Representational Similarity Analysis (RSA) Workshop

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Workshop Outline

- Intro: Why use RSA?

- Workshop Tutorials
  - Part-1: Item (Trial)-Level RSA: Within subject
  - Part-2: Item (Trial)-Level RSA: Across subjects
  - Part-3: Predict behavior from ROI-RSA

- Outro: Significance testing, additional resources

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What is RSA?

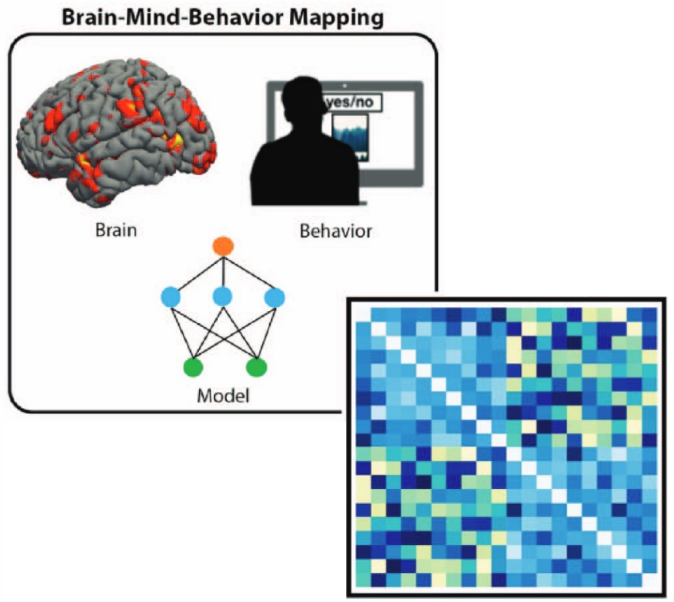
RSA is a statistical technique that

- Computes a measure of similarity between different measures
  - *(Instead of directly analyzing the relationship between one measure and another)*
- Compares these similarities to each other
- Pioneered by Kriegeskorte, Mur, and Bandettini (2008, Frontiers in System Neuroscience)

Why use RSA?

Highly flexible, allowing us to link:

- Neural and behavioral data



Popal, Wang & Olson (2020), SCAN

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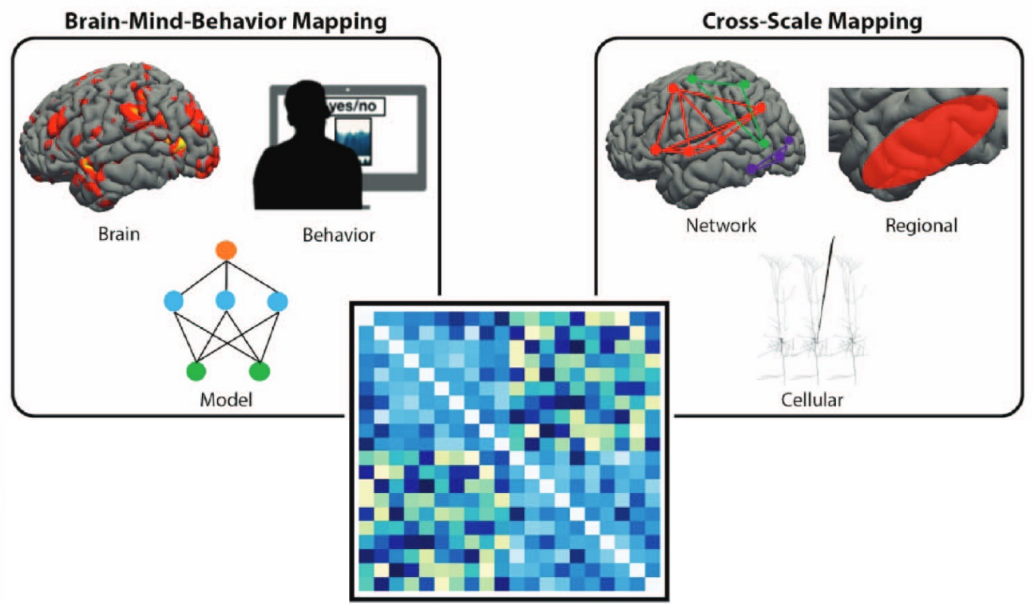

