

Visual cortical architecture in autism spectrum disorders

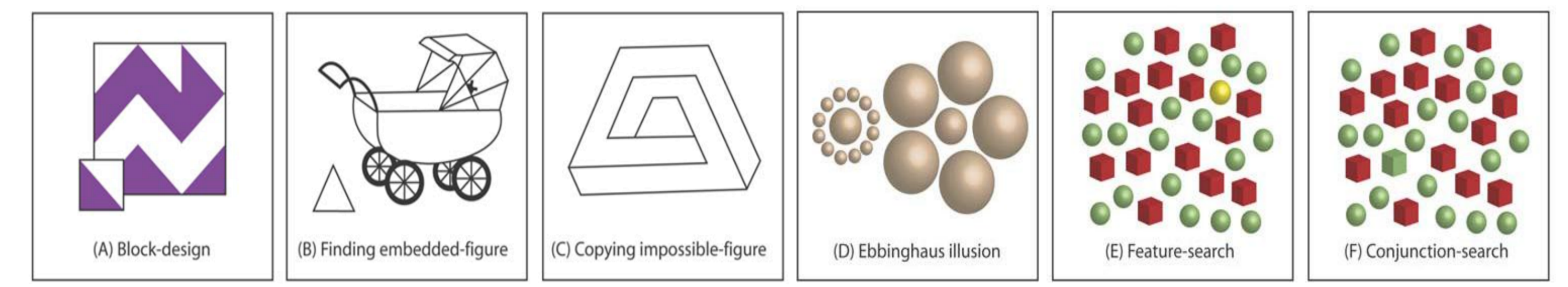
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Background

Individuals with autism spectrum disorders (ASD) may show greater "local processing" e.g. reduced illusions like the Ebbinghaus and an enhanced ability to ignore context in perceptual tasks.

