

# Gaussian face part tuning in human OFA

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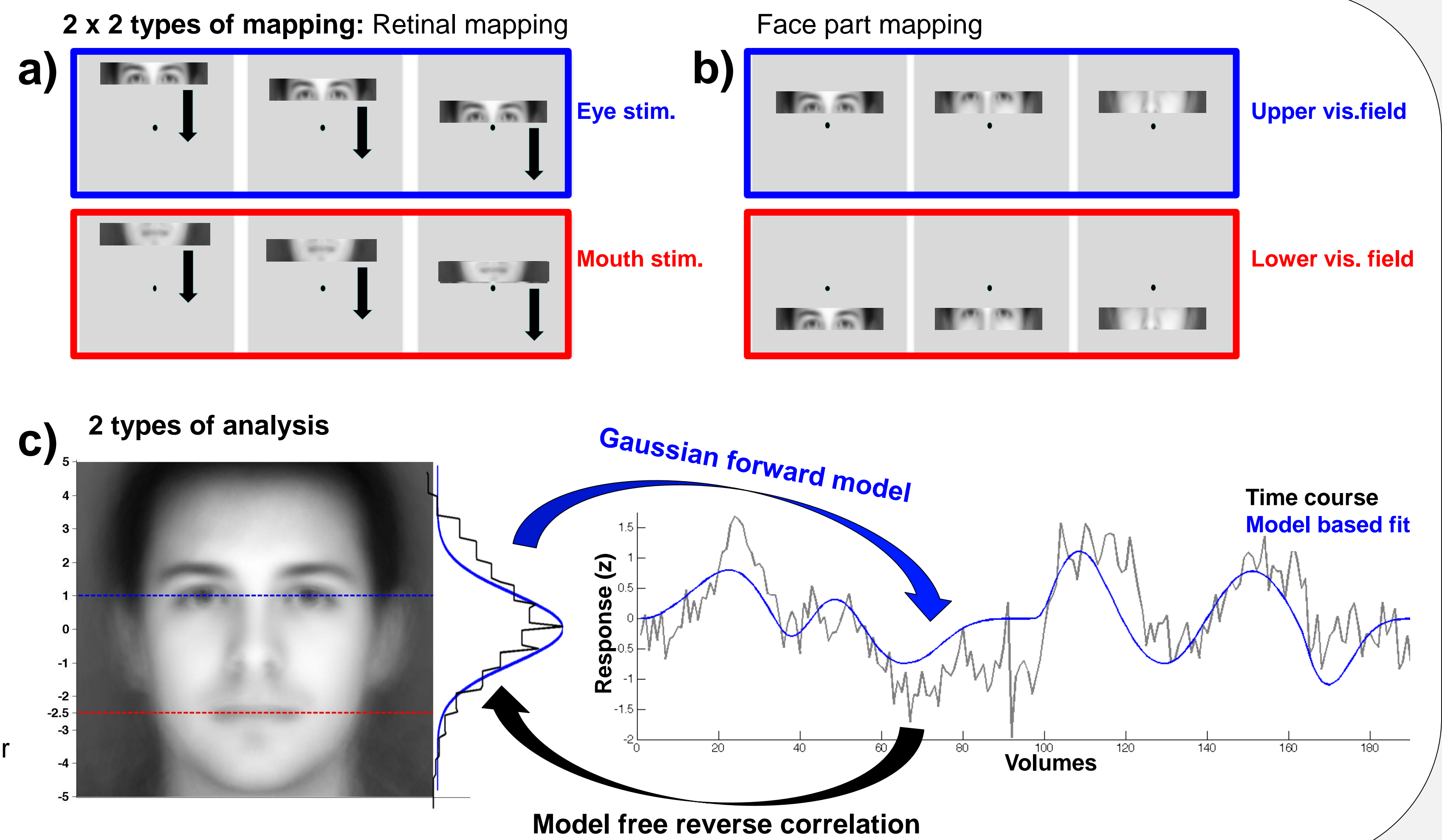
## Background

- Face sensitive areas show Gaussian retinotopic tuning on the single voxel level (Kay et al., 2015)
- They may also contain a map of face parts (Orlov et al., 2010; Henriksson et al., 2015)
- Retinotopic and face part tuning may be linked (Issa & DiCarlo, 2012; de Haas et al., under review)

- Do face sensitive voxels show face part tuning?
- If so, is it linked to retinotopic tuning?

