



MRC Cognition  
and Brain  
Sciences Unit



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CAMBRIDGE

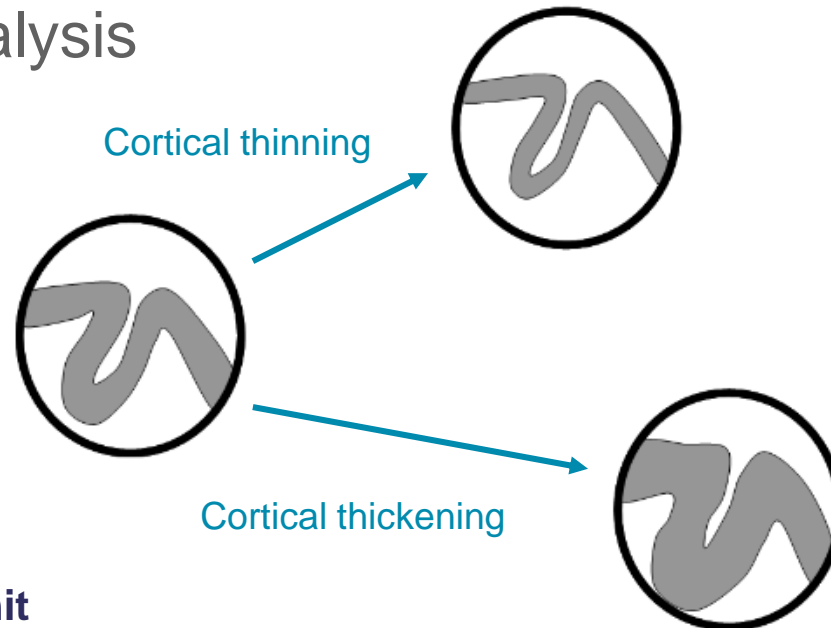
# Voxel Based Morphometry (VBM)

Marta M. Correia

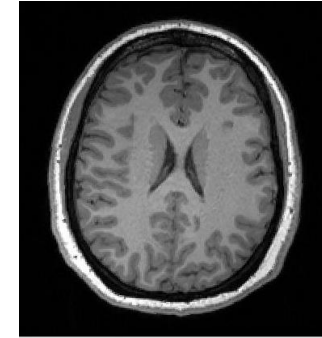
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# Overview of VBM

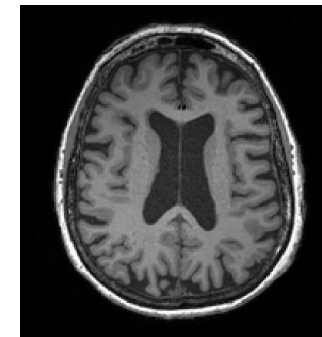
- Voxel-wise grey-matter (GM) volume analysis
- Very widely used technique to investigate GM changes
  - Volume/density changes between populations
  - Correlations with cognitive metrics or clinical scores
- Whole-brain unbiased analysis
- Fully automated



