

Orientation Selectivity for Motion Boundaries is Distributed Across Multiple Visual Areas

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Background

Motion-boundary selectivity in primate visual cortex

- In macaque, neurons selective for motion boundary (MB) orientation found in multiple visual areas¹⁻⁴
- In humans, strongest (fMRI) responses to MB stimuli in area KO⁴⁻⁶ (relative to transparent motion (TM) stimuli)
- Many human visual areas respond strongly to MB stimuli⁶

Are areas that respond to motion-boundary stimuli also selective for motion-boundary orientation?

Or, is strong response to MB vs TM merely due to differences in local motion energy or motion opponency?

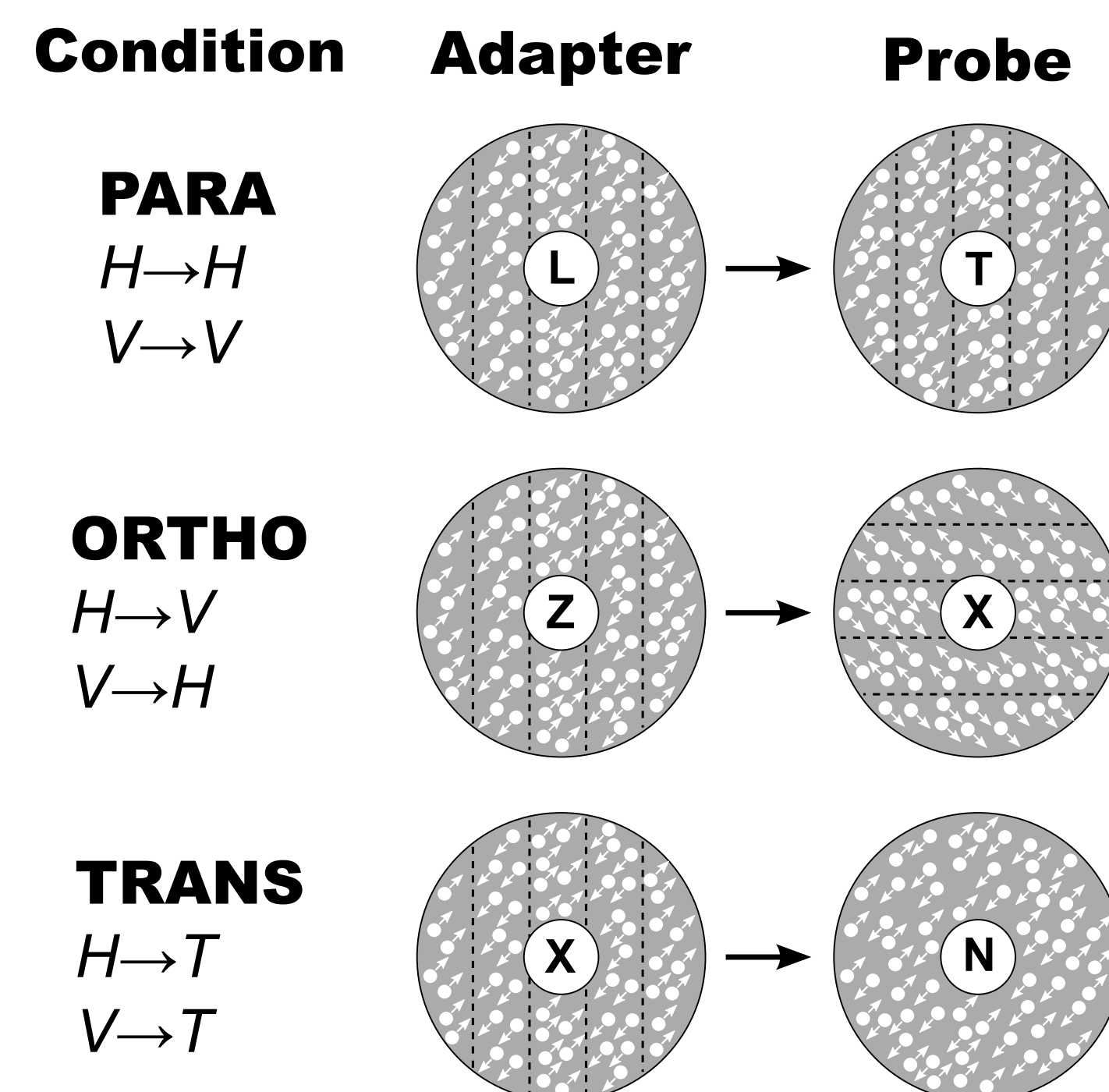
Are visual areas selective for motion-boundary orientation the same in humans and monkeys?

