MRC Cognition and Brain Sciences Unit

UNIVERSITY OF CAMBRIDGE

Voxel Based Morphometry (VBM)

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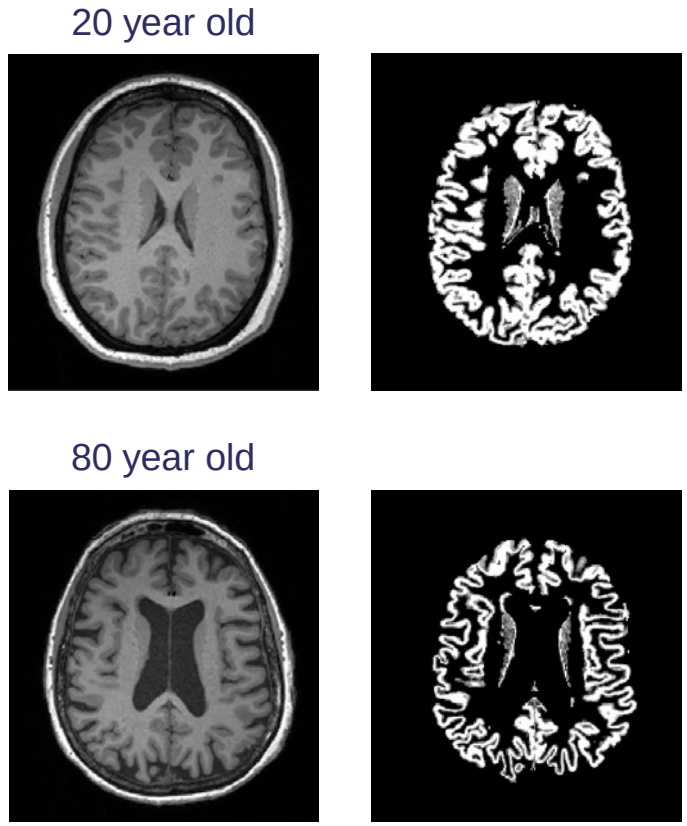
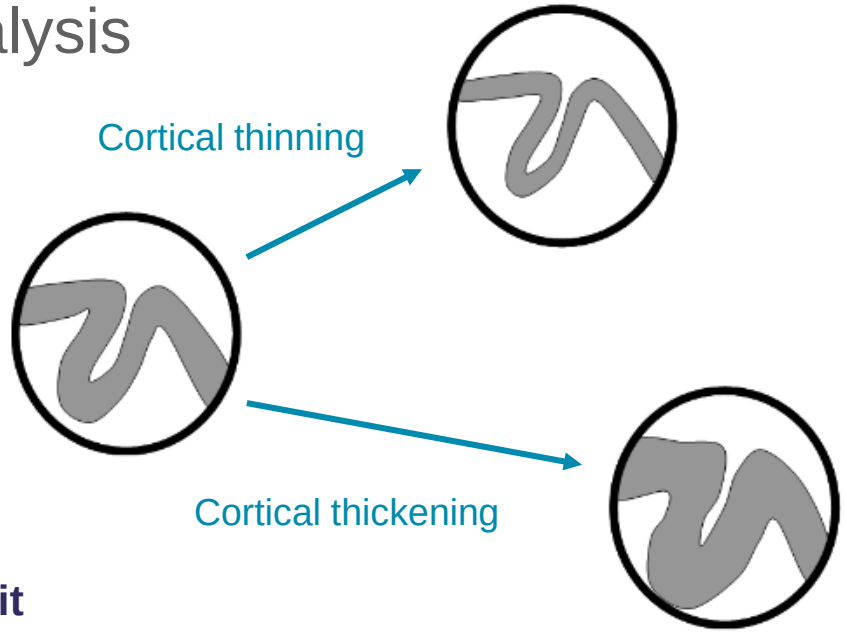
Overview of VBM

- Voxel-wise grey-matter (GM) volume analysis
- Very widely used technique to investigate GM changes
  - Volume/density changes between populations
  - Correlations with cognitive metrics or clinical scores
- Whole-brain unbiased analysis
- Fully automated