20 year old

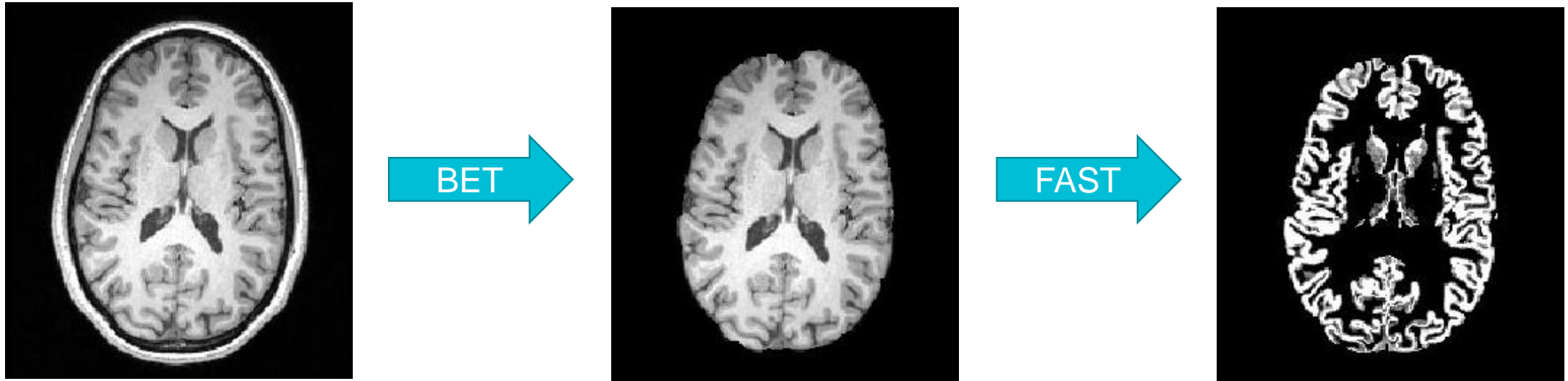


80 year old



# VBM using FSL tools

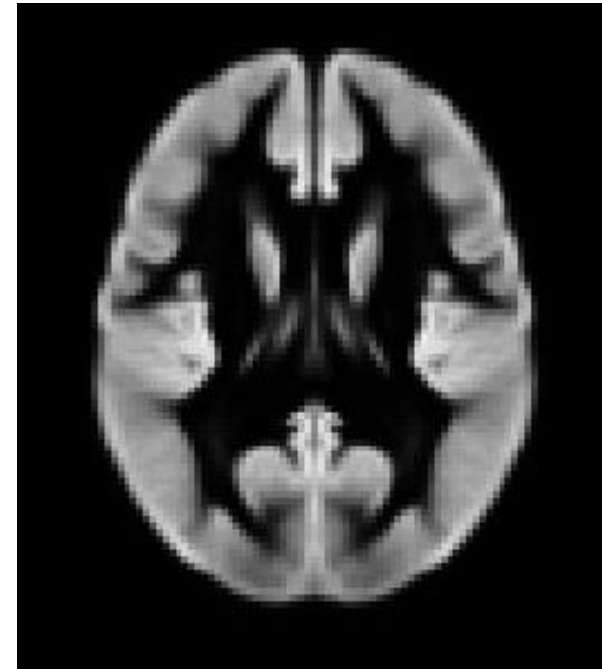
1. Extracting brain information: brain extraction and tissue segmentation



# VBM using FSL tools

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

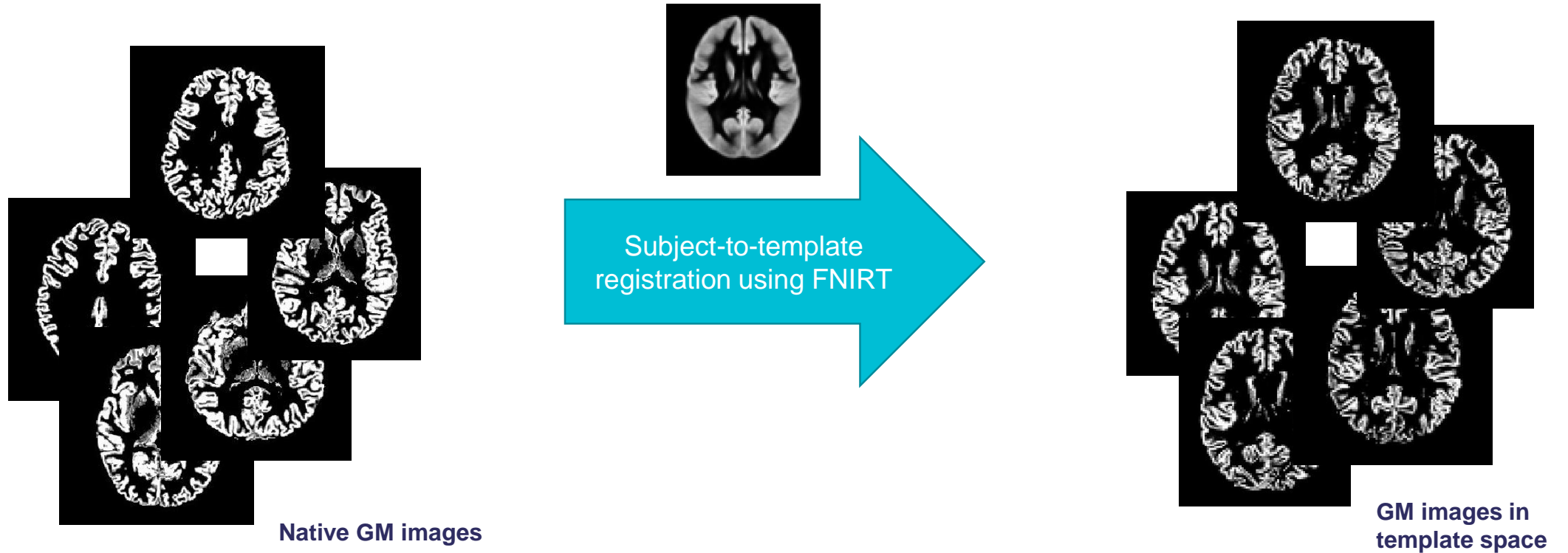
- Iteratively register all GM images to generate a representative template
- Equal number of images from each group