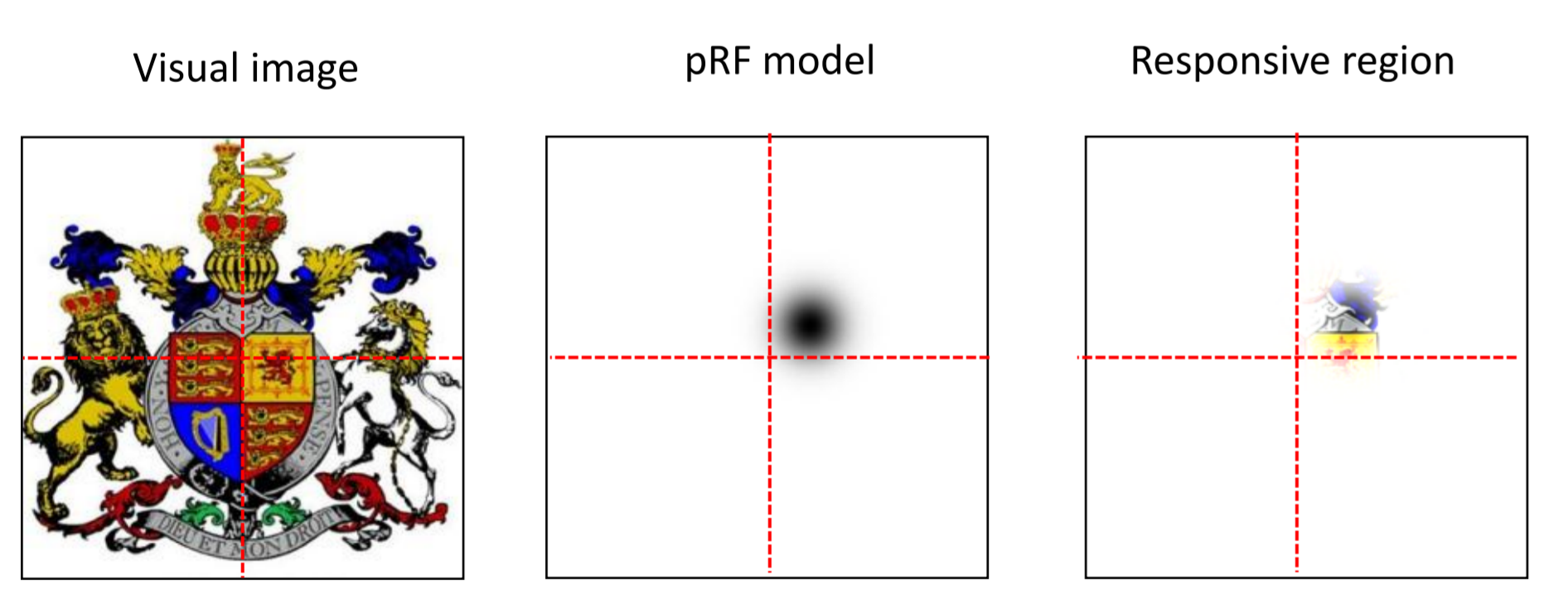


Dakin & Frith, 2005, *Neuron*

Is autism associated with finer spatial tuning in visual cortex?

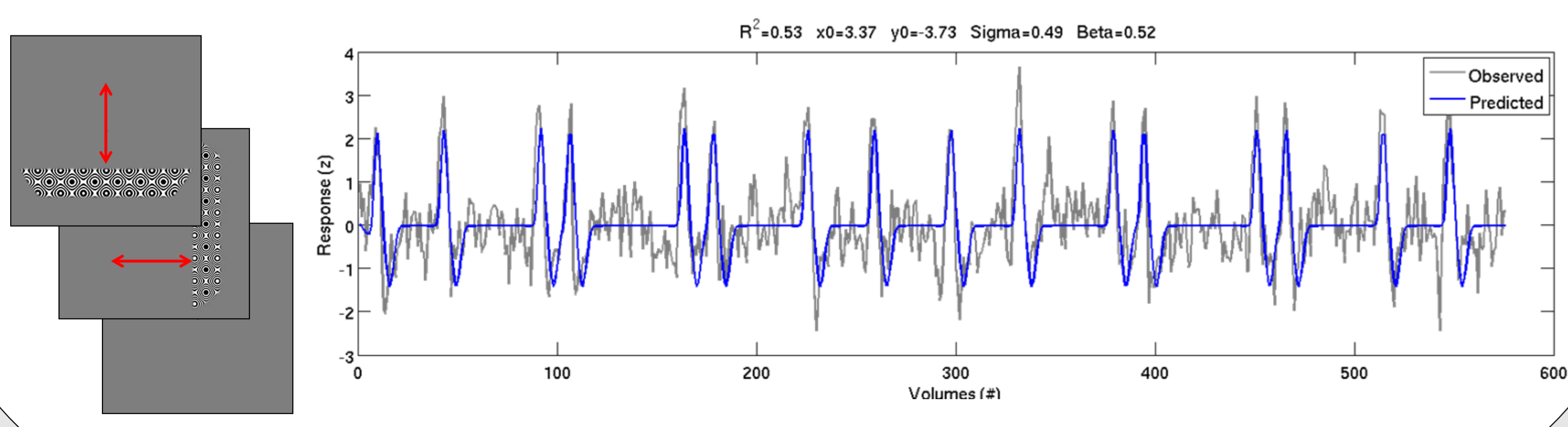
Methods

Population receptive field (pRF) analysis is a model-based approach to retinotopic mapping using fMRI. Instead of only estimating the visual field location each voxel responds to, it optimizes the parameters of the two-dimensional receptive field profile that best predicts the observed fMRI response to visual stimulation.



In its simplest form, the pRF model incorporates the Cartesian position of the pRF center (x,y), a measure of pRF size (σ), and a parameter for the response amplitude (β).