From John Ashburner

VBM using FSL tools

1. Extracting brain information: brain extraction and tissue segmentation

VBM using FSL tools

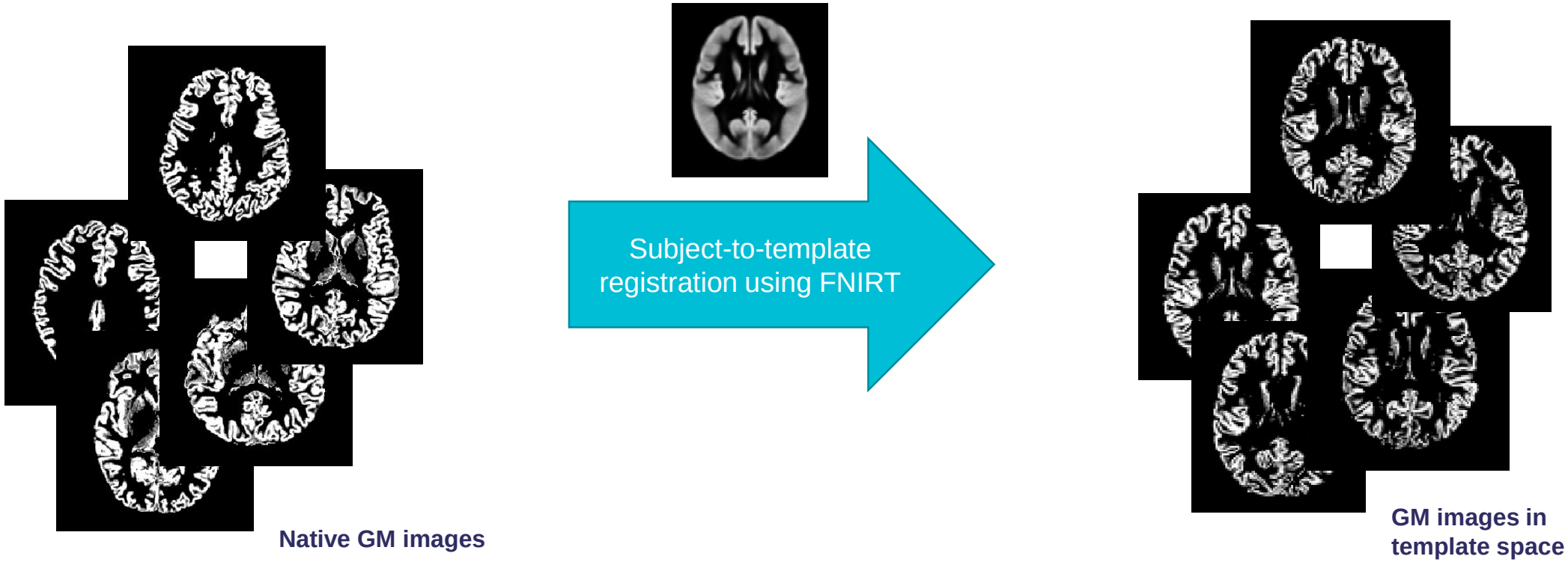
2. Creating the template: make a study-specific template

- Iteratively register all GM images to generate a representative template
- Equal number of images from each group

VBM using FSL tools

3. Processing the native GM images:

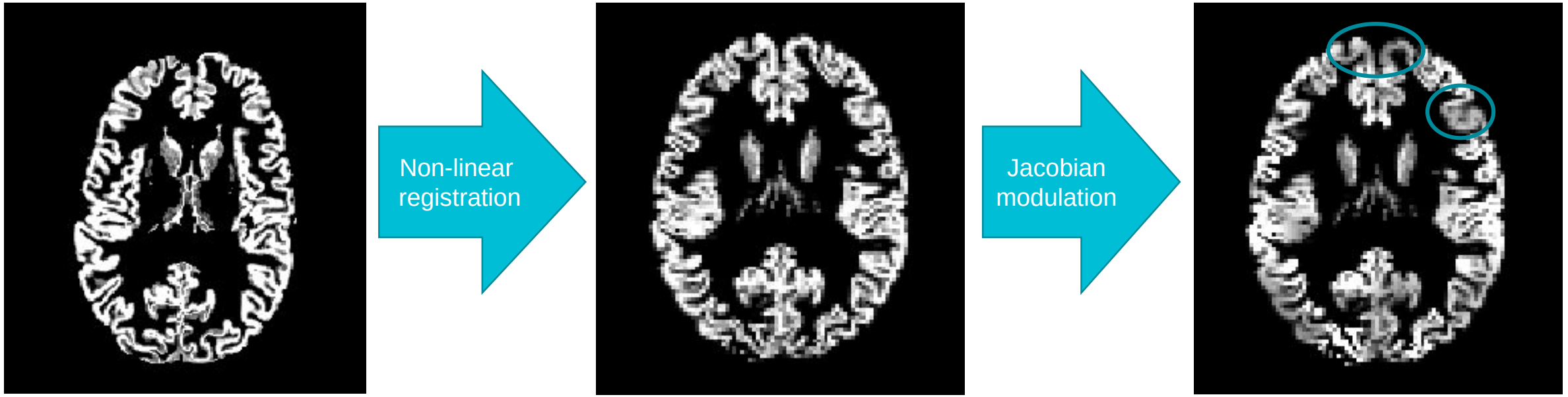
- Non-linear registration to the template