## Design

- fMRI experiment (1.5T Siemens Avanto, 2.3mm isotropic multiband sequence, TR 1s)
- Gaze contingent feedback about fixation stability (Eyelink 1000)
- 7 experienced participants, scanned for up to 12 runs per condition
- 4 Conditions
  - 2 x Retinotopic mapping: Bars containing Eye or Mouth stimuli sweeping up and down (a)
  - 2 x Face part mapping: Faces sweeping vertically behind window in upper or lower visual field (b)Independent localiser for OFA and FFA ROIs
- Hypotheses
  - Voxel-wise Gaussian tuning for retinotopy and face parts
  - Link between the two: Upwards shift of retinal preferences for Eye vs Mouth stimuli and of face part preferences for upper vs lower visual field (intra-voxel comp.)
- Analysis
  - Pre-processing in SPM, runs averaged and surface projected (FreeSurfer, SamSrf)
  - Voxel-wise reverse correlation for model free response profiles (c, black; used for results presented here)
  - Additional Fitting of Gaussian forward model (grid search; c, blue)



## Results

- Gaussian face part tuning in OFA & posterior FFA
  - Voxels with reliable fwd fits for each participant ( $R^2 > 30\%$  for both conditions)
  - Gaussian response profile confirmed by model free reverse correlation (Figs 1,2)
  - Organised in face part patches (map? Figs 1,2)
- Link with retinal tuning (in OFA)
  - Response peaks are correlated across conditions...
  - OFA:  $r = 0.54 / r = 0.38$  for retinal / face peaks (Figs 3,4)
  - FFA:  $r = 0.21 / r = 0.41$  for retinal / face peaks (all  $p < 10^{-20}$ )
  - ...but somewhat shifted in predicted direction
  - OFA:  $t = 10.58 / t = 7.45$  for retinal / face peaks
  - FFA:  $t = 6.34 / t = 6.06$  for retinal / face peaks (all  $p < 10^{-8}$ )
  - Cumulative coverage confirms stimulus dependent shifts for OFA (Fig 5)
- Surprise finding: Laterality in OFA
  - OFA: Left and right hemisphere dominate coverage of upper and lower face, resp.
  - Matching bias for visual field coverage (Fig 6)
- Catch 22
  - Fitted peaks show opposite pattern of reverse correlation data shown here