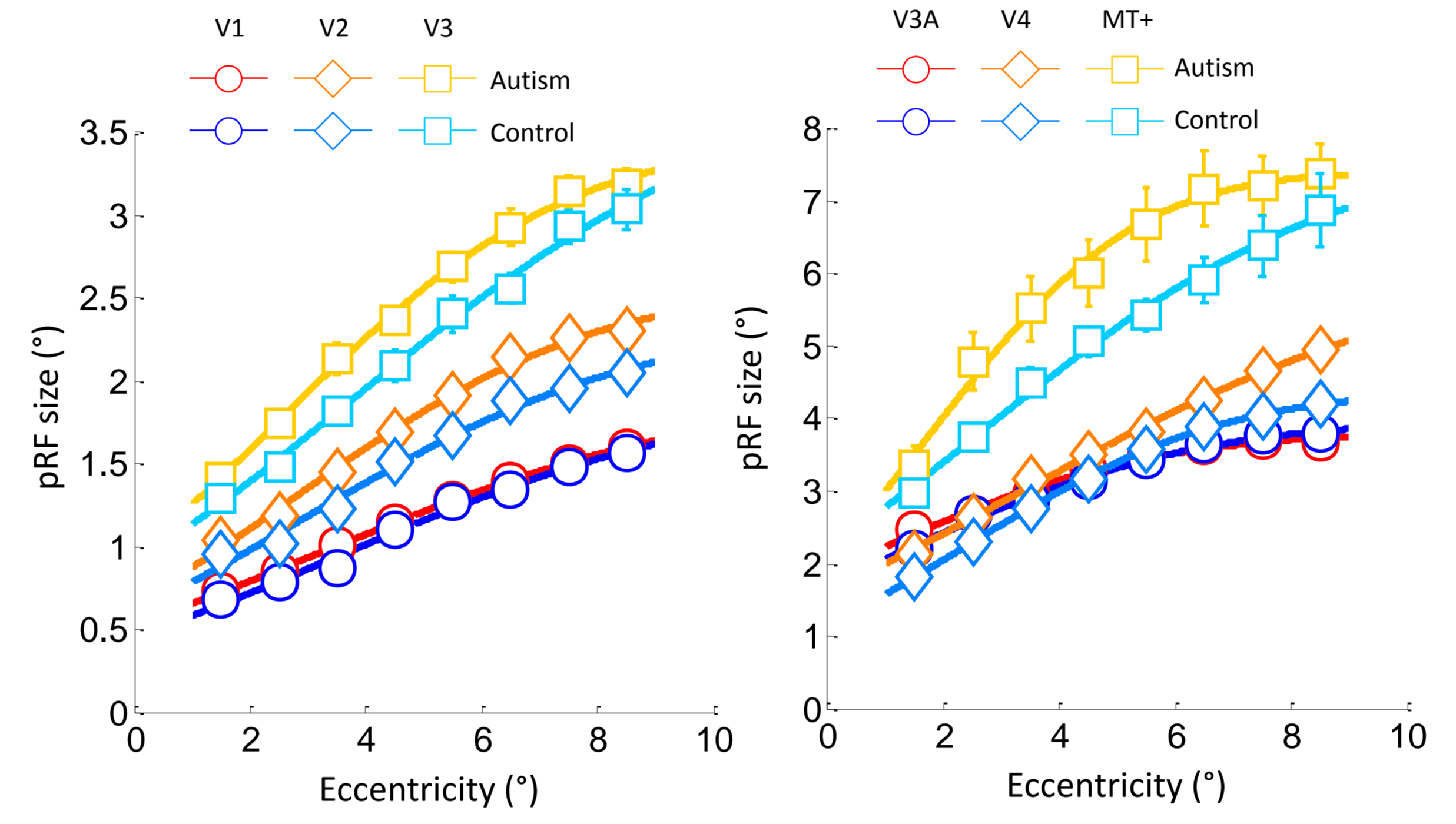
Inside the scanner, participants with ASD (n=14) and demographically matched neurotypical controls (n=12) viewed traversing, high-contrast bar stimuli while performing a simple fixation task. The overlap between the pRF profile and the stimulated part of the visual field at each time point was used to predict the neuronal pRF response. This prediction was further convolved with the hemodynamic response function (HRF) estimated through an independent scan. (Siemens 3T Trio, TR=2.55s, 30 slices, 2.3mm isotropic voxels).