VBM using FSL tools

3. Processing the native GM images:

- Jacobian modulation to compensate for contraction/enlargement during non-linear registration



VBM using FSL tools

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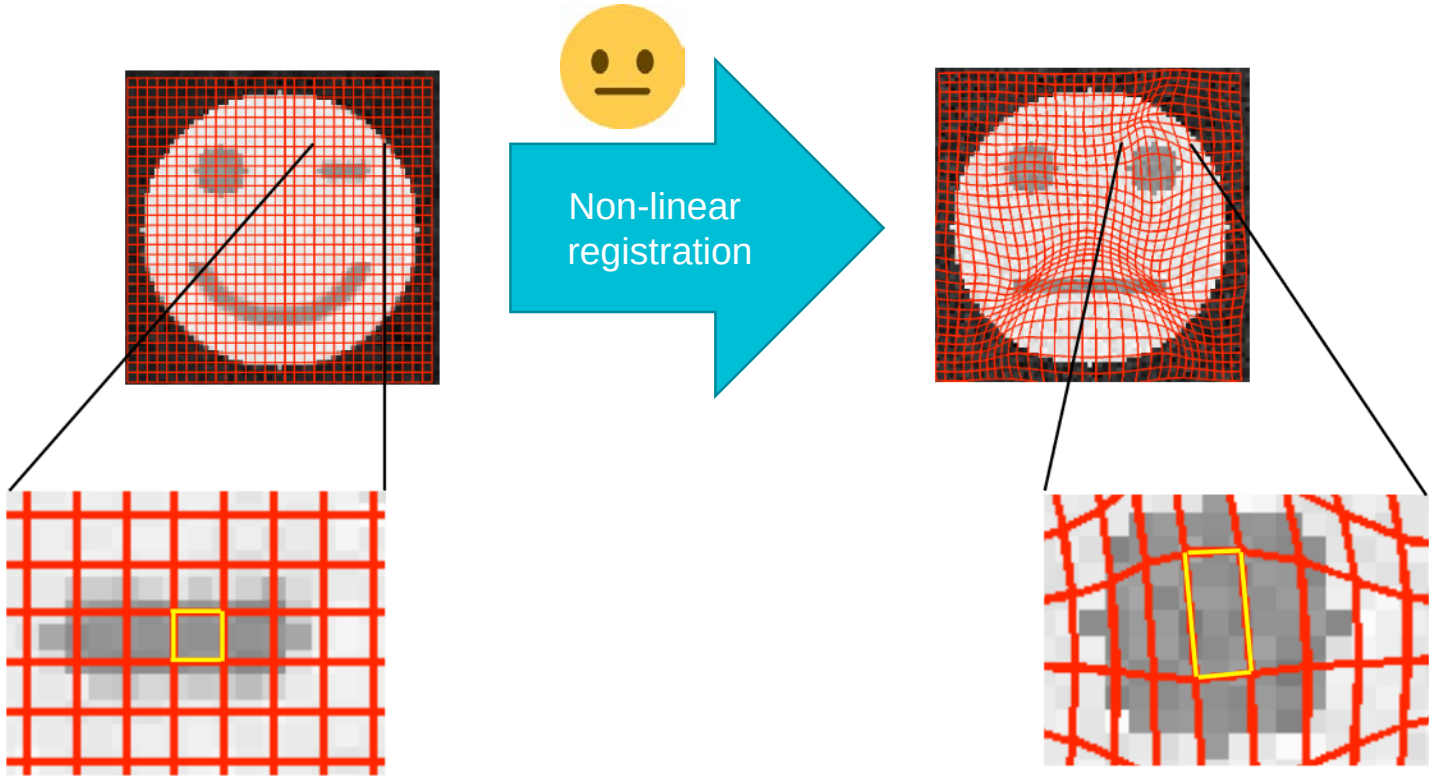
- Jacobian modulation to compensate for contraction/enlargement during non-linear registration

