The neural basis of lightness constancy in the visual system

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Goal
Use multivariate methods to identify the neural correlates of lightness constancy in early visual cortex.

Methods

1. 4 experimental conditions:
   - (1, 2) Used contextual cues to make a target luminance appear lighter or darker\(^1\) (see above).
   - (3, 4) Subjects adjusted the actual luminance of a target in a different display to match the appearance of the two context-cued stimuli.

   fMRI parameters:
   - 2-second EPI sequence, 24 slices, 2 mm isomorphic voxels, covering most of visual cortex.
   - 8 runs, each with two 20-s blocks of each condition (random order) with 20-s ISIs.
   - ROI localizer runs (3):
     - A flashing Mondrian pattern identified voxels responsive to a region in the center of the target.

2. Data for each condition within localized ROIs in V1, V2 and V3 were averaged across TRs in a block.
3. 2-way classification was performed between conditions 1 and 2, using SVM.
4. Above-chance classification was possible in all early visual areas.

ROI localization
- Data mapped to flattened cortical surfaces.
- ROIs drawn on surface.
- Voxels in the intersection of the drawn ROIs and pre-mapped V1-V3 used in the analysis.

Conclusions
1. Our results support previous findings (Boyaci et al., 2007) that early visual cortex carries information about context-dependent variations in perceived lightness.
2. The data are inconclusive about the specific involvement of early visual cortex in processing perceived lightness, that give rise to this information.

1 Inspired by an illusion created by J. Gurney [http://gurneyjourney.blogspot.com]