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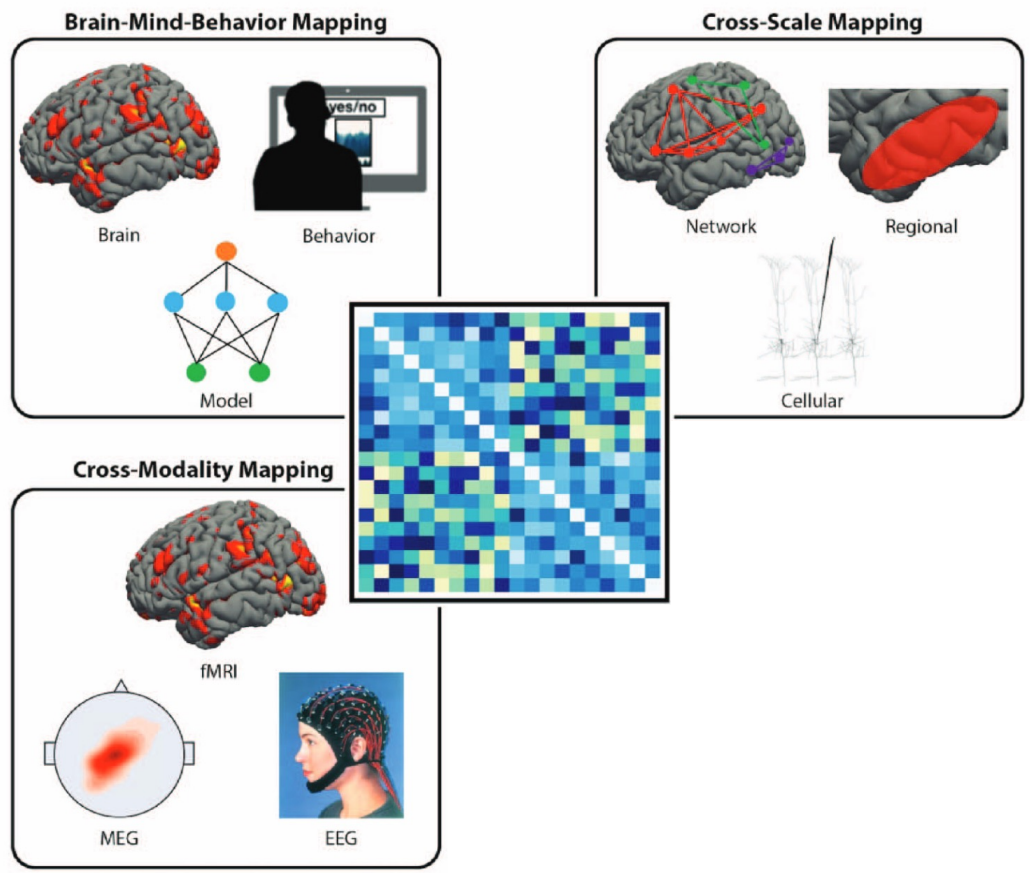

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Why use RSA?

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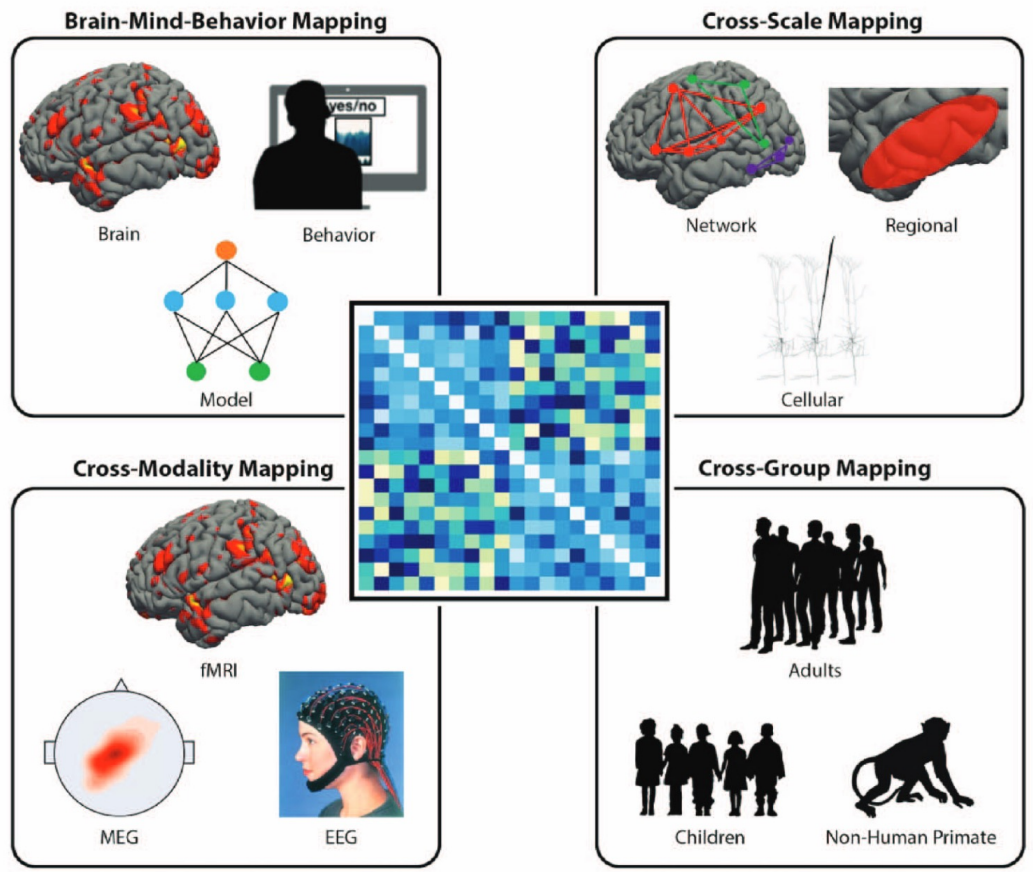
- Neural and behavioral data
- Different scales of neural assessments
- Different modalities of neural data
- Data from different groups/species



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Neural RSA

- Assumption: if two stimuli evoke a similar response in a set of voxels, they share something in their representation as they are supported by overlapping neural populations.