# 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:

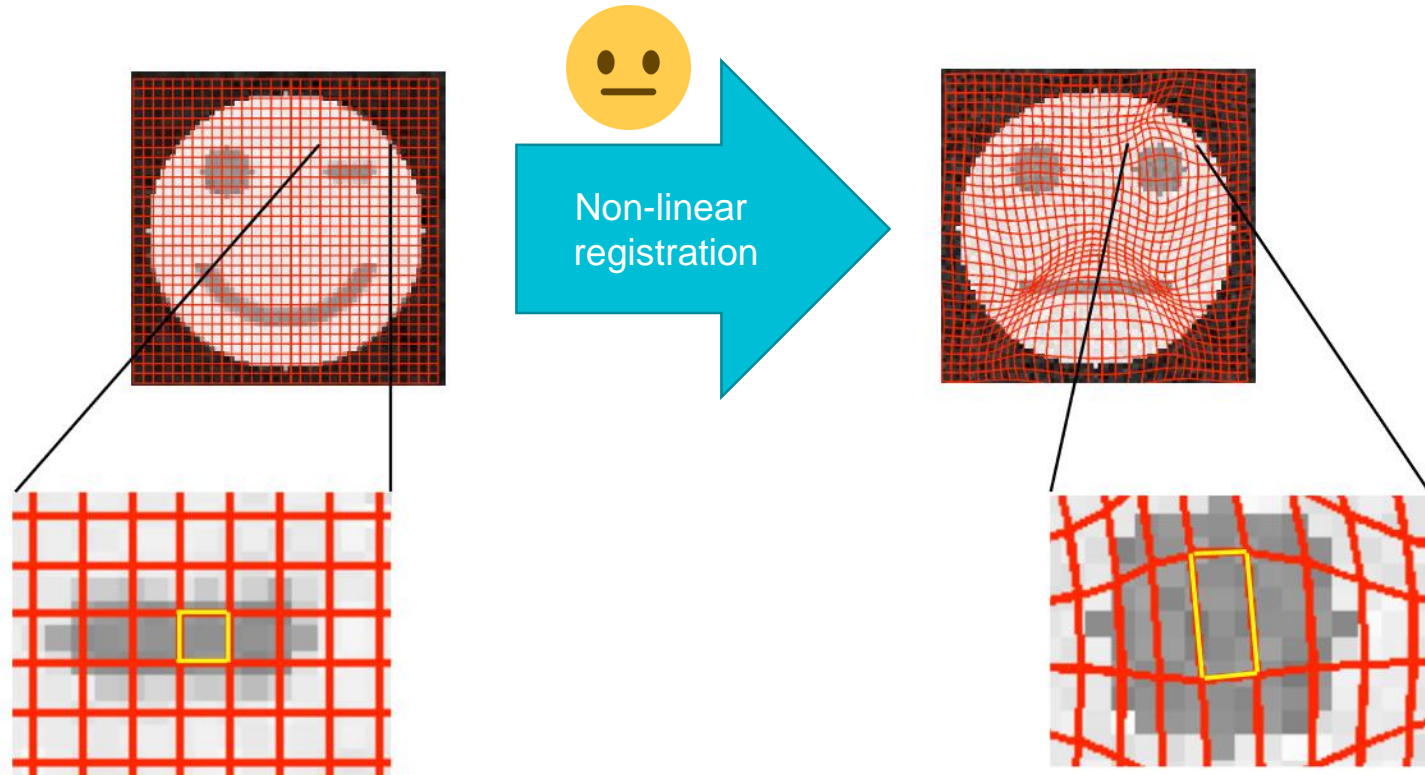
- Jacobian modulation to compensate for contraction/enlargement during non-linear registration



