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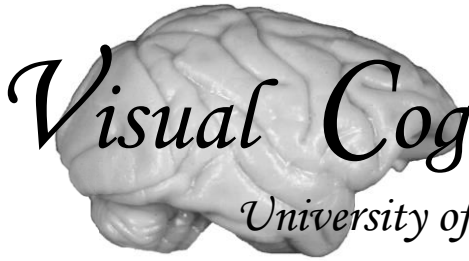

Visual Cognition laboratory

University of Fribourg

Visual form processing in primary and secondary visual cortex of the tree shrew

Paolo De Luna, Jordan Poirot, Gregor Rainer

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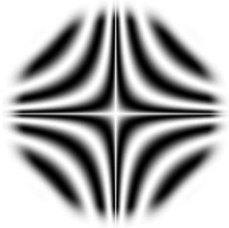
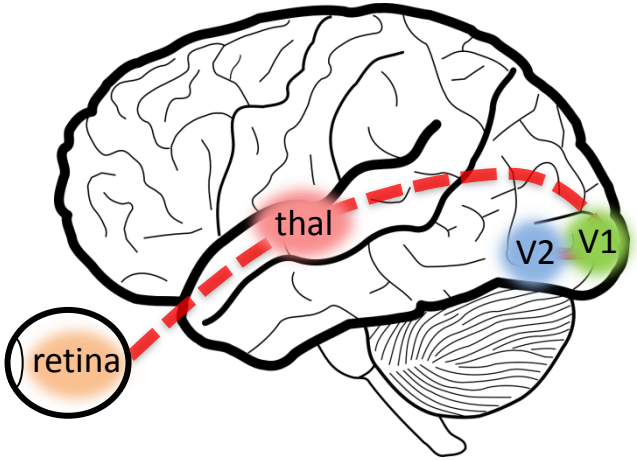
VISUAL FORM PROCESSING

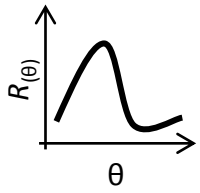
Polar

Hyperbolic



Cartesian





- ✓ Orientation tuning
- ✓ Spatial frequency preference
- ✓ Spatial phase modulation

- Visual information is processed in a hierarchical fashion.

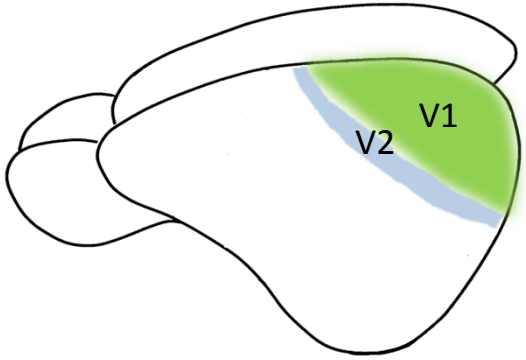
  How is information represented and transformed?

- Investigation by means of Cartesian (parallel) gratings.

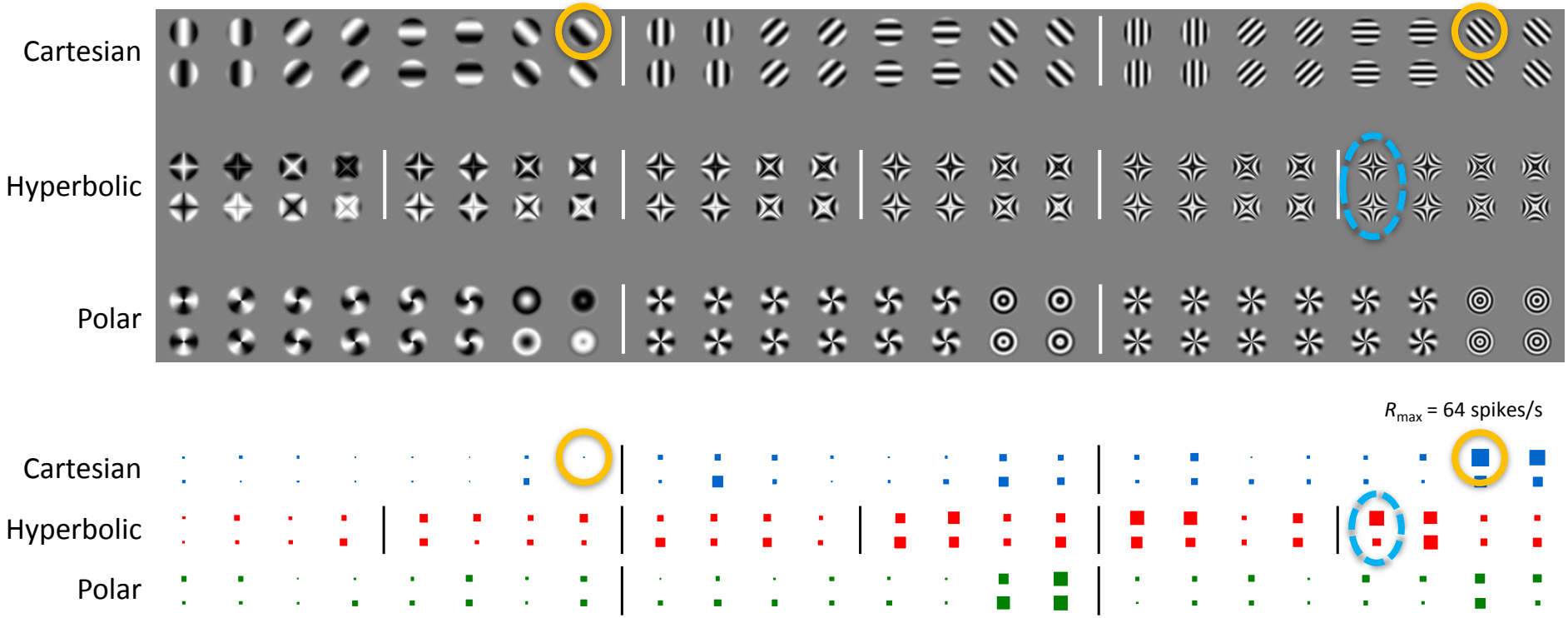
  Naturalistic scenes are rich and complex.

- Tree shrew as animal model for visual neuroscience.

  Anatomical homology, and similar neurophysiology of the visual system.



EXEMPLAR NEURAL RESPONSE

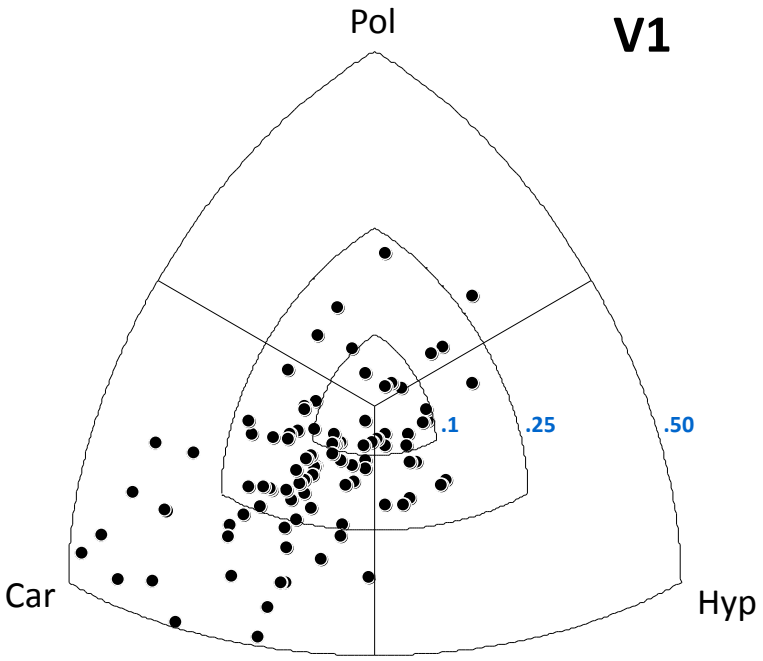


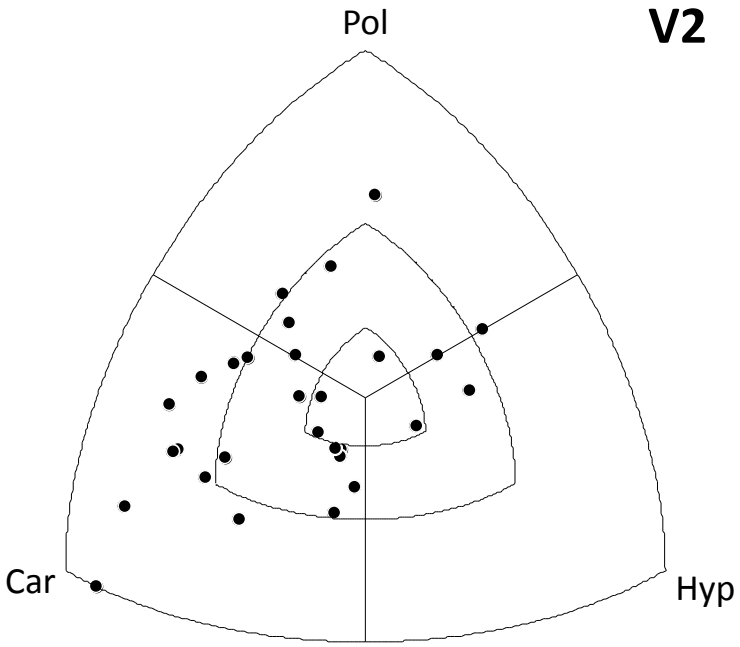
	Cartesian	Hyperbolic	Polar
Structure selectivity index	0.73	0.55	0.56
Polarity sensitivity index	0.23	0.30	0.02

1) Selective responses to a broad range of stimulus structures.

2) Selectivity to complex patterns is not predictable on the basis of responses to Cartesian gratings.

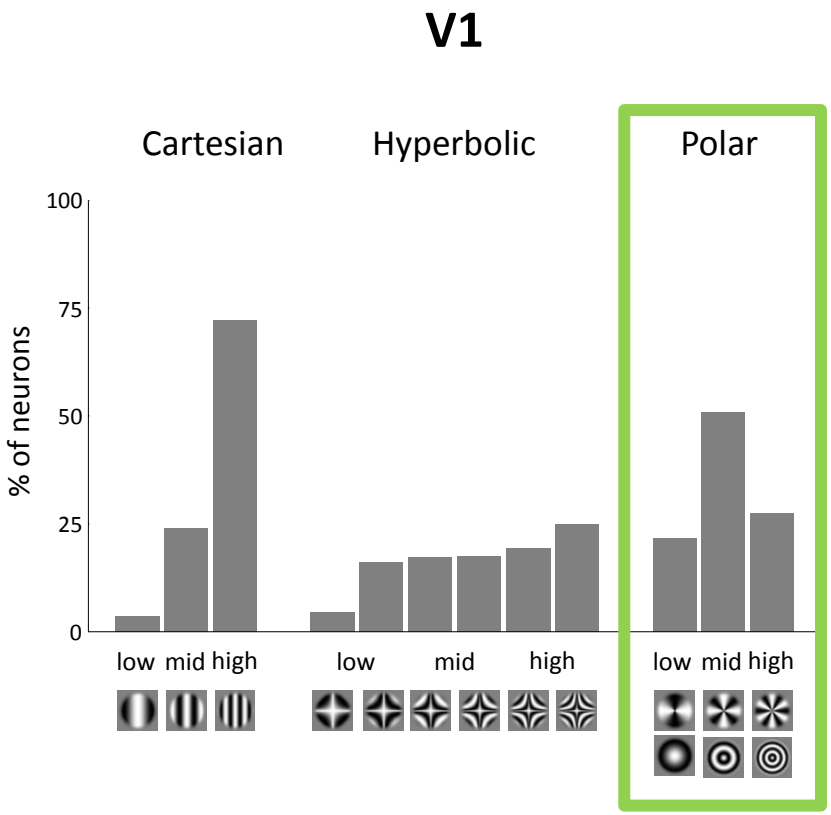
GRATING PREFERENCE IN V1 AND V2

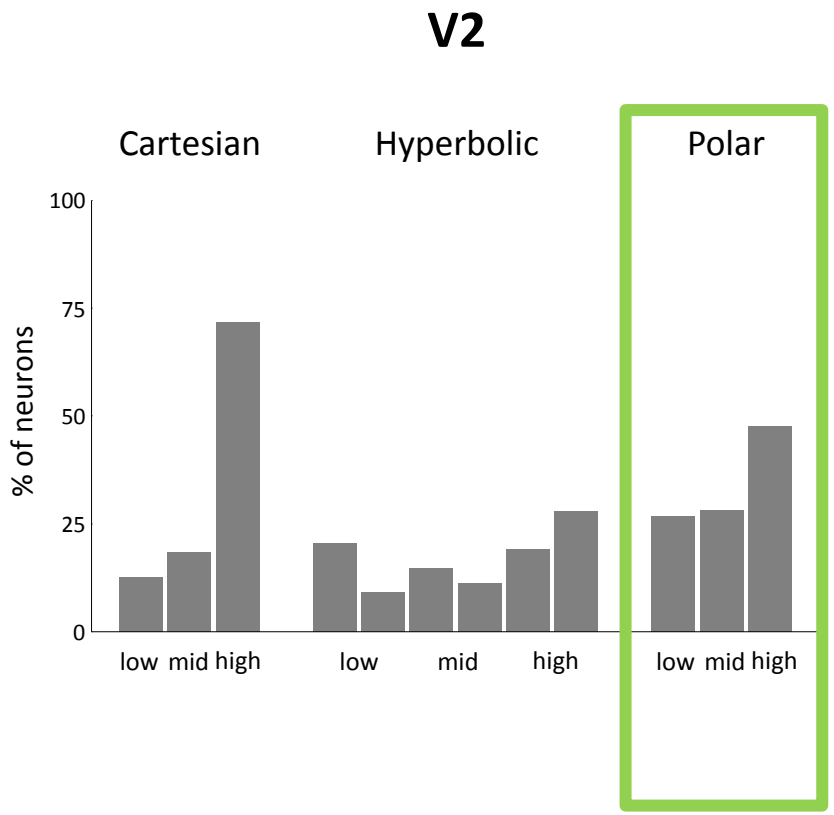




Preference for Cartesian gratings, but also specialization for non-Cartesian stimuli in both V1 and V2.

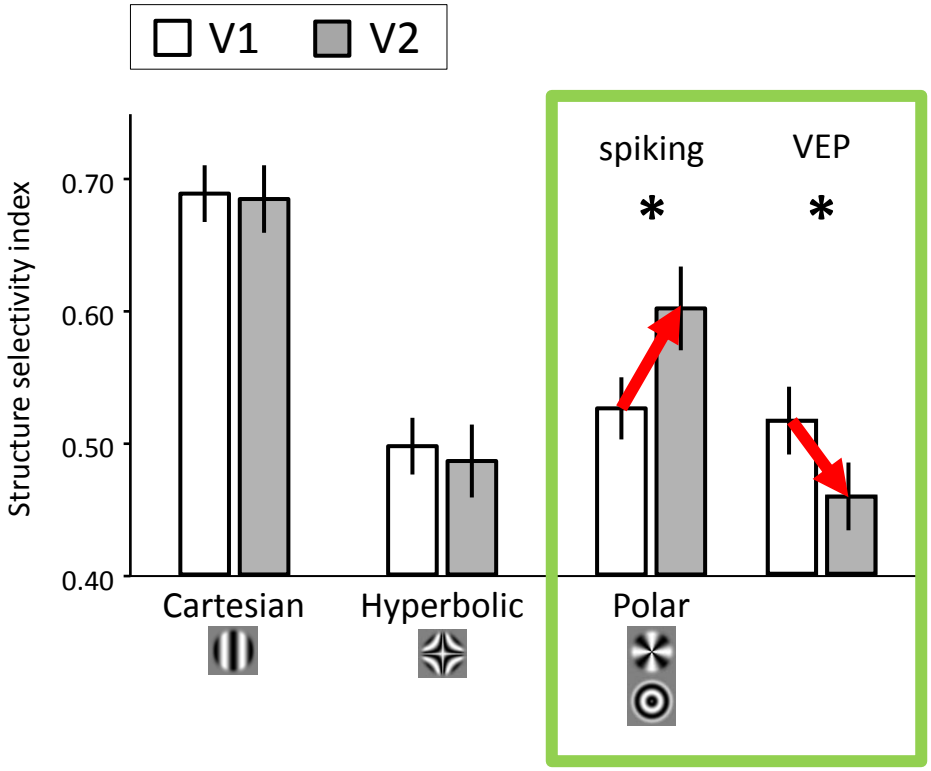
GRATING SELECTIVITY: SPATIAL FREQUENCY

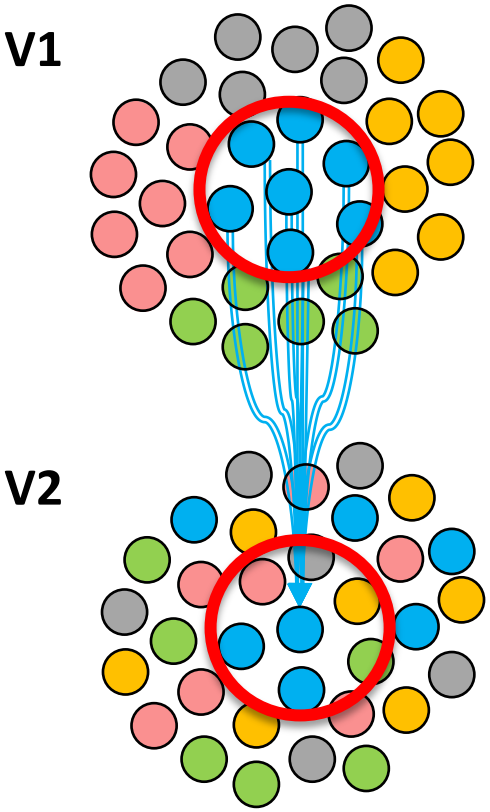




- Borders extraction from visual scene
- Enhancement of figure-ground segregation

GRATING SELECTIVITY: FUNCTIONAL DOMAINS OF THE CORTEX





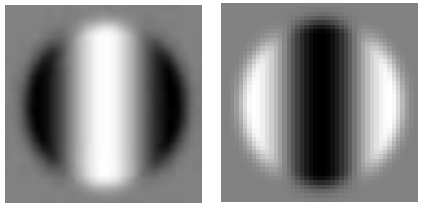
1) V1 neurons are organized in local domains which compute complex patterns of polar gratings.

2) V2 neurons receive converging tuned inputs onto individual neurons.

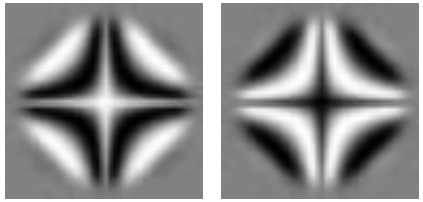
VEP: Visually evoked potentials.

STIMULUS POLARITY AFFECTS NEURAL SELECTIVITY

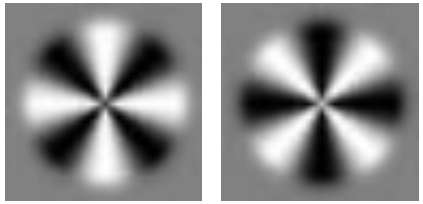
Cartesian

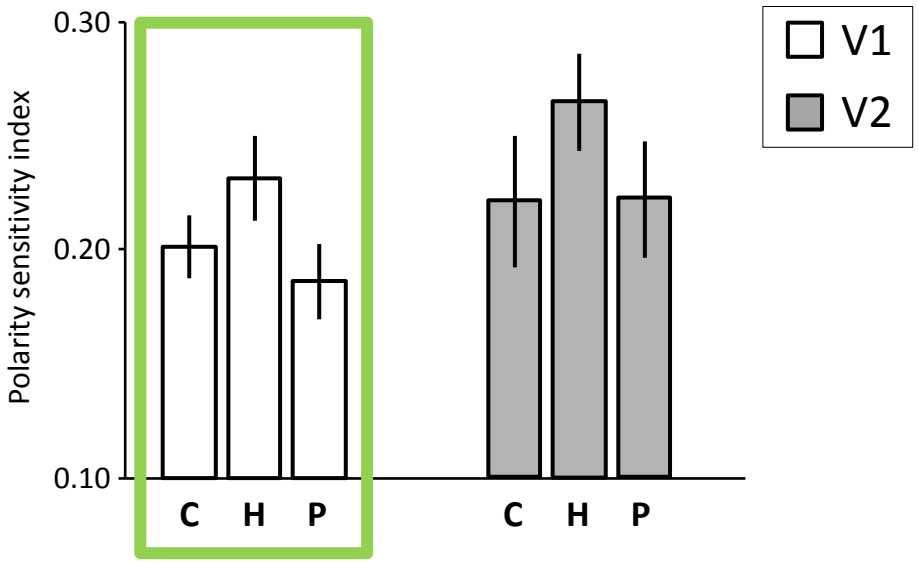


Hyperbolic



Polar





- In V2:
  - neurons retain similar levels of polarity sensitivity to V1;
  - no difference between grating classes.
- In V1, polarity sensitivity for hyperbolic gratings is higher than for the other classes.

CONCLUSIONS

Non-conventional stimuli provide useful insights into the functional organization of the early visual cortices (structure of polar gratings, and polarity of hyperbolic stimuli).

V1 and V2 neurons are selective for a **wide range of visual patterns**.

Neurons in tree shrew's **V2 exhibit emergent selectivity** for polar-like stimuli.

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ACKNOWLEDGEMENTS

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