Cortical representation of texture and scale studied with fMRI

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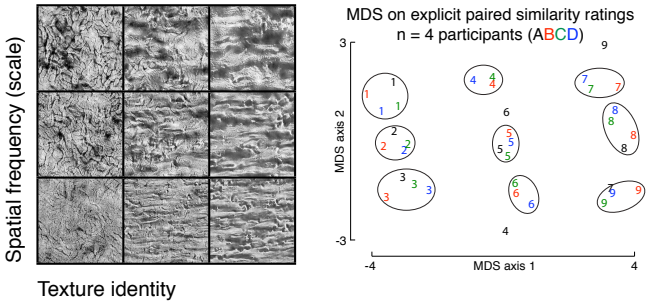
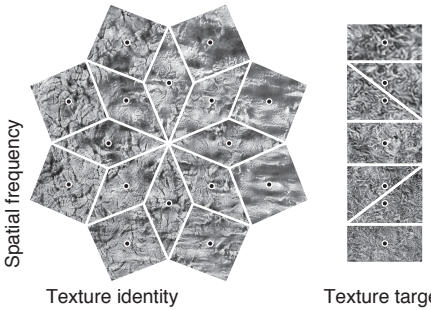
Introduction

While there is evidence that ventral extrastriate neurons may be tuned for the surface properties of objects (Cant et al., 2008), relatively little is known regarding the cortical representation of variations in texture appearance in humans. We used a carry-over fMRI design (Aguirre 2007, Neuroimage) to test if 1) the perceptual similarity of textures is reflected in the similarity of neural population codes; 2) if these representations co-localize with neural populations sensitive to spatial frequency; and 3) if conjoint neural tuning accompanies integral perception of the stimulus axes.

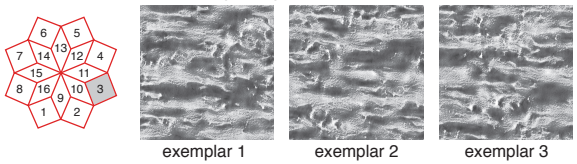
Steerable pyramids to create regular texture space



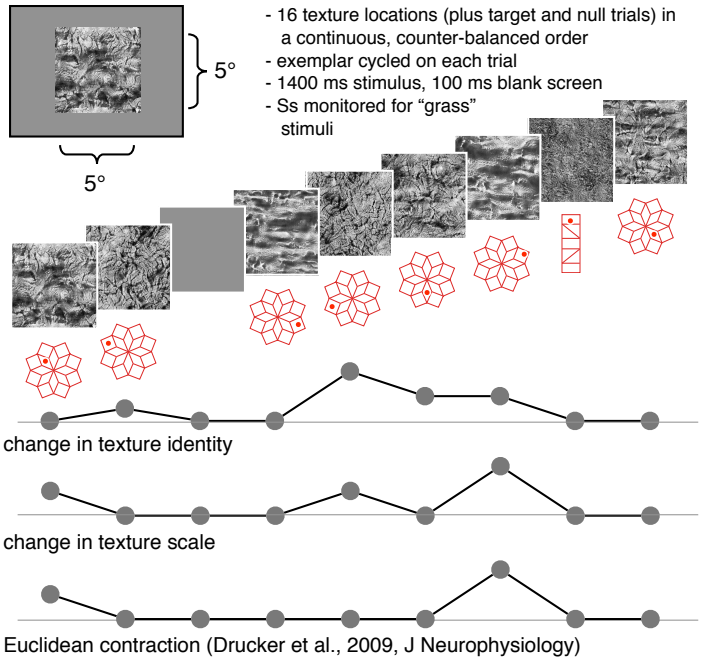
Di-octagonal sampling for fMRI efficiency



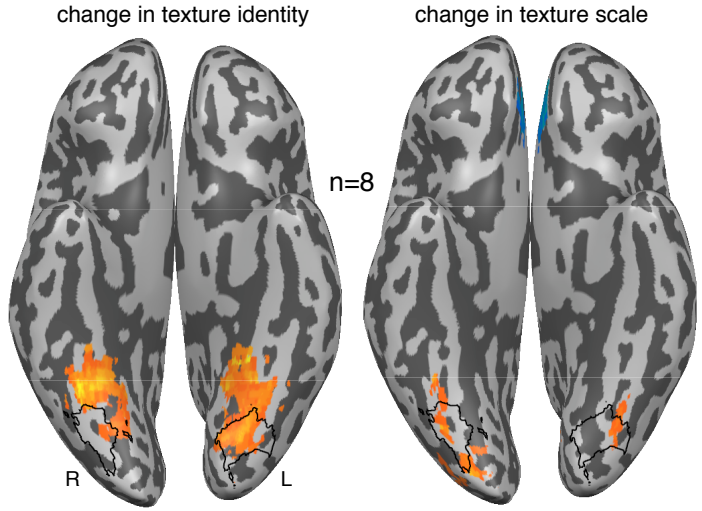
Multiple exemplars of each texture position



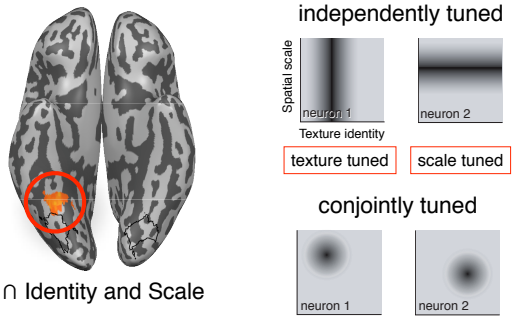
Carry-over fMRI design



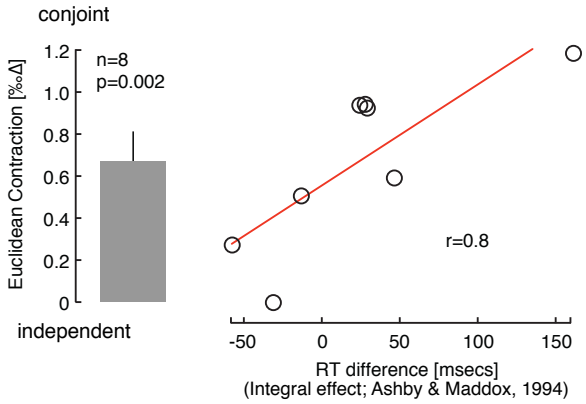
Proportional adaptation in ventral LOC and V4



Neural tuning for both axes in R ventral LOC?



Conjoint tuning reflects perceptual integrality



Conclusions

Proportional adaptation measured with fMRI revealed neuronal populations within bilateral ventral LOC and V4 that code for texture identity. Weaker responses to variations in the spatial scale of texture were also located in ventral LOC. Within a R ventral LOC region sensitive to both texture and scale, neural tuning for both dimensions was overall conjoint but varied across subjects. This variation was systematically related to individual differences in the perceptual integrality of the stimulus space.

http://cfn.upenn.edu/aguirre