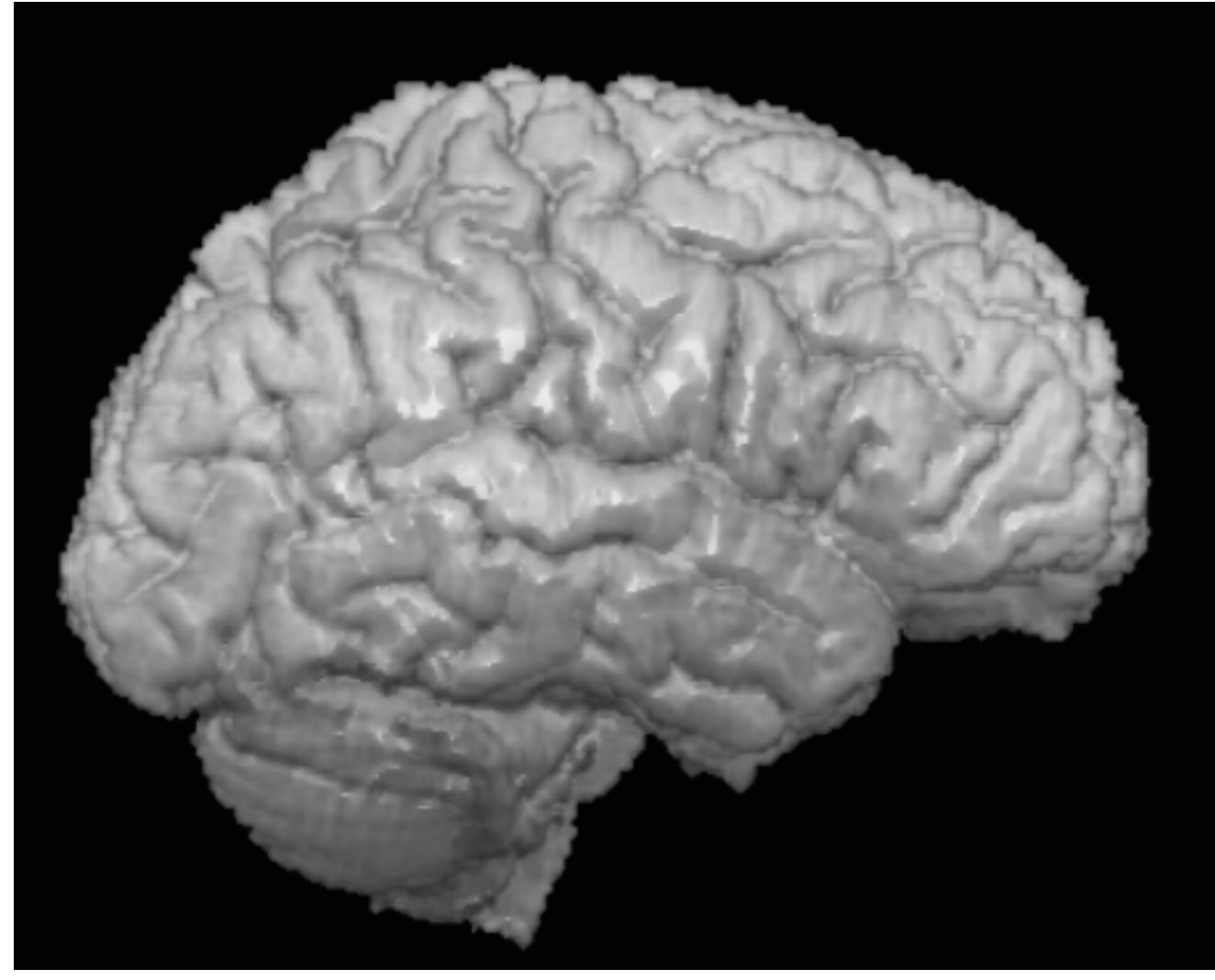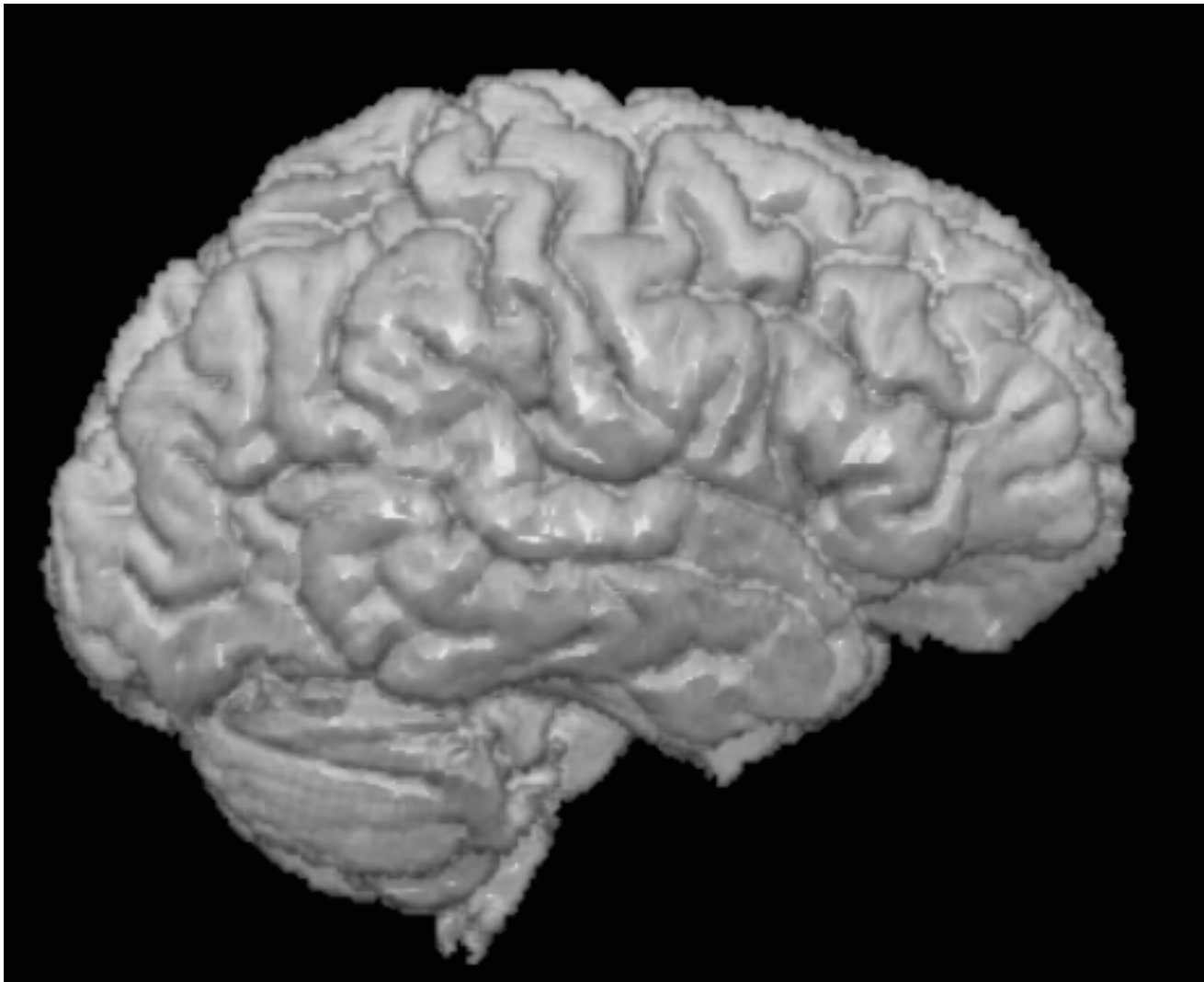# Spatial normalization

What are we trying to match?

