Depth perception from motion parallax: dependence on texture spatial frequency and orientation

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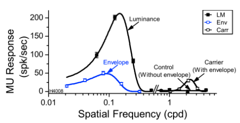
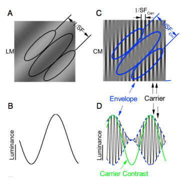
Introduction

Background :
Motion parallax is a powerful cue for depth and segmentation. All previous studies of motion parallax used random dots that are broadband in terms of spatial frequency and orientation. Here we examine depth perception from motion parallax using Gabor micro patterns of different spatial frequencies and orientation.
We examine to what extent different parameters of micro patterns are important for optimal depth perception.





Second order stimuli responsive neurons demonstrate distinct Carrier and Envelope tunings.

Li and Baker(2012)

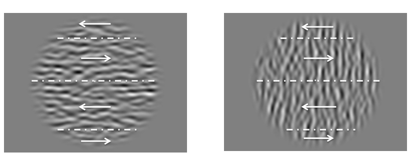
Methods

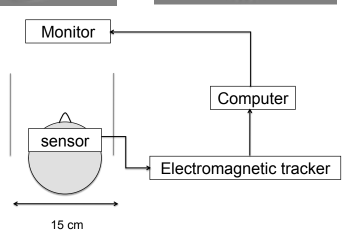
Hardware:
- Electromagnetic head tracking (100Hz sampling)
- Head position recording in 6-DOF
- Minimal lag (20 ms)

Stimulus:
- Random micropattarens presented on a gray background
- Fixation point: center of the window, visible during stimulus presentation
- Free head movement (no chin rest), with limited span ~15 cm
- 5s presentation time
- Envelope Spatial frequency at 0.1 cpd
- Syncing gain = 0.03
- 1.5 cycles/image
- 114 cm viewing distance
- Monocular viewing

Task :
- **Depth ordering**, 2AFC, 5s

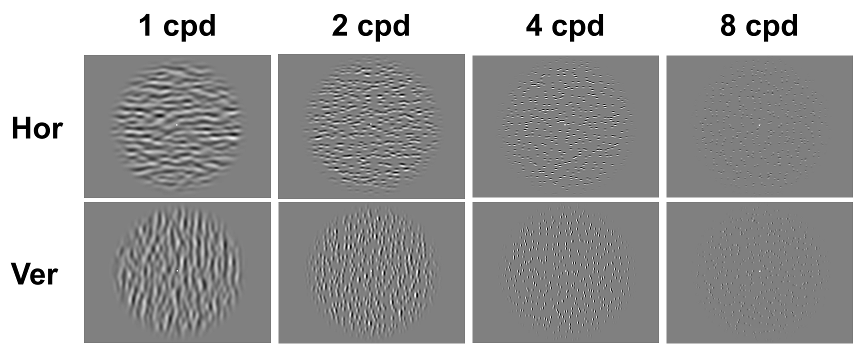
Parameters:
- **Coherence**

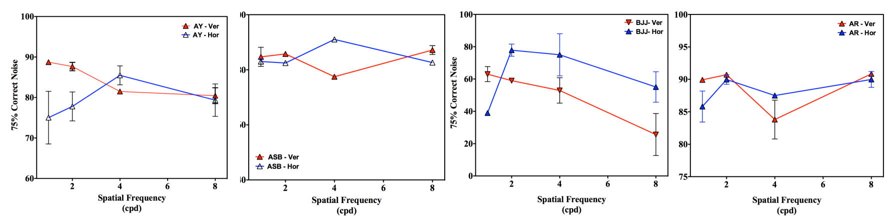




Results

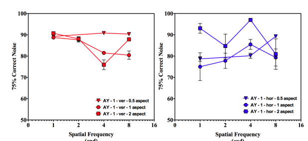
Spatial Frequency & Orientation





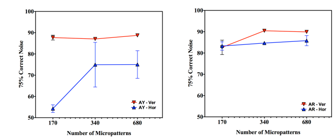
Aspect Ratio

1 cpd



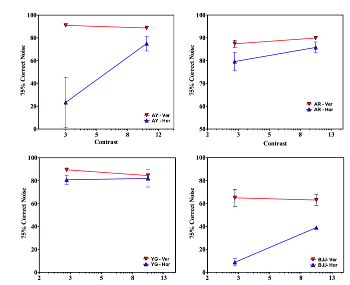
Density

1 cpd



Contrast

1 cpd



Conclusions

➢ Vertical micropatterns provide the best performance at low spatial frequencies whereas horizontal micropatterns provide the best performance at mid-range spatial frequencies.

➢Variations in density have relatively small effect but decrease in contrast reduces the performance especially for horizontal micropatterns.

➢ Changes in Gabor micropattern aspect ratio significantly change the peak tunings for spatial frequency, suggesting spatiotemporal selectivity for carrier and envelope.

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