NYU/CNS Center for Neural Science

Estimating 2nd-Order Filter Bandwidth in Spatial Frequency and Orientation with Critical-Band Masking

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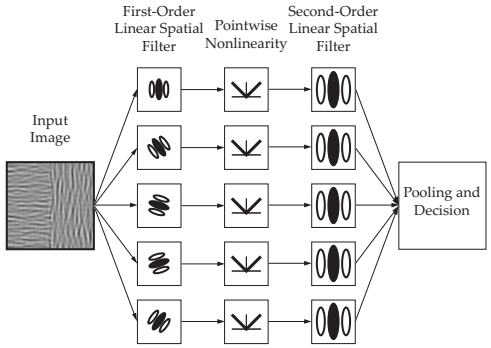
INTRODUCTION

The tuning properties of spatial filters in the early visual system have been measured using adaptation, summation, and masking. We used critical-band masking to measure the spatial frequency and orientation tuning of 2nd-order channels.



Standard Filter-Rectify-Filter model of 2nd-order texture perception.

Support: NIH EY16165
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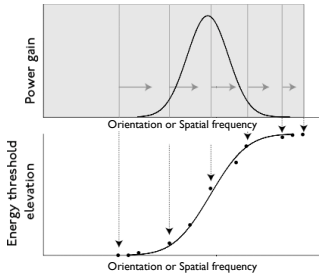
METHODS

Critical-Band Masking

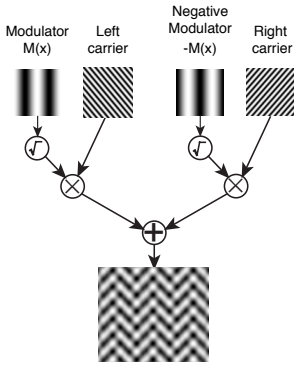
The curve represents the power gain of an observer's hypothetical channel in either the orientation or spatial-frequency domain.

The shaded areas represent noise masks with different cutoffs.

The derivative of the resulting threshold elevation yields an estimate of the channel's power gain.

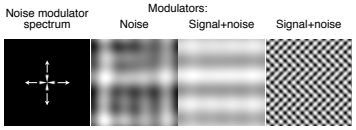


Stimulus Construction



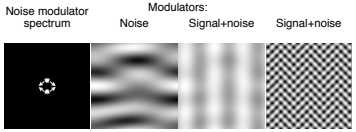
Noise Masks

Experiment 1*: *Spatial frequency bandwidth increases across conditions:



Task: Vertical/horizontal discrimination

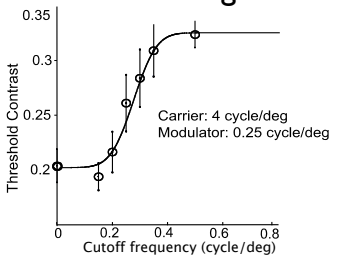
Experiment 2: Orientation bandwidth increases across conditions:

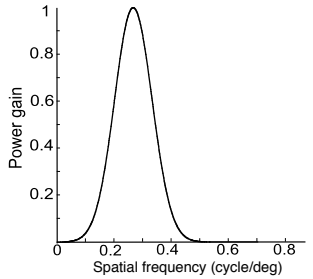


Task: Vertical modulation detection

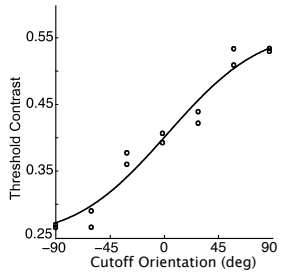
RESULTS

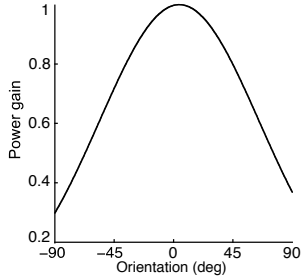
Spatial Frequency Masking





Orientation Masking





CONCLUSION

- Critical-band masking is effective for 2nd-order channel characterization.
- Estimated 2nd-order orientation tuning is broad relative to 1st-order channels, while 2nd-order SF tuning is relatively narrow.