Identical twins

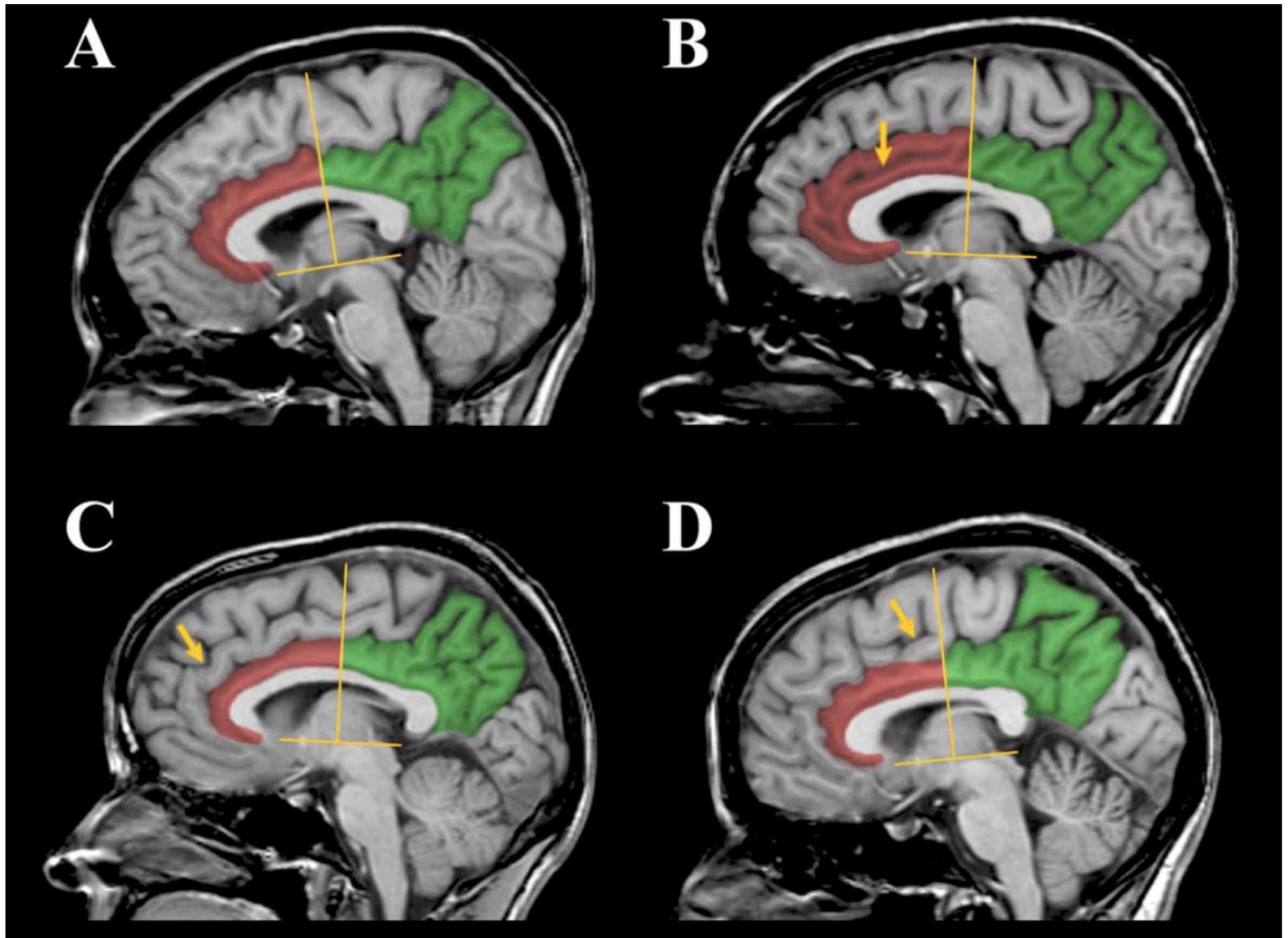