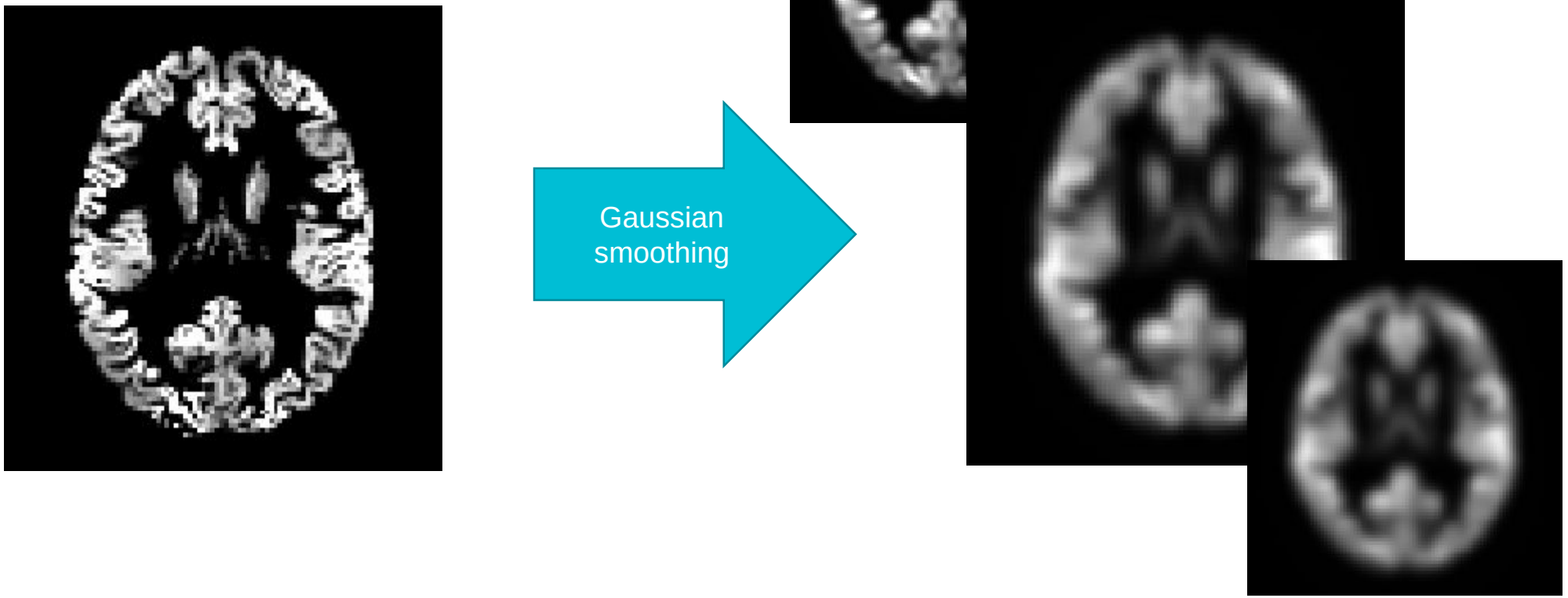


From Mark Jenkinson

VBM using FSL tools

3. Processing the native GM images:

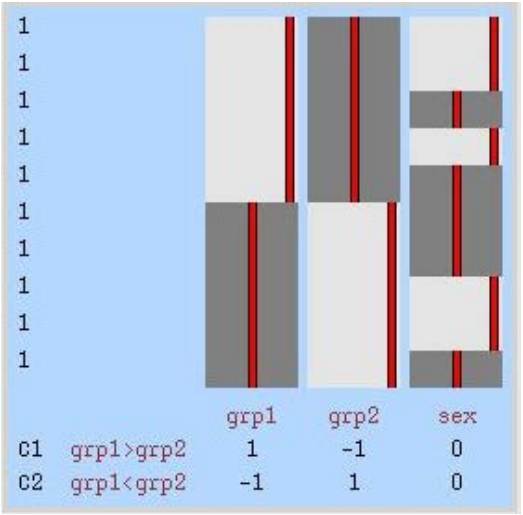
- Smoothing with Gaussian kernel

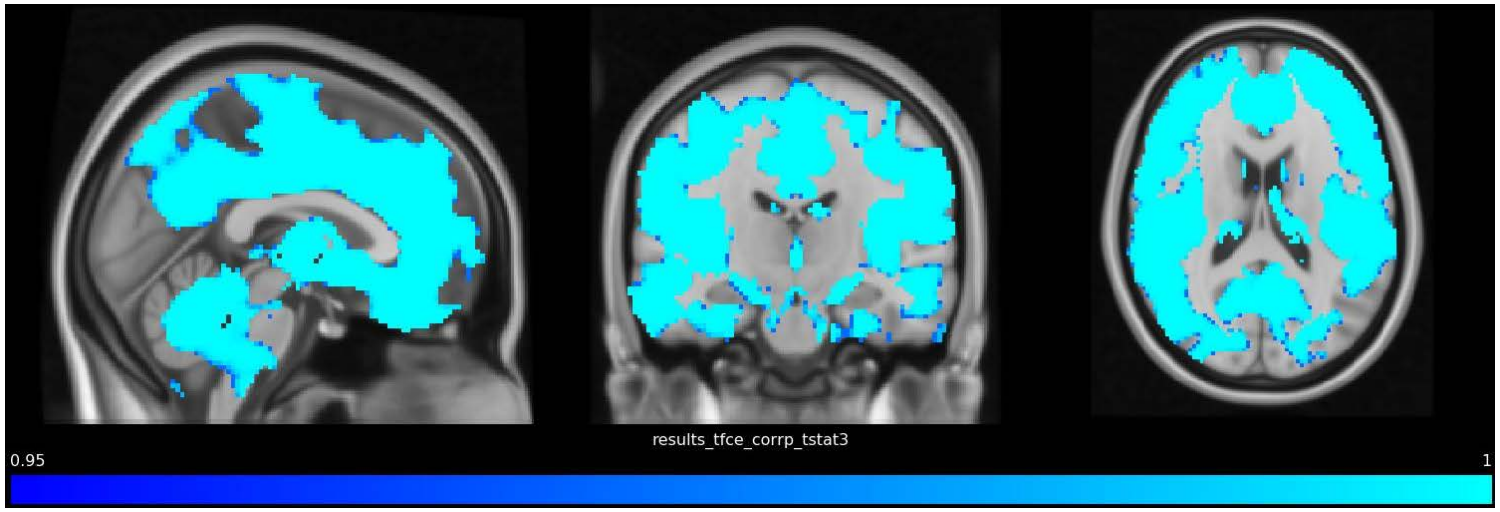


VBM using FSL tools

4. Statistical analysis:

- Create the design matrix