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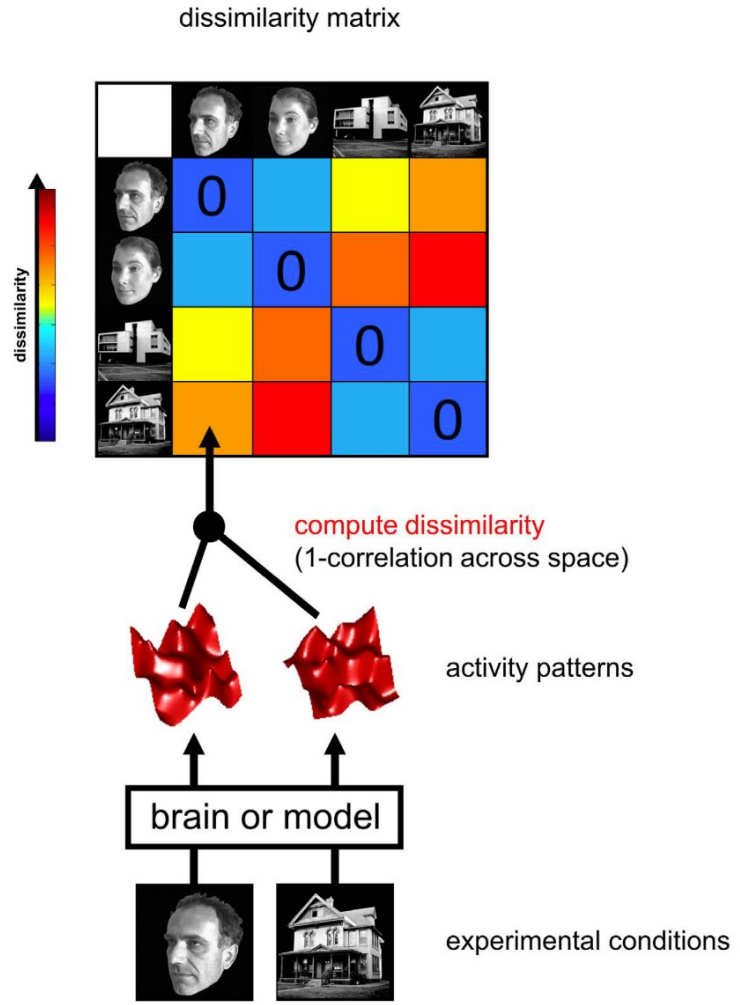

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Significance Testing

To test the relatedness of two similarity matrices (RSMs):

1. Correlate the two RSMs you obtained

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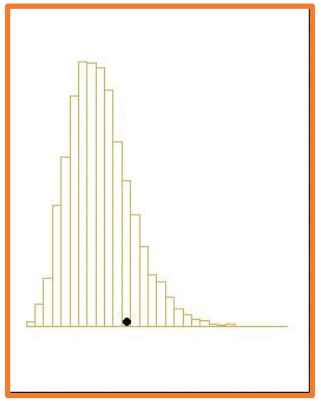
1. Correlate the two RSMs you obtained

2. Simulate null correlations between your two RSMs
   - *Randomize the condition labels (by reordering rows and columns of one of the two similarity matrices you'd like to compare)*
   - *Then compute the correlation between the two RSMs with random labels*
   - *Repeat these steps a number of times (e.g., 10,000 times) to obtain a distribution of null correlations (i.e., the two RSMs are unrelated)*



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3. Compare your "*true*" correlation (from step1) to the null distribution (from step2)
   - *Reject the null hypothesis with a false positive rate of α, if the true correlation is within the top α X 100% of the simulated distribution.*

Kriegeskorte, Mur, & Bandettini (2008)

Additional Resources

Literature

- Kriegeskorte et al., 2008
  - *The original paper that introduced RSA*
- Popal et al., 2019
  - *An RSA how-to and why-to guide aimed for the social neuroscience community*
- Dimsdale-Zucker & Ranganath, 2018
  - *An in-depth RSA guide aimed for memory researchers*

Packages in other languages

- Dartbrains - Python
- PyMVPA - Python
  - *Includes searchlight analysis*
- Brain imaging analysis kit
- NeuroRA
- RSA toolbox - MATLAB
  - *By Kriegeskorte's group.*