



# Colour and Texture Processing in Human Extrastriate Cortex: an fMRI study



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## Introduction

Areas within the lingual and fusiform gyri are thought to be a critical for the perception of colours and textures<sup>1,2</sup>. Furthermore, both macaque<sup>3</sup> and patient studies<sup>4</sup> suggest that patterns of activation within these areas may vary as a function of the perceived hue.

The present study sought to determine if the visual extrastriate areas in humans are:

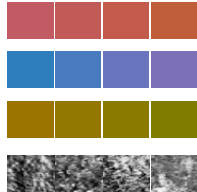
- a) differentially activated by texture when compared to colour.
- b) differentially activated according to colour.

## Methods: Behavioural Task



### Example Stimulus Presentation

Twelve healthy right handed females, aged 35-40, performed forced-choice, match-to-sample tasks within a 1.5T whole body clinical MRI. A block design was used in which the ability to match target and choice patches on the basis of wavelength or texture was assessed separately for isoluminant colour patches from the red, yellow, and blue regions of colour space and for Brodatz textures. Participants completed five blocks for each of the four types of visual stimuli.



### Stimuli for Discrimination of Colours and Textures

Each set of colour stimuli consisted of 4 Munsell colour patches (2° visual angle) matched in luminance and chroma. Within each set, hue was systematically varied so that the patches were evenly spaced in the colour domains and steps in hue were equally spaced at 2.5 perceptual steps (range 2.5-7.5 steps). For the texture task, patches of marble-like textures from Brodatz's textures were employed. Due to the lack of a standard metric for textures, it was not possible to create equal perceptual steps for these stimuli.

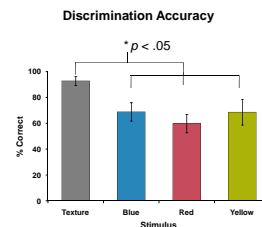
## Methods: MRI Acquisition

- 1.5 Tesla whole body magnet (GE Signa Horizon LX)
- homogeneous birdcage coil.
- EPI images acquired parallel to the AC-PC line (22-24 slices were imaged in the axial plane)
- Single-shot blipped gradient-echo planar images were acquired (TR/TE = 2000/40 ms, flip angle = 90°, 64 x 64 matrix, 25 cm FOV).

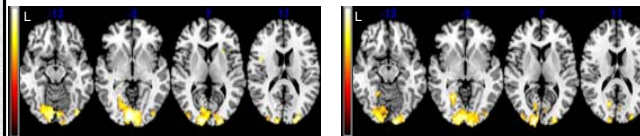
## Methods: fMRI Analysis

- Analyzed using SPM-2.
- Individual functional runs were realigned, normalized to the MNI-305 brain using the EPI template, and spatially smoothed using a 6mm FWHM kernel.
- Voxel-wise analysis was carried out on the group data using  $p = .0001$  ( $k=10$ ), uncorrected.
- WFU pickatlas<sup>5</sup> was used to generate an anatomical Region of Interest (ROI) based on AAL atlas, containing the right and left fusiform gyri.
- Voxel-wise analysis within the ROI was carried out on the group data using  $p = .001$  ( $k=50$ ), uncorrected.

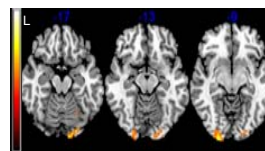
## Results: Behavioural Data



## Results: Whole Brain Analyses ( $p = .0001$ ; $k=10$ )

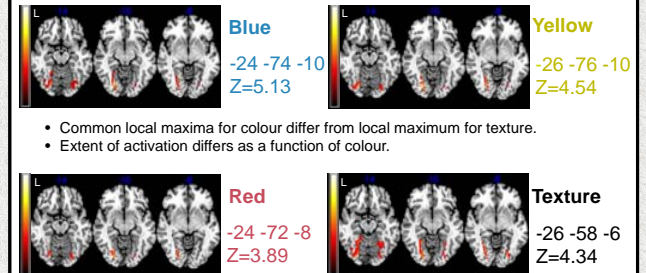


**Colour Perception**  
Colour and texture produced similar activations in the cuneus, lingual and fusiform gyri (above).  
**Texture Perception**  
Texture processing required additional resources in lingual gyrus and cuneus (below).



Texture > Colour

## Results: Fusiform Gyrus ROI ( $p = .001$ ; $k=50$ )



- Common local maxima for colour differ from local maximum for texture.
- Extent of activation differs as a function of colour.

## Conclusions

Perception of texture and colour produce large overlapping patterns of activation. In agreement with recent research<sup>6</sup>, subtractive contrasts demonstrated no differences in the fusiform gyrus, but texture did require additional resources in the lingual gyrus and cuneus.

Current results are further suggestive of unique activation patterns within the fusiform gyrus, according to colour.

## References and Acknowledgements

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