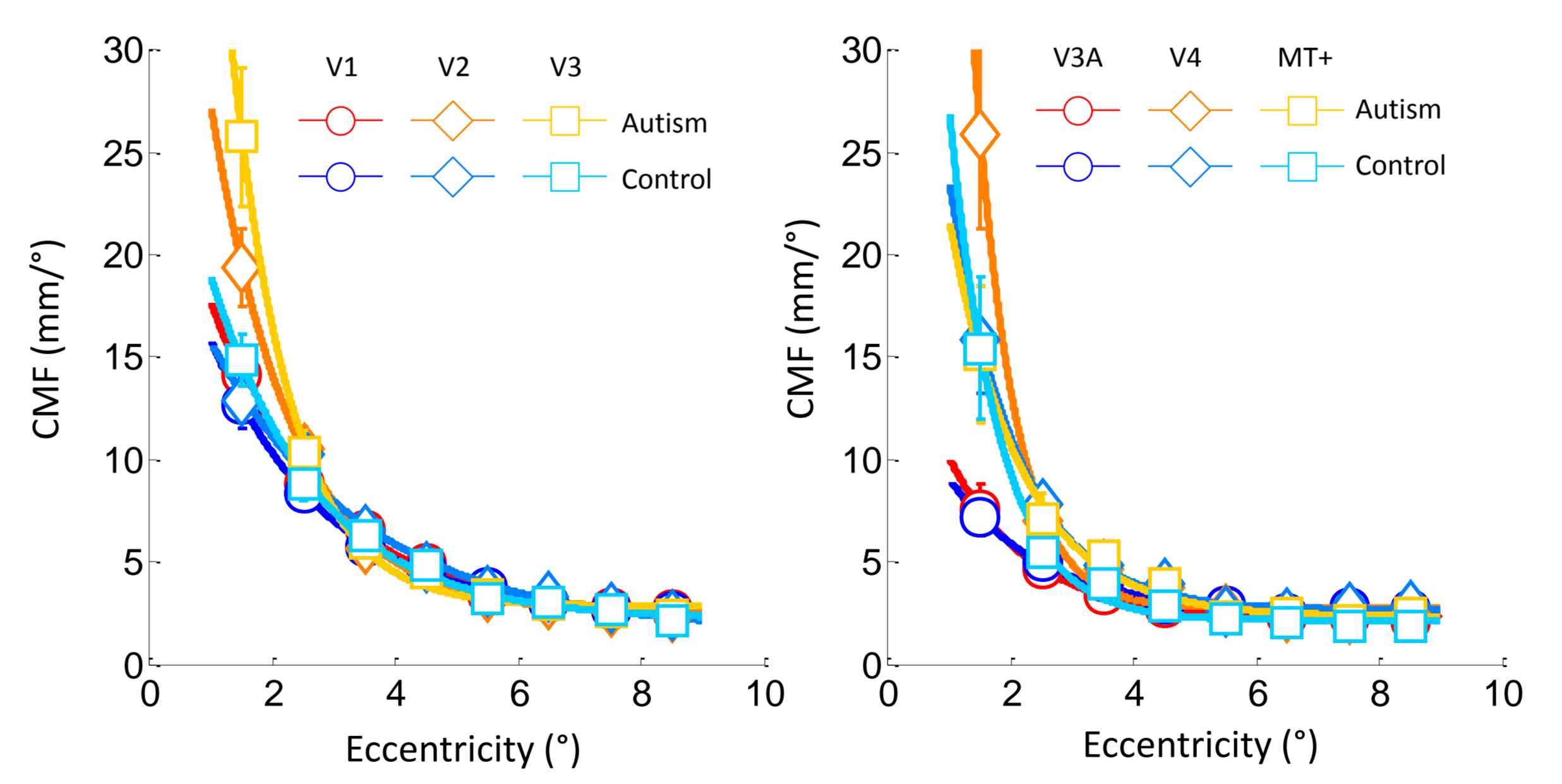
Methods loosely based on Dumoulin & Wandell, 2008, *NeuroImage*