Stimuli

- Motion-boundary gratings (horizontal H or vertical V) presented in annulus
- Strips of diagonally moving dots
- Motion direction reversed between strips
- Axis of motion switched from 45°/225° to 135°/315° every 0.5s

Methods

Experimental design



At fixation:
ZLNTZXNTZLNTZLXT.....ZLNTXLNTZLNT+
160ms/letter

Attentional control task

RSVP task at fixation: count the X's

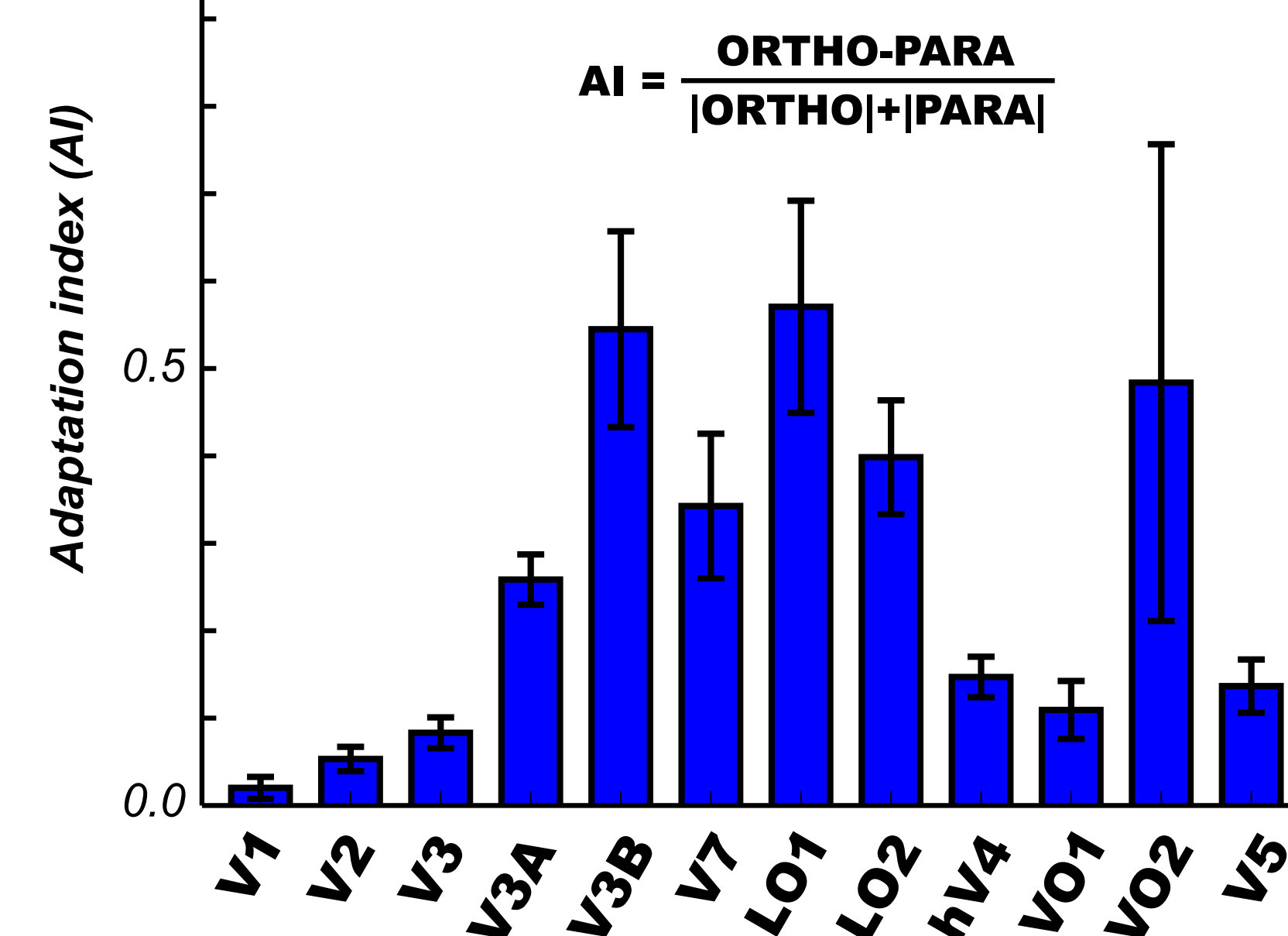
fMRI methods and analysis

- BOLD fMRI (3T Allegra)
- 5 subjects, 8 adaptation scans/subject and adapter orientation, 36 trials/scan
- 30s pre-adaptation
- Standard retinotopic area mapping
- Response to probe estimated by GLM