# VBM using FSL tools

## 3. Processing the native GM images:

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

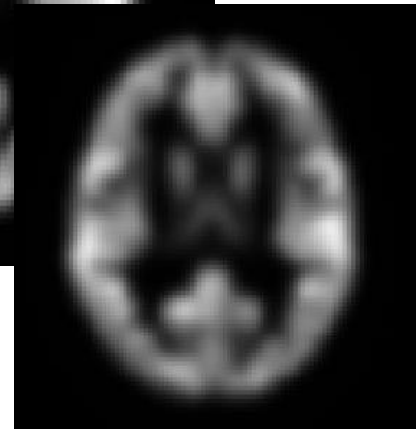
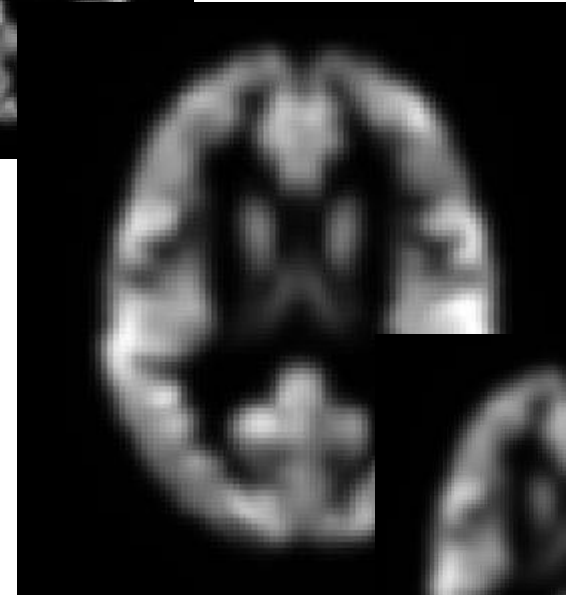
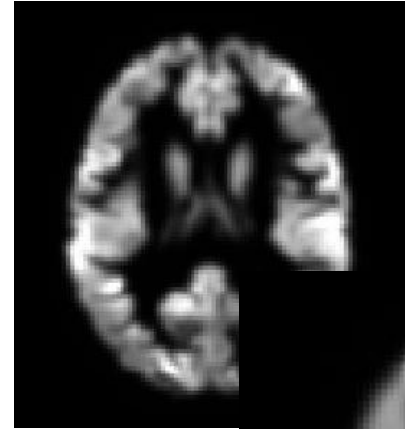