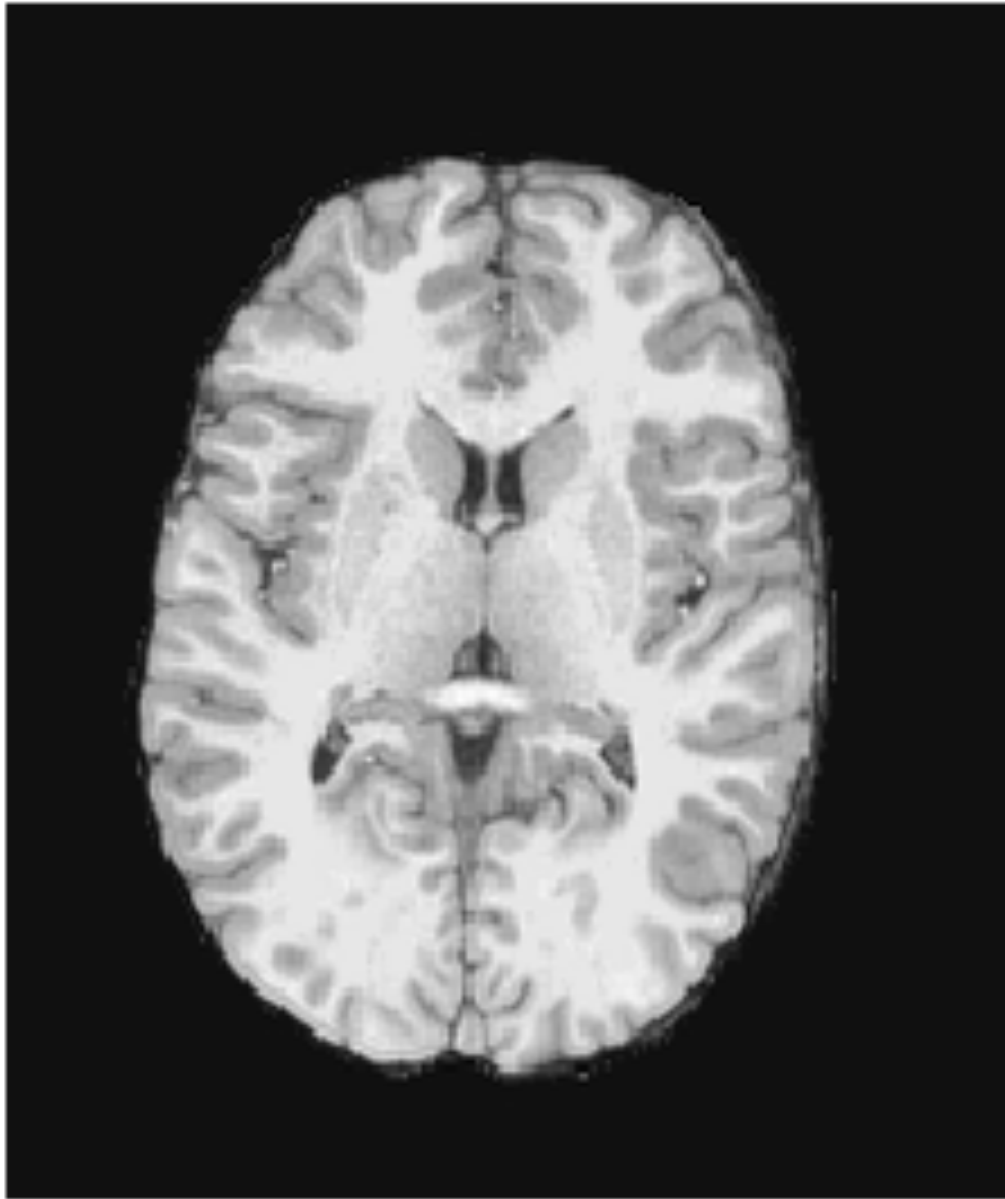