Results

Many visual areas respond both to motion boundaries and to transparent motion

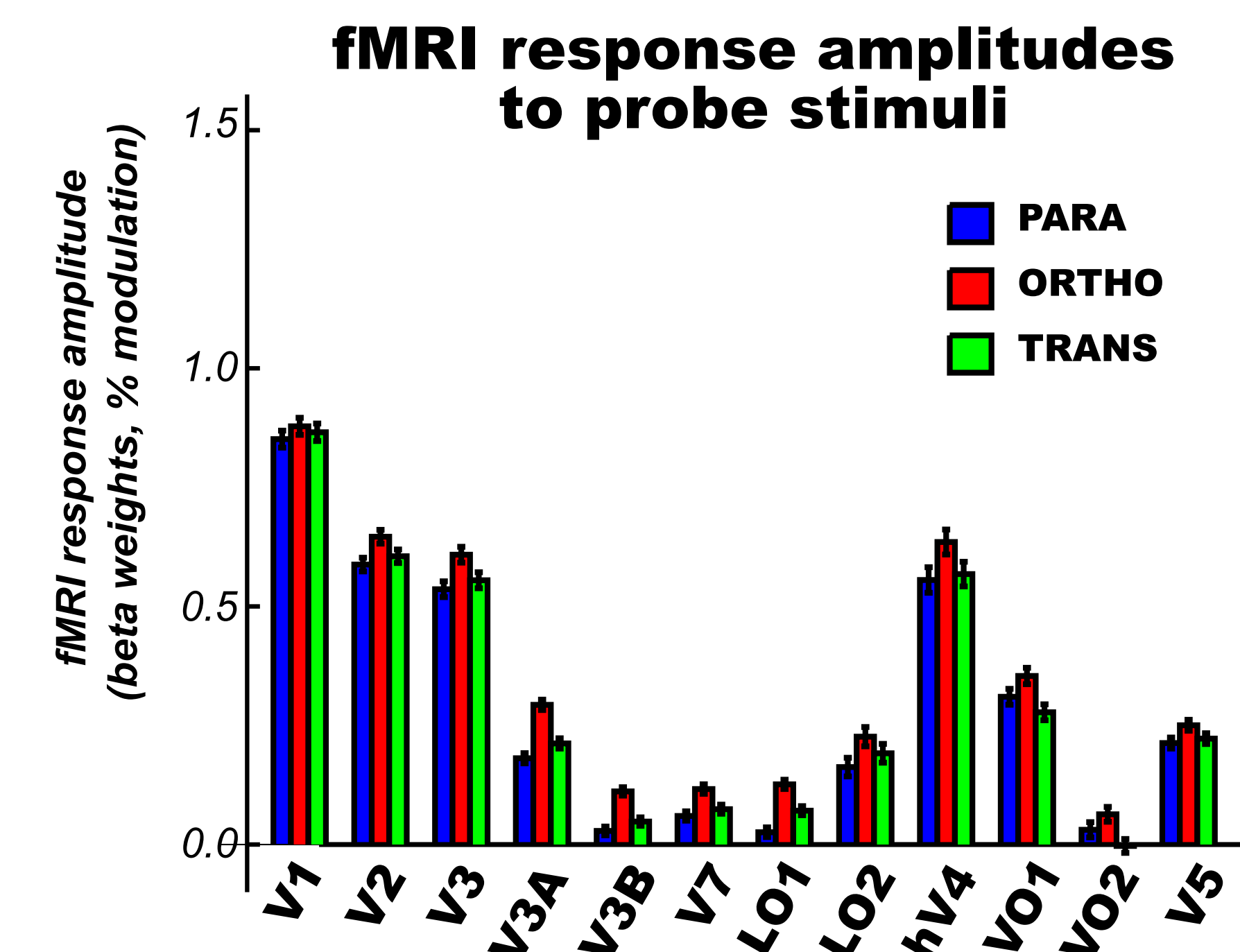
Orientation selectivity



Adaptation differentiates cortical areas better than standard block design