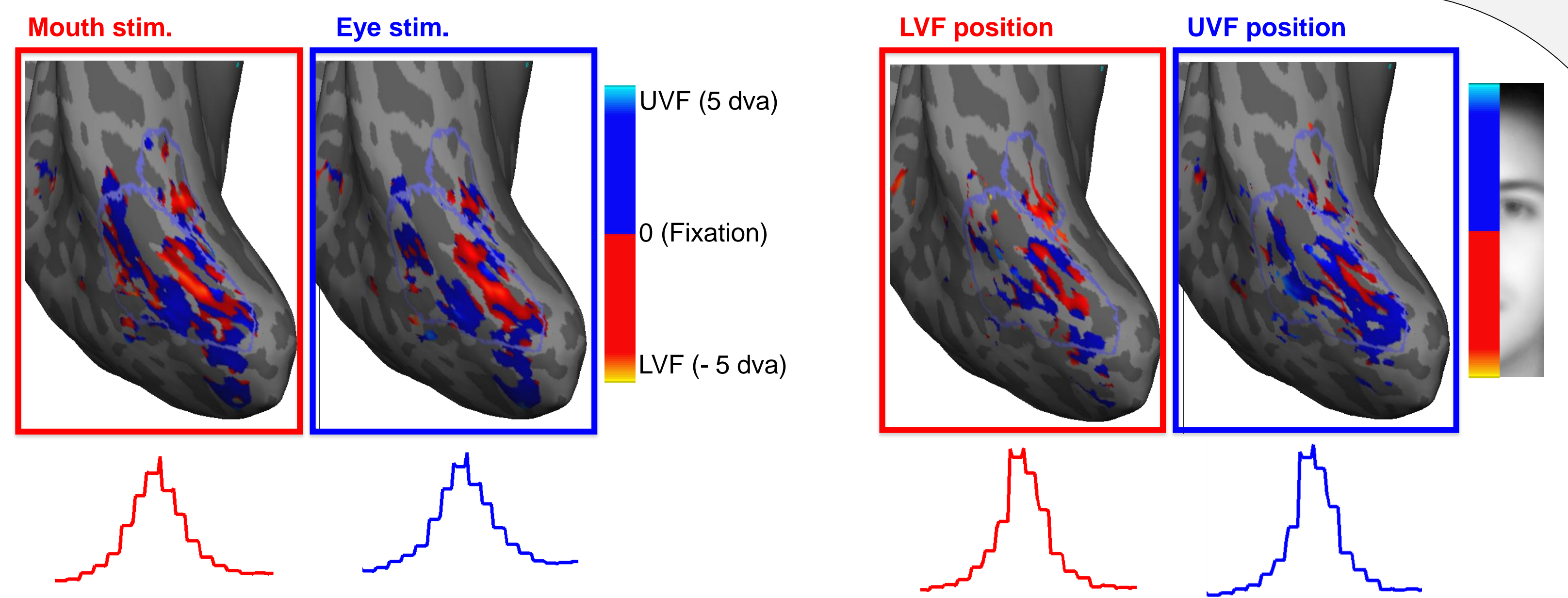


Figure 1: Example retinal maps and average response profiles

Figure 2: Example face maps and average response profiles

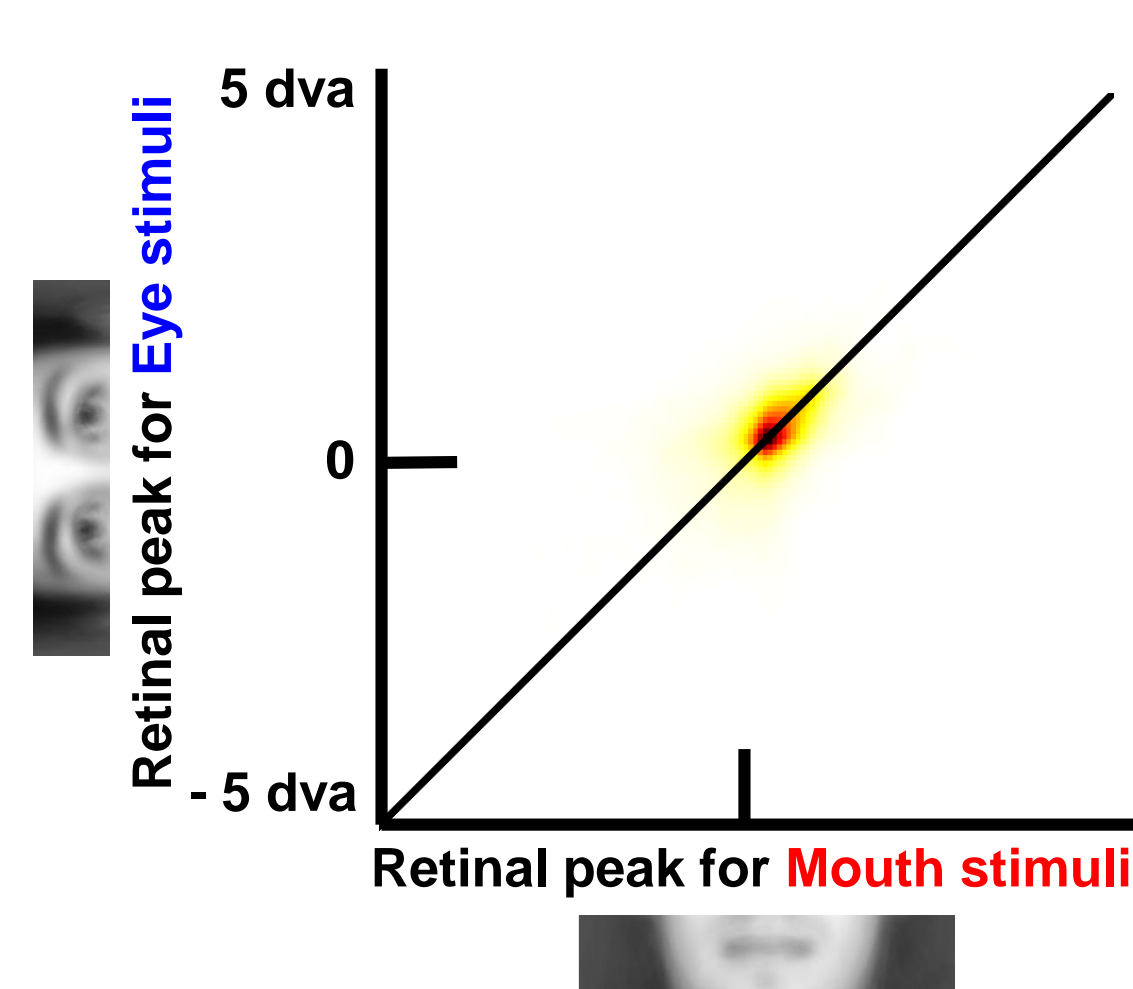


Figure 3: Density of retinal peak responses