- Use **randomise** for non-parametric inference





VBM using FSL tools

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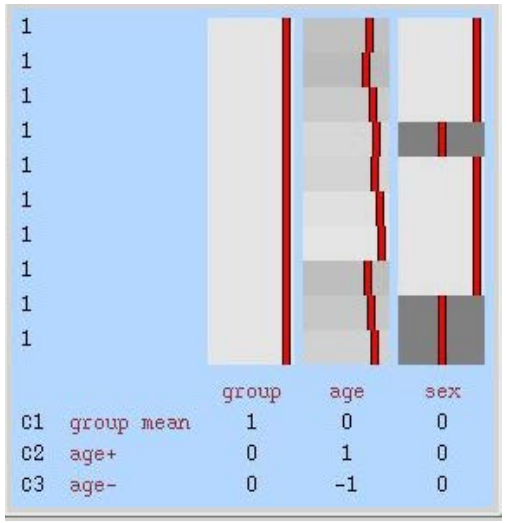
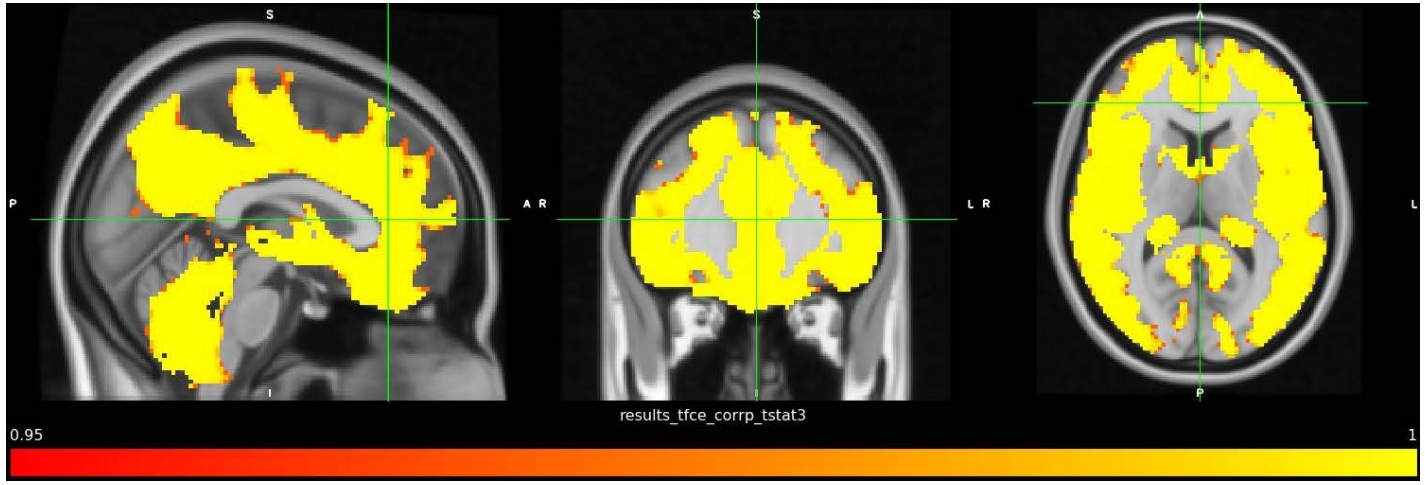
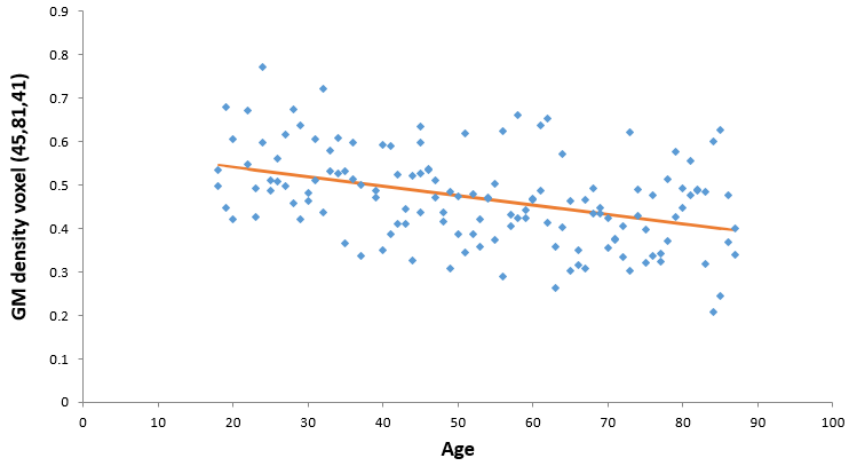


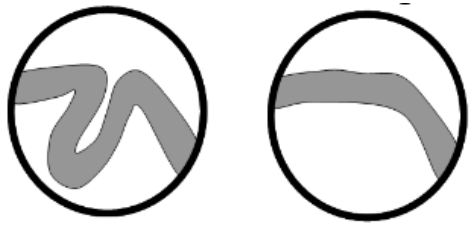




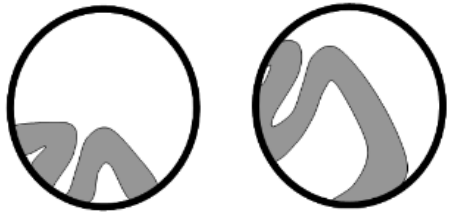
Interpretation of results

- VBM results are sensitive to real GM volume changes

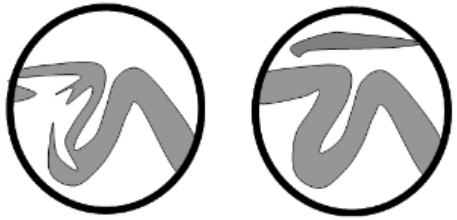
- Also sensitive to changes in folding



- But can also reflect processing errors:
  - poor registration



  - segmentation mistakes



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Questions?