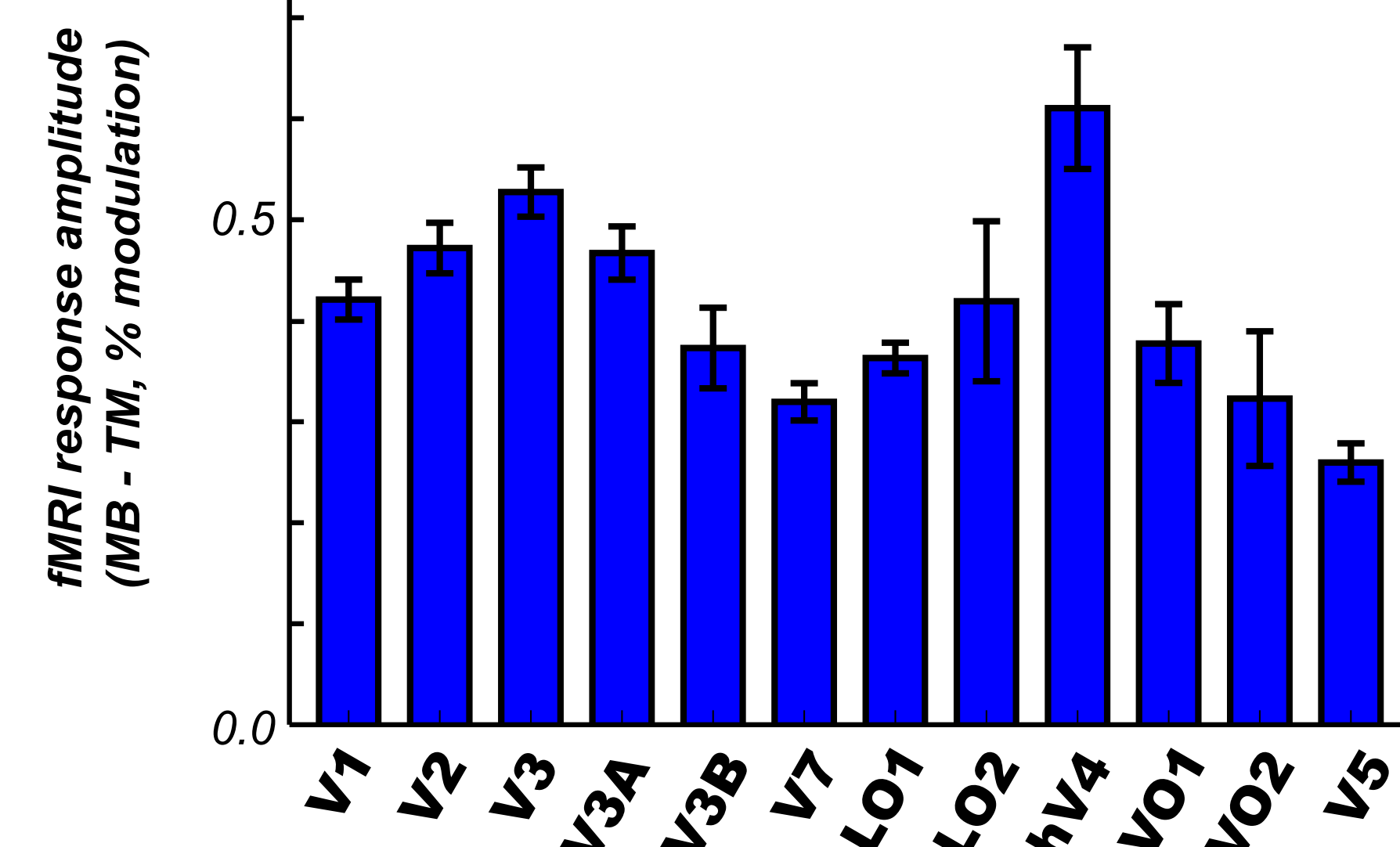
Unlike AI:

- MB vs TM responses varied little across visual areas
- Strong MB vs TM response in V1



Orientation-selective fMRI adaptation to motion boundaries in dorsal and lateral visual areas

