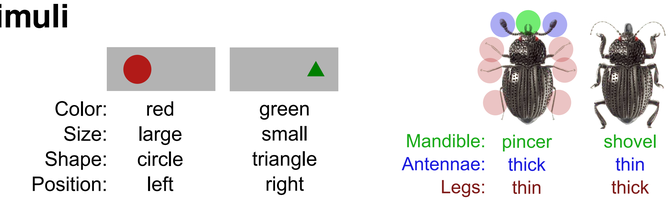
Occipitotemporal Representations are Modulated by Conceptual Knowledge and Interact with a Frontoparietal Network

Braunlich, K.[1] & Love B. C.[1,2]
[1]University College London, [2]The Alan Turing Institute

Introduction

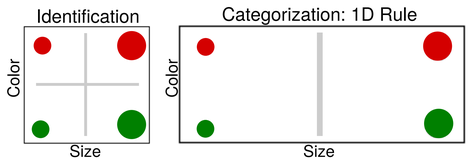
- Through selective attention, conceptual knowledge can emphasize informative stimulus features.
- Although this effect is well-known, its neural substrates are poorly understood.

Stimuli



Hypothesized Attentional Effects

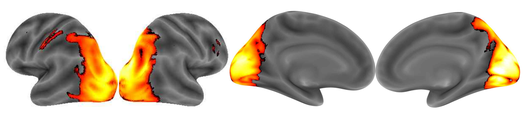
Conceptual knowledge is often described as *warping* psychological space to accentuate behaviorally-relevant stimulus dimensions.



$$d_{ij} = \sum_k |x_{ik} - x_{jk}| \qquad d_{ij} = \sum_k w_k |x_{ik} - x_{jk}|$$

Example: Attention Influences Psychological Space. ***Left:*** *During object identification, all stimulus dimensions are relevant.* ***Right:*** *In this example, only a single dimension is relevant, and decision-makers could ignore the irrelevant dimension.*

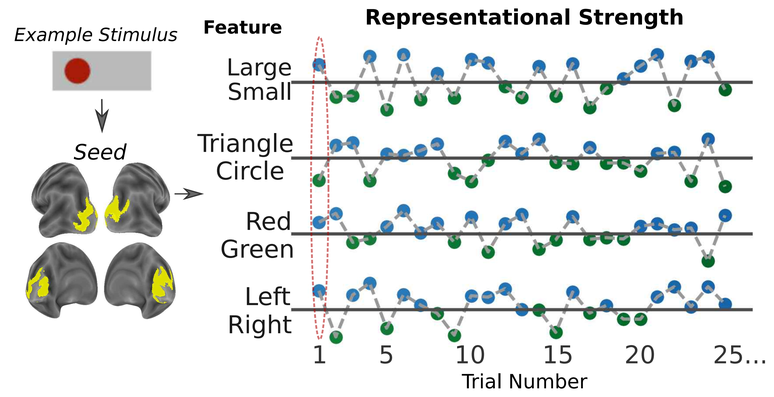
Binary Feature Representations



Visual Representations: *A searchlight was used in conjunction with a cross-validated support vector classifier to identify regions representing the stimulus features. The strength of these representations reflected the idiosyncratic attentional parameters, w.*

Representational Strength Connectivity

Step 1: Dimensionality Reduction

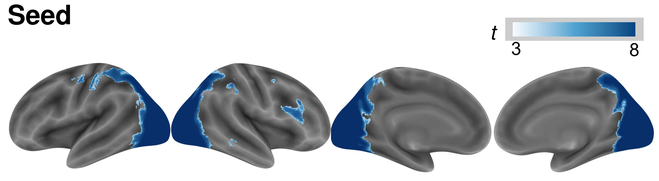


The neuroimaging data (from the seed) was projected onto a lower-dimensional subspace.

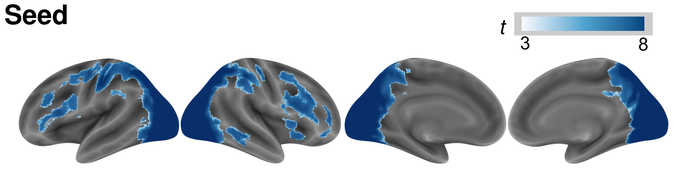
Step 2: Cross-Validated Searchlight

- A searchlight, in conjunction with cross-validated support vector regression, was used to identify regions capable of decoding the basis vectors.
- In a permutation test, the analysis was repeated, each time projecting the seed neuroimaging data onto a random subspace.

OTC Seed



IPS Seed



The results highlight regions capable of predicting the strength and sign of the binary stimulus feature representations in the seed.

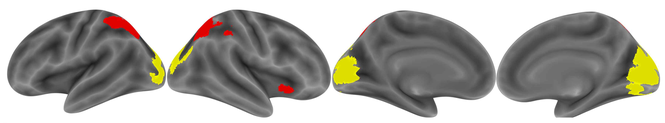
Step 3: *Posthoc* Tests

- Each basis vector was decoded for each binary feature value separately (e.g., "triangle").
- Using the *unsigned* basis vectors, regression was used to investigate whether the representation of a given feature in the *target* predicted the representation of that feature in the *seed*, above and beyond predictions based on the other features in the seed.

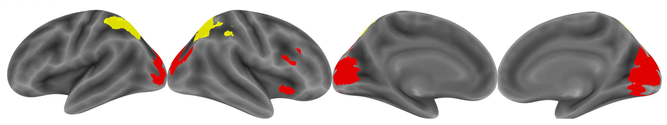
Attention Modulates Connectivity

- Using the *unsigned* basis vectors, the correlation between each feature representation in the seed and each target was calculated.
- Regression was used to determine whether these correlations reflected the idiosyncratic attentional parameters, w.

OTC Seed



IPS Seed



Results: *The correlation between the representational strength of the features in the seed (yellow), and each target (red), reflected the attentional parameters, w.*

Summary

- OTC feature representations reflect conceptual knowledge, and were communicated with IPS and right anterior insula.
- IPS feature representations were communicated with OTC, right anterior insula, and IFS.

The Leverhulme Trust
The Alan Turing Institute
NIH
wellcome trust