pRF mapping results

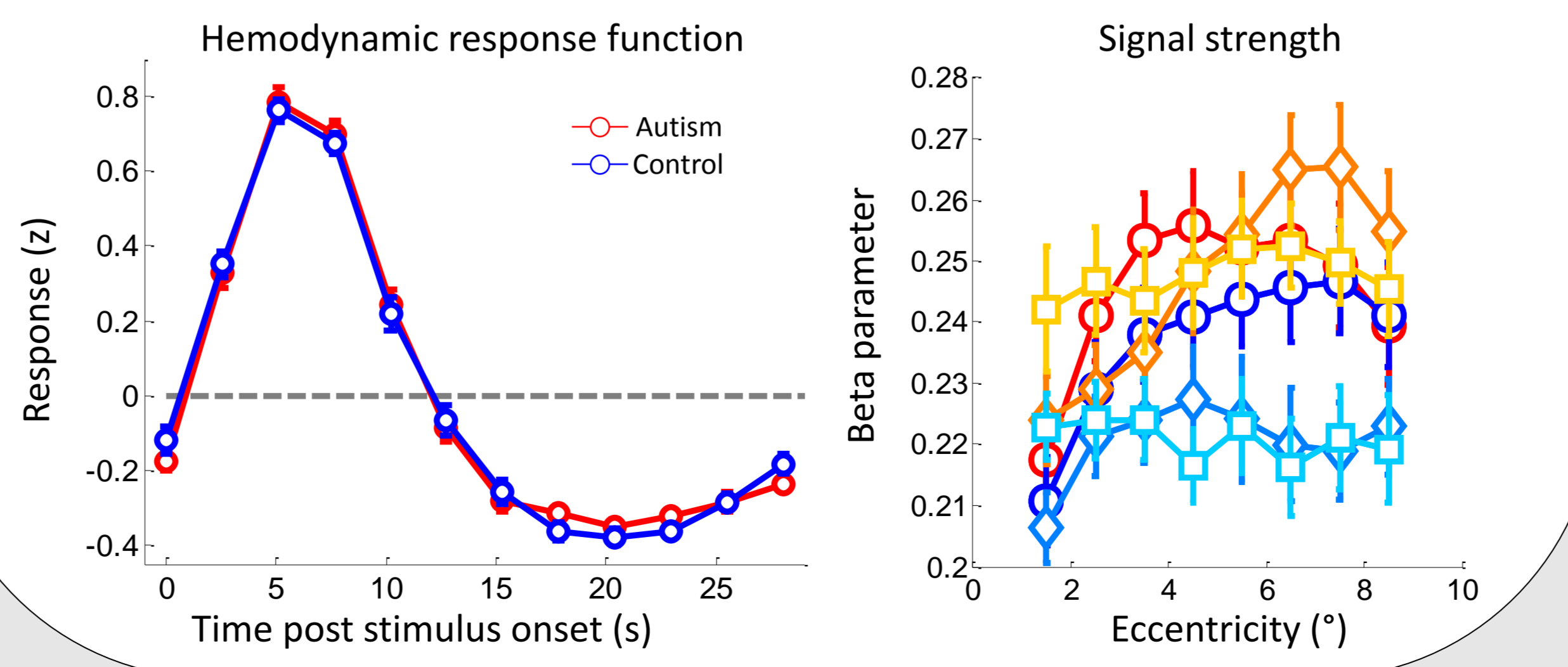
In ASD, pRF sizes at mapped peri-foveal eccentricities were enlarged in most extrastriate regions.



Local cortical magnification factors (CMF) were also greater in the representation of the central visual field in V2 and V3.