KO localizer response amplitudes



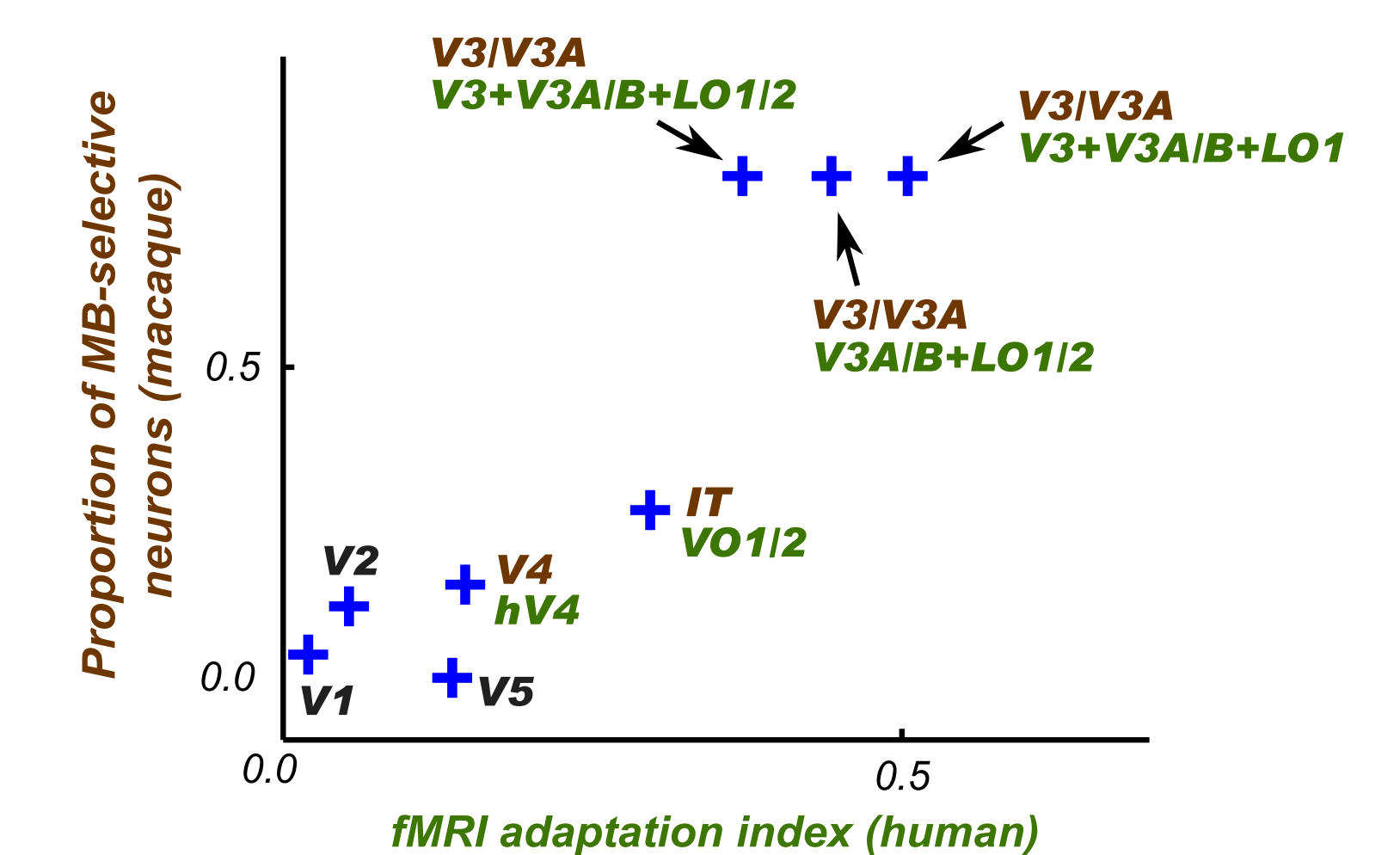
Conclusions

Several human visual areas are selective for motion boundary orientation

- MB-orientation selectivity in a subset of areas responding to MB stimuli
- MB-orientation selectivity not restricted to a single area "KO"
- Strong MB responses in V1 are not selective for motion-boundary orientation

Correspondence between human and macaque visual areas selective for motion boundary orientation

- Similar sets of areas in both species show MB-orientation selectivity
- Similar rank order of MB selectivity across human and macaque visual areas



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References

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