The effect of stimulus visibility on visual field inhomogeneities

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INTRODUCTION
- Performance across the visual field is not homogenous, even at equal eccentricities.
- Visual (performance) field inhomogeneities have been the subject of considerable investigation, but some aspects of these inhomogeneities, such as the vertical meridian asymmetry (VMA) or “north effect” – particularly poor performance at the location directly above the point of regard (Carrasco et al., 2001) – are less well understood.
- The VMA depends upon the visual stimulus.\(^1\)

METHODS

Experiment 1: Manipulating contrast & task difficulty.
- Participants
  - 2 non-naïve participants (LC & IB) & 4 naïve (college-aged) observers
  - Normal or corrected-to-normal vision
- Stimuli
  - 0.5 and 8 cpd 2.0 deg. Gabor patches, tilted clockwise or counterclockwise, presented for 54 ms at one of 8 isoeccentric locations (4.5 deg. eccentricity) in one of 3 conditions:
    - 2 deg tilt at “high” contrast
    - 15 deg tilt at “medium” contrast
    - 90 deg tilt at “low” contrast
- Task
  - 2-AFC orientation discrimination task
  - Prior to data collection established “baseline” parameters to obtain ~80% PC for each observer
  - 2000 trials per condition

Experiment 2: Complex (high contrast) images.
- Participants
  - 12 naïve (college-aged) observers
  - Normal or corrected-to-normal vision
- Stimuli
  - Natural images presented for 70 ms at one of 8 isoeccentric locations (4.5 deg) in one of 4 conditions:
    - horse vs. monkey (8 practice trials)
    - scenes vs. scenes with animals (32 stimuli)
    - biological vs. non-biological (36 stimuli)
    - cats vs. dogs (40 stimuli)
- Task
  - 2-AFC task: discriminate between images (e.g., cat vs. dog)

RESULTS

Table: Performance field inhomogeneities depend on grating contrast at low SF.

SUMMARY & DISCUSSION
- The visual field is not homogenous, even at a fixed eccentricity. This has been well documented in a number of studies (e.g., Abrams, Nizam & Carrasco, 2012; Carrasco et al., 2001) and replicated here.
- Performance field inhomogeneities are less pronounced at high contrast, when equated for task difficulty.
- Spatial frequency is an important parameter – performance field inhomogeneity is pronounced even for high contrast stimuli at high SF (8.0 cpd). (But note small range of contrasts.)
- Performance fields are homogeneous for complex, high contrast images.

Remaining Questions:
- Do these data make ecological sense? (Note: We are unaware of “north effect” in typical visual experience.)
- Is the extent of performance field inhomogeneity due to a complex interaction between spatial frequency and contrast?
- How does task impact the performance field inhomogeneity?

REFERENCES


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