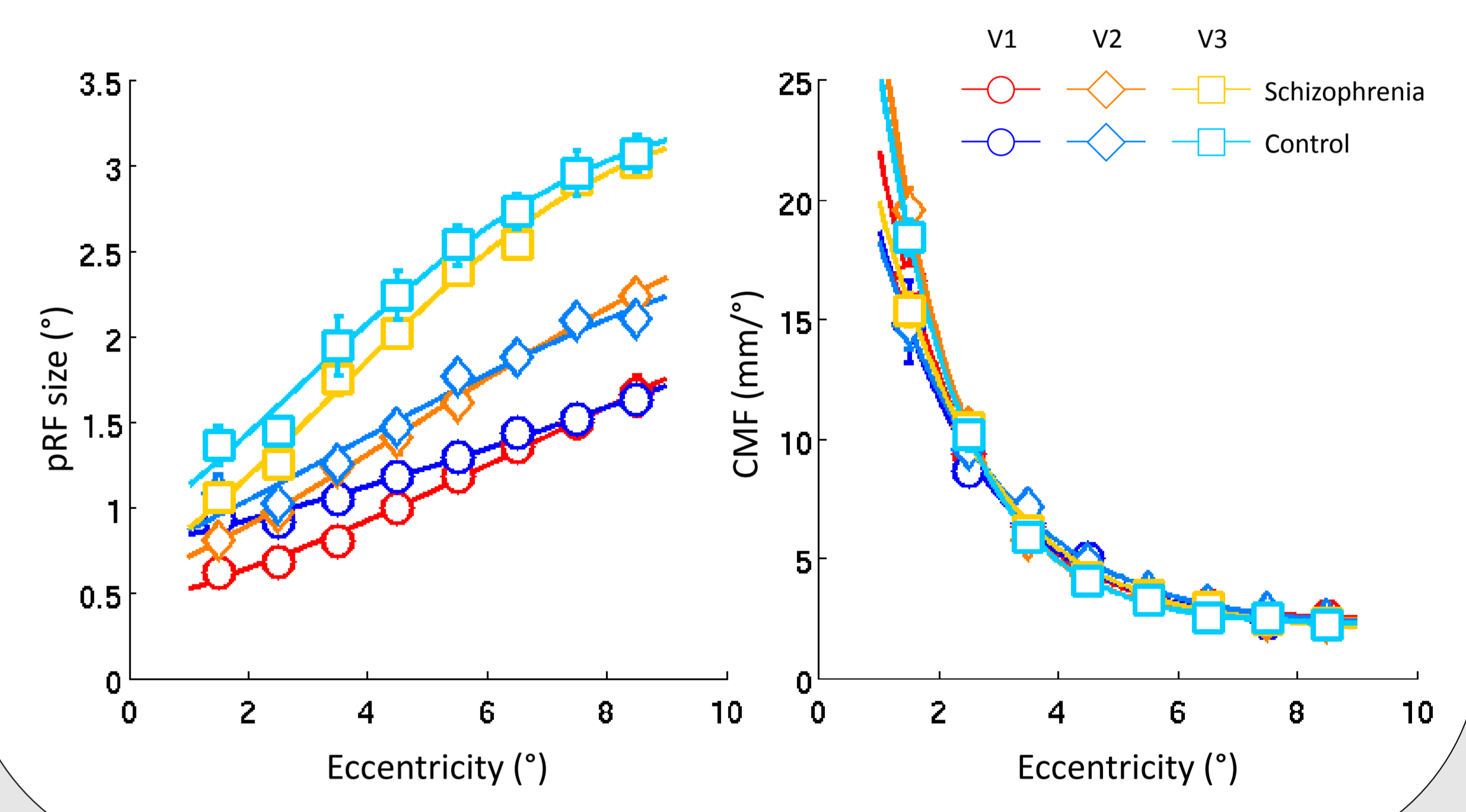


The shape of the hemodynamic response function did not differ in ASD but fMRI responses were subtly stronger.



Comparison with schizophrenia

We also scanned 12 participants with schizophrenia under the same stimulus conditions. Schizophrenia has also been linked to reduced contextual interactions in visual perception. Interestingly, pRF sizes were smaller in schizophrenia for para-foveal eccentricities in V1 only.



Conclusion and Discussion

We found no evidence of finer spatial tuning in visual cortex of individuals with ASD. Instead pRF sizes were generally larger in most extrastriate regions (but not in V1). Cortical magnification was also greater for the central visual field in V2 and V3.

These differences could be due to differential deployment of attention or result from enhanced responses to visual stimulation. Future research must seek to disentangle these possible mechanisms by testing the effect of spatial attention on pRFs.

Interestingly, we find a dissociation with schizophrenia where pRFs in para-foveal V1 were smaller than in controls. This may point towards different neural mechanisms underlying reports of weakened contextual effects in ASD and schizophrenia.