From Mark Jenkinson

# VBM using FSL tools

## 3. Processing the native GM images:

- Smoothing with Gaussian kernel

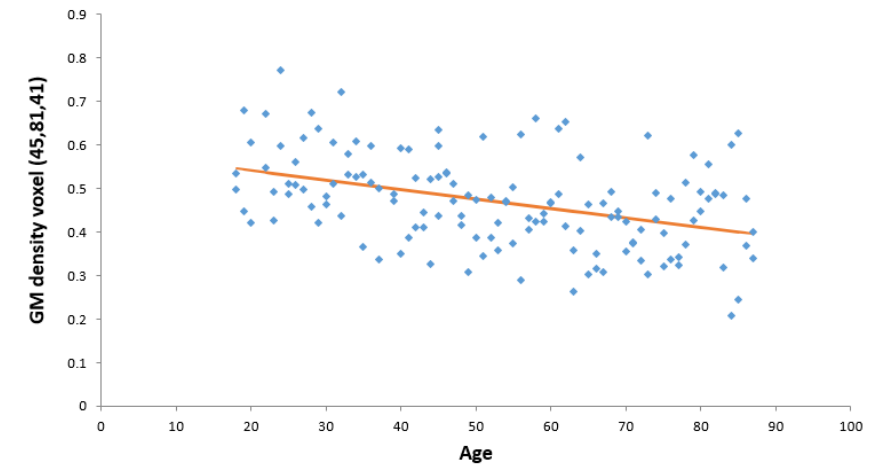
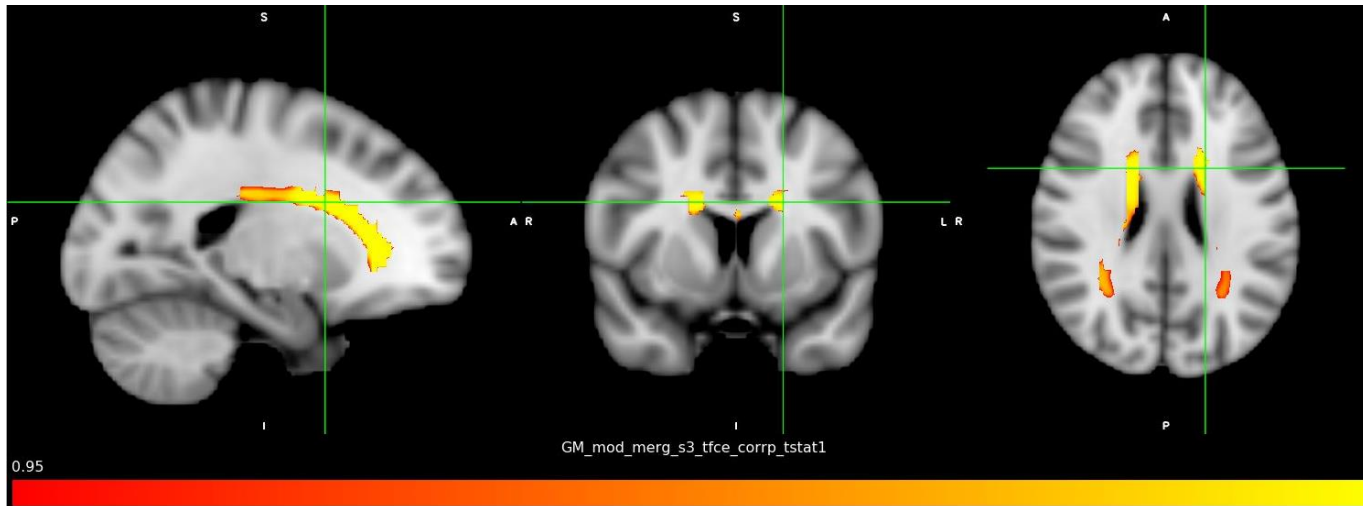
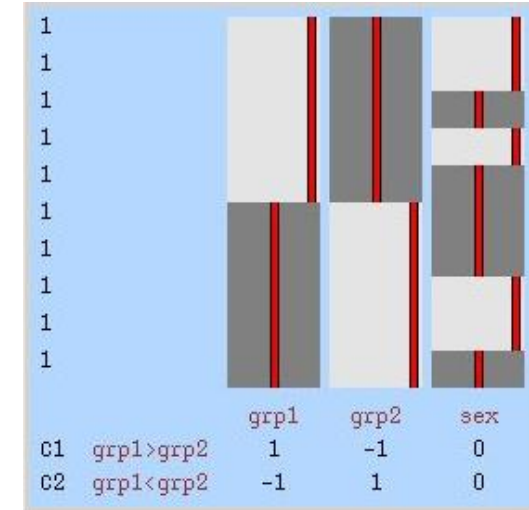




# VBM using FSL tools

## 4. Statistical analysis:

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

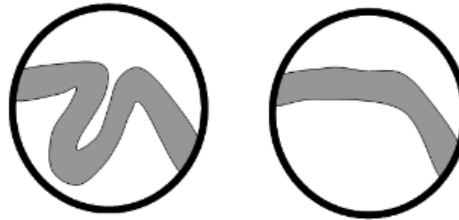


# Interpretation of results

- VBM results are sensitive to real GM volume changes

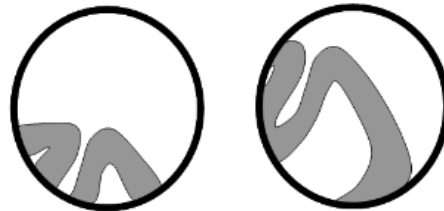


- Also sensitive to changes in folding

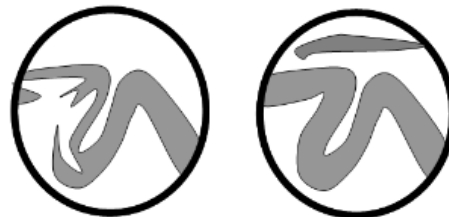


- But can also reflect processing errors:

- poor registration



- segmentation mistakes





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**Thank you**

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