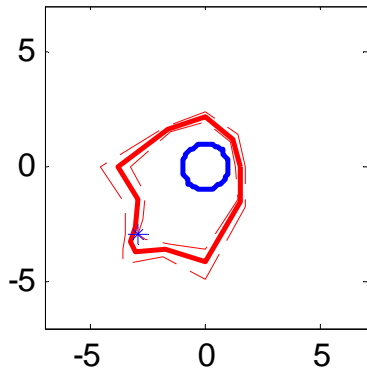
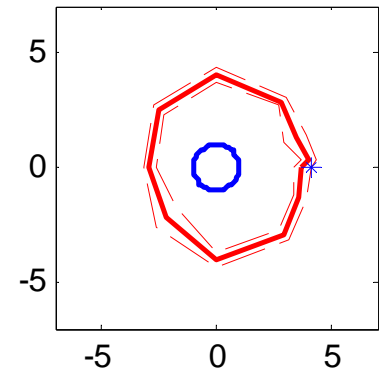


Threshold elevation plot (isoluminant plane)





Red/Green
Blue/Yellow
Plane (N=3)



Results & Conclusions

- Polarity selectivity: Color masking is polarity selective, luminance masking less so.
- Anisotropy:
 - Color (L-M cone axis) masks luminance, luminance does not mask color
 - Color (L-M cone axis) masks color (S-cone axis), but S-cone axis does not mask L-M cone axis.
- Tests that escape masking are seen with roughly veridical luminance and color contrast, inconsistent with a model of sensitivity change of cardinal mechanisms.
- Inconsistent with a simple cardinal mechanisms model
 - similar color difference can have different masking effect
 - tuning is not broader for intermediate directions
 - masking does not simply reduce contrast

