Attention enhances spatial resolution by shifting sensitivity to high spatial frequencies

Yun-Xian Ho, Fani Loula & Marisa Carrasco
New York University

Goals
Using a masking procedure to:
- Investigate the spatial properties that underlie the central performance drop.
- Characterize the attentional effect in texture segmentation tasks.
- Evaluate the hypothesis that attention shifts sensitivity to higher spatial frequencies.

Covert attention enhances spatial resolution
- Improves or impairs performance on a texture segmentation task.
- Allows for a finer scale analysis of stimuli.
- Neurophysiological studies suggest attentional modulation via a spatial tuning mechanism.

Texture segmentation task
- The size of spatial filters at the fovea is too small for the scale of the textures. Thus, the resolution at the fovea is too high for the scale of the textures.
- Precuing the target location affected performance on texture segmentation tasks.
- Attentive boosts early stages of visual processing.
- Attention improved performance at the periphery but impaired it at central locations.

Selective Adaptation
Attention may reduce filter size by increasing the sensitivity of the smallest receptive fields at the attended area (Balz & Hock, Vis Res 1997). This may inhibit the sensitivity of the larger receptive fields at the same area.

Masking
To evaluate the hypothesis that attention shifts sensitivity to higher spatial frequencies.
- Masking high spatial freq adapting to high spatial frequencies.
- Masking low spatial freq adapting to low spatial frequencies.

Task
- 2-IFC task: target present in the 1st or 2nd interval?

Masks
- Broadband
- Low-pass
- High-pass

Results
Selective adaptation and masking provide consistent effects:
- Attention enhances spatial resolution by shifting sensitivity to higher spatial frequencies

Conclusions
- Masking high spatial frequencies but not the low spatial frequencies
- Removes high-frequency information from the display
- Enhances the central performance drop
- Selective attentional adaptation towards higher spatial frequencies; but masking high-frequencies precludes such a shift.
- Attention enhances spatial resolution by shifting sensitivity to higher spatial frequencies