Background and goals

Typically, visual mapping studies employ ordered stimulus sequences - such as rotating wedges, contracting and expanding rings, or sweeping bars - to span the visual field (1-4, but 5-6).

Despite the importance of expectations in perception, visual mapping studies have mostly overlooked the influence of spatial predictability of visual stimuli in mapping estimates.

We employed functional MRI and the population receptive field (pRF) mapping approach (3) to estimate the polar angle preference and the width of the tuning function of voxels in early visual cortex (pRFs modelled as a von Mises distribution). Comparing parameter estimates obtained with different mapping sequences (ordered, random, predictable), we explored whether expectations and spatio-temporal regularities modulate how stimuli are represented and mapped in human visual cortex.

### Methods

#### Mapping stimulus

**Exp. 1-3**

- Stimulus duration: 1s
- Full cycle: 5s

**Exp. 4**

- Stimulus duration: 1s
- Full cycle: 36s

### Predictable condition: location cues across experiments

- 6 unique sequences were learned before the mapping exp.
- Low-contrast numbers indicated the sequence of wedge locations.
- A cue operating 200ms before the next wedge indicated the location of the upcoming stimulus.

### Results

**Exp. 1 N=5**

- Polarity maps for different mapping conditions for the same (left) hemisphere of one participant (S1).
- Pearson correlation matrix of polar angle estimates between mapping conditions (group mean).

**Exp. 2 N=5**

**Exp. 3 N=4**

**Exp. 4 N=4**

#### Polar angle highlights

- Spatio-temporal regularities in mapping sequences do not systematically bias spatial location estimates in early visual areas.
- Increase in spatial resolution (smaller wedge size) and increase in cycle duration improves polar map consistency across conditions (Exp. 1-3 vs Exp. 4).

#### Tuning width highlights

- The spatial-location predictability does not systematically influence the width of polar angle tuning functions (FWHM of predictable sequence < FWHM of random sequence in Exp. 1 but not Exp. 2-4).
- The length of the mapping cycle biases FWHM for ordered mapping stimuli in opposite directions (FWHM of ordered sequence < FWHM of random/predictable sequence in Exp. 1-3, and > in Exp. 4).

#### Visual field coverage highlights

- The visual field coverage maps are highly consistent across conditions in Exp.4, reflecting more consistent polar angle and FWHM estimates with a longer cycle duration.

### Data Quality highlights

- The comparison of predicted and observed BOLD responses suggests that different mapping sequences provide comparable parameter estimates, even though the estimated goodness of fit is the highest for the ordered sequences (in particular in Exp. 4).

### References