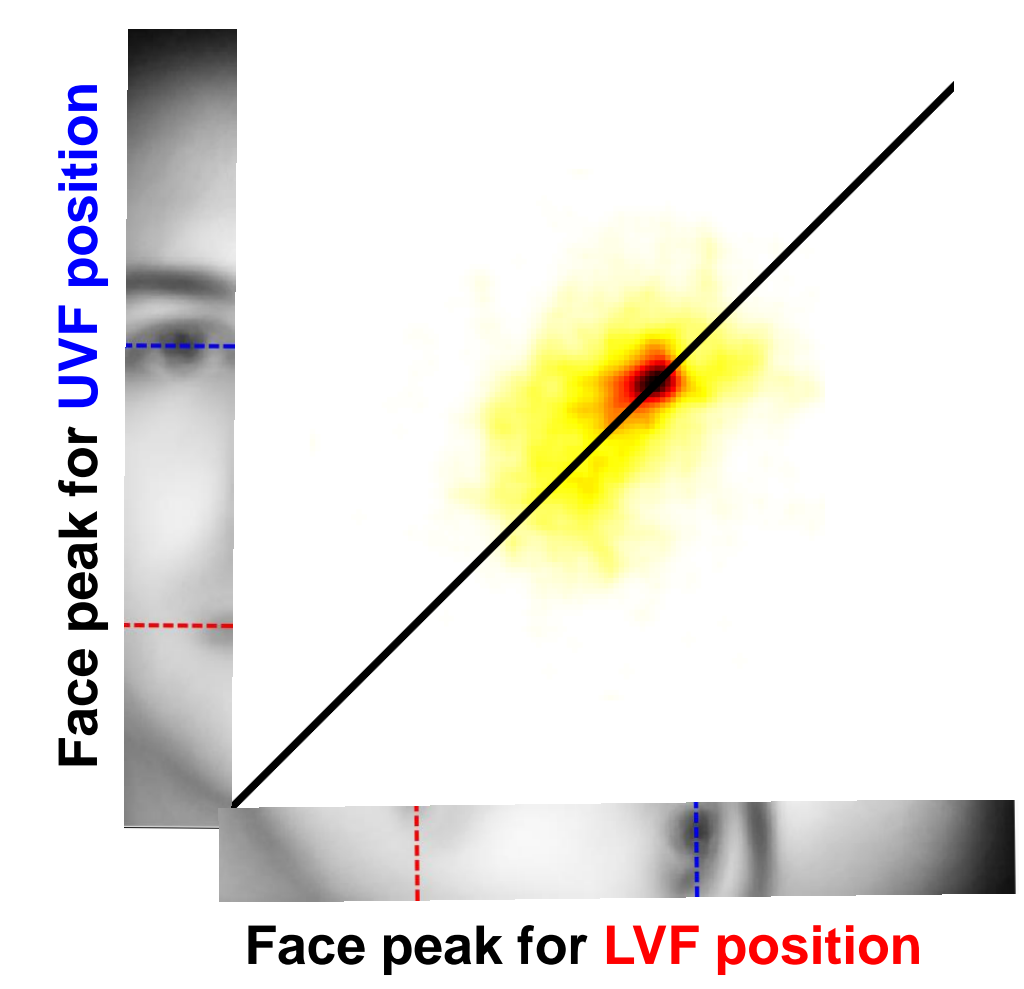


Figure 4: Density of face part peak responses

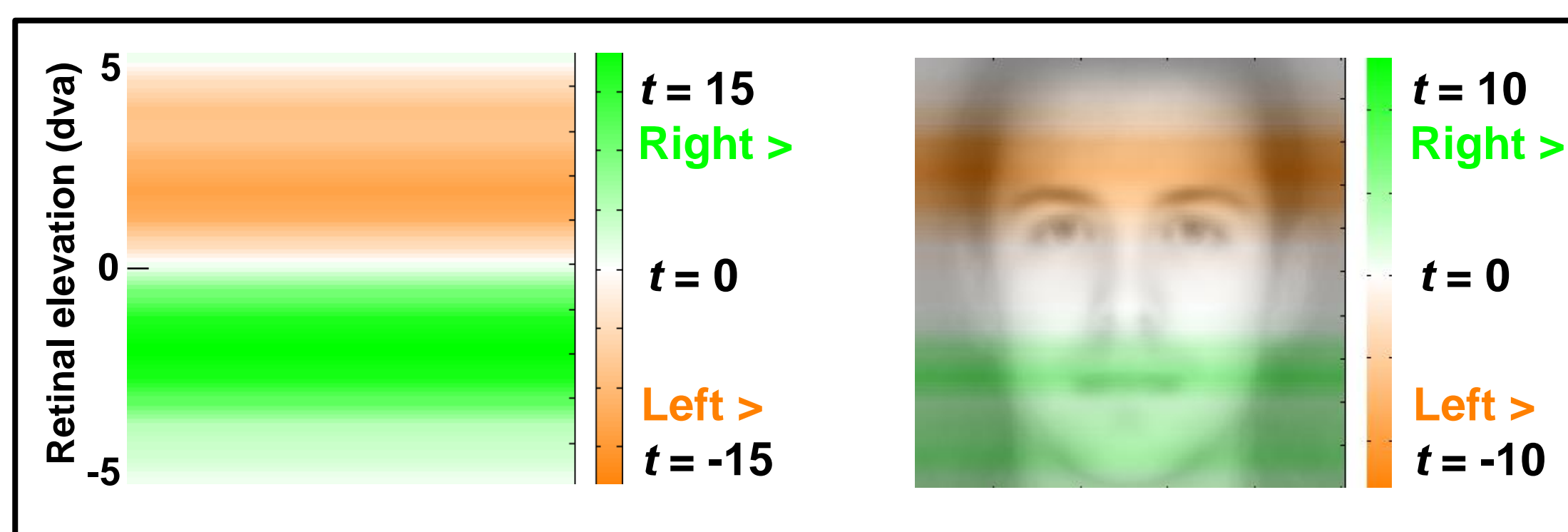


Figure 6: Hemispheric differences in field and face coverage

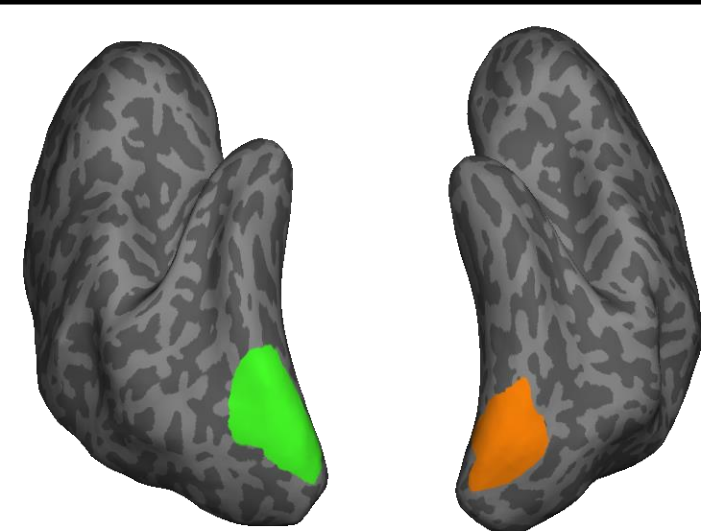
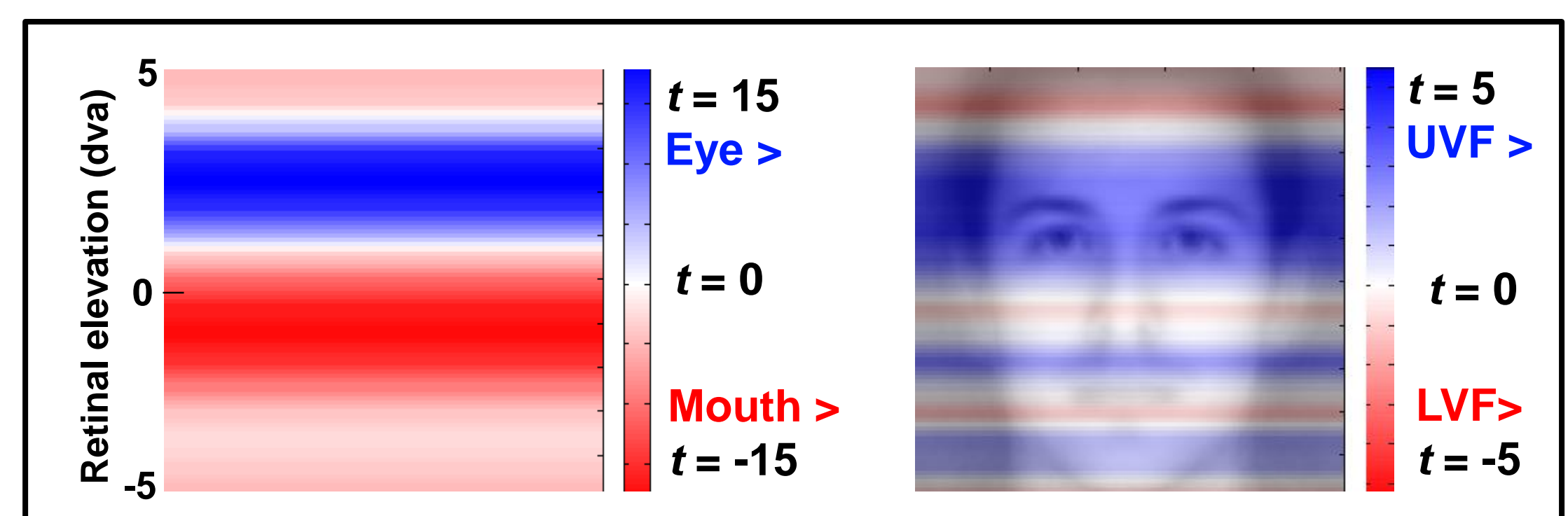


Figure 5: Stimulus dependent differences in field coverage (left), Location dependent differences in Face coverage (right)



## Conclusions

Human OFA shows Gaussian face part tuning, which is probably linked to retinotopic tuning

- Are small effects meaningful?
- What explains differences between model based and reverse correlation results?

## References

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