A ubiquitous and uniform representational structure across higher-level visual cortex

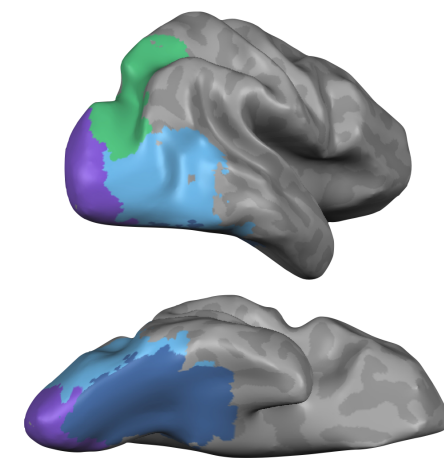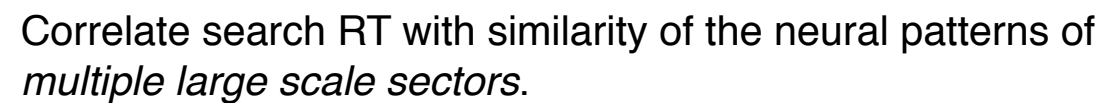Michael A. Cohen, Talia Konkle, Ken Nakayama, & George A. Alvarez

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Questions

Does the representational structure of visual cortex predict performance on a behavioral task?
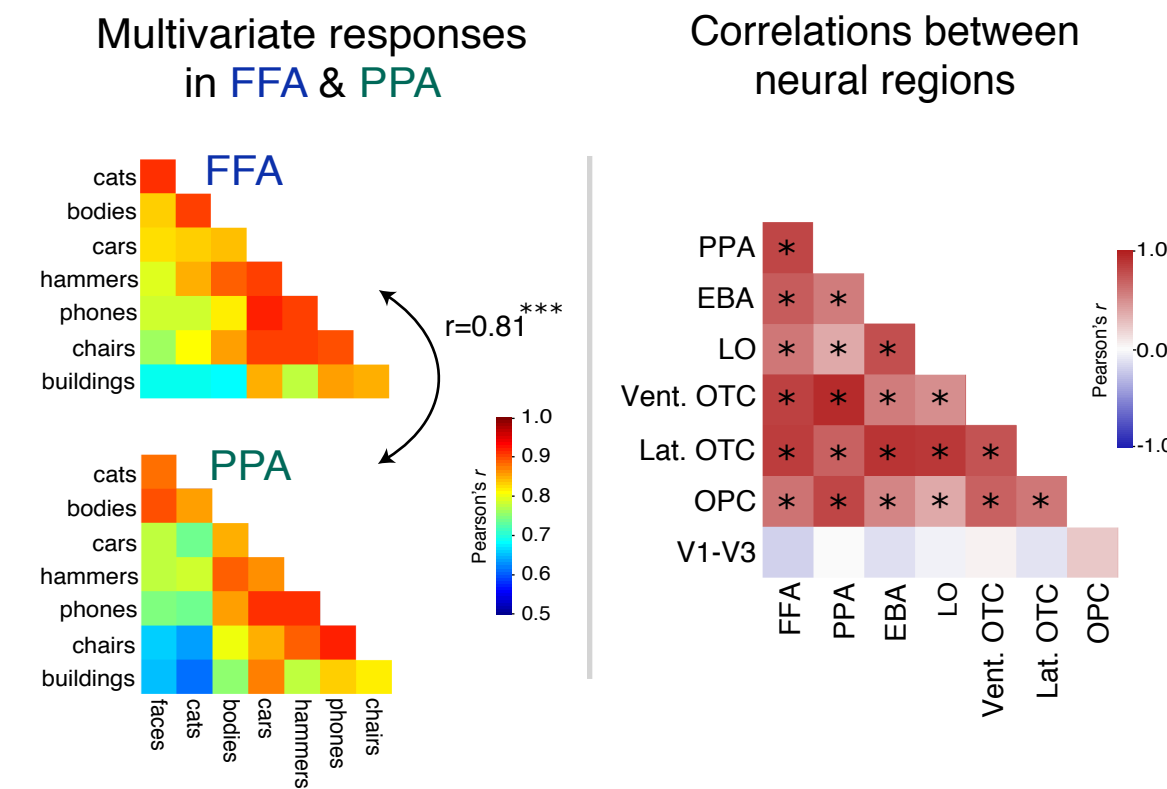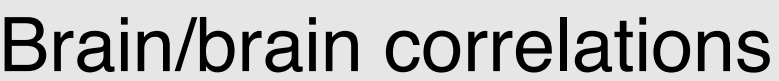
Which neural structures are the most behaviorally relevant (i.e. strongest brain/behavior correlations)?

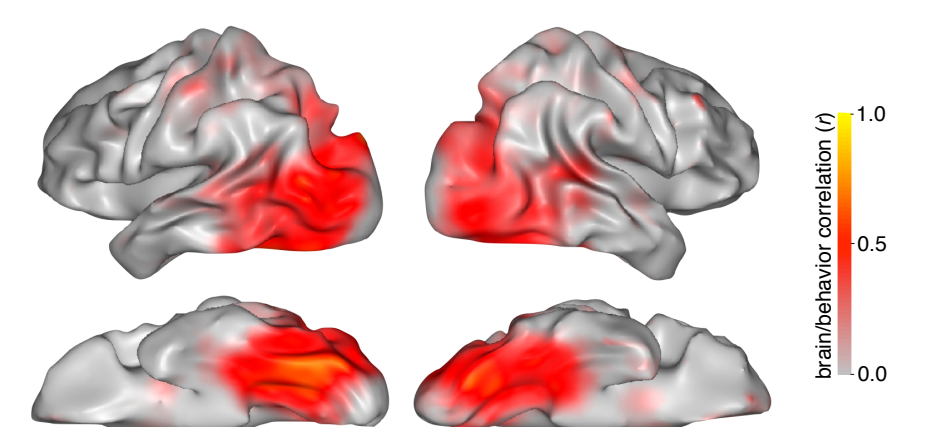How does the representational structure of these different regions compare to each other?

Stimuli & behavioral task

Bodies
Chairs
Target present trial
Buildings
Faces
Cars
Hammers
Target absent trial
Cats
Phones

Search reaction times

reaction time (secs.)

faces / hammers, faces / chairs, faces / buildings, faces / cars, faces / phones, cats / buildings, hammers / buildings, faces / cats, faces / bodies, cats / chairs, cats / hammers, bodies / buildings, bodies / cars, cats / phones, bodies / chairs, bodies / hammers, cars / buildings, cars / cats, bodies / phones, phones / hammers, chairs / buildings, buildings / chairs, chairs / phones, buildings / phones, cars / phones

Large-scale sectors

In six new participants, whole-brain neural patterns for these 8 categories were obtained using a blocked design.

Measure response patterns for all 8 categories.

buildings   faces

Correlate all possible pairwise pairings.

Bodies — Buildings
Phones — Cars
Hammers — Cats
Faces — Chairs

r

Correlate search RT with similarity of the neural patterns of *multiple large scale sectors*.

Ventral OTC r=0.77***
Lateral OTC r=0.65***
Occipitoparietal r=0.49**
V1-V3 r=0.12

reaction time (secs.)
neural similarity (r)

Category selective regions

Correlate search RT with similarity of the neural patterns of *category selective regions*.

FFA r=0.65***
PPA r=0.63***
EBA r=0.56***
LO r=0.49**

reaction time (secs.)
neural similarity (r)

Brain/brain correlations

Multivariate responses in FFA & PPA

FFA
cats, bodies, cars, hammers, phones, chairs, buildings
faces, cats, bodies, cars, hammers, phones, chairs

PPA
cats, bodies, cars, hammers, phones, chairs, buildings
faces, cats, bodies, cars, hammers, phones, chairs

r=0.81***

Pearson's r

Correlations between neural regions

PPA, EBA, LO, Vent. OTC, Lat. OTC, OPC, V1-V3
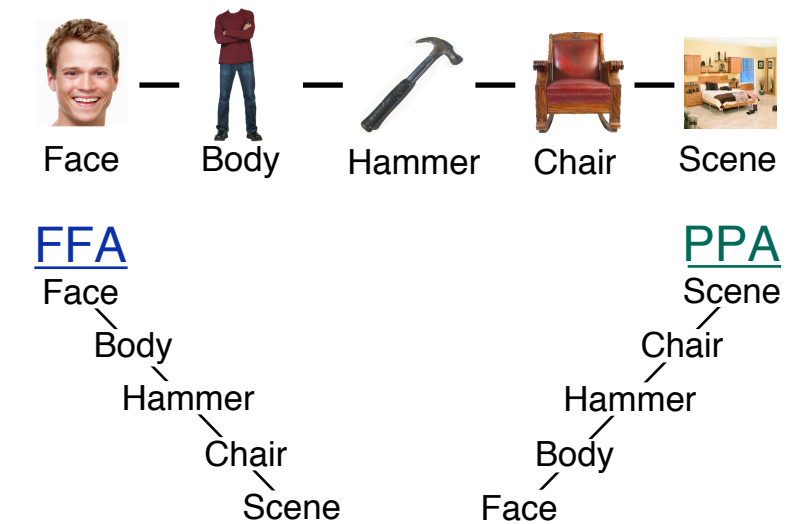FFA, PPA, EBA, LO, Vent. OTC, Lat. OTC, OPC

Pearson's r

Searchlight

Move a sphere of voxels across entire cortex, and correlate patterns with behavior at each location.

brain/behavior correlation (r)

Summary & Questions

We found evidence for a common representational structure across the majority of higher-level visual cortex that directly relates to behavior.

These results highlight how regions (e.g. FFA/PPA) can have different tunings, but similar underlying representational structures.

How might these different representational schemes be reconciled under a common framework?

Face — Body — Hammer — Chair — Scene

FFA
Face
Body
Hammer
Chair
Scene

PPA
Scene
Chair
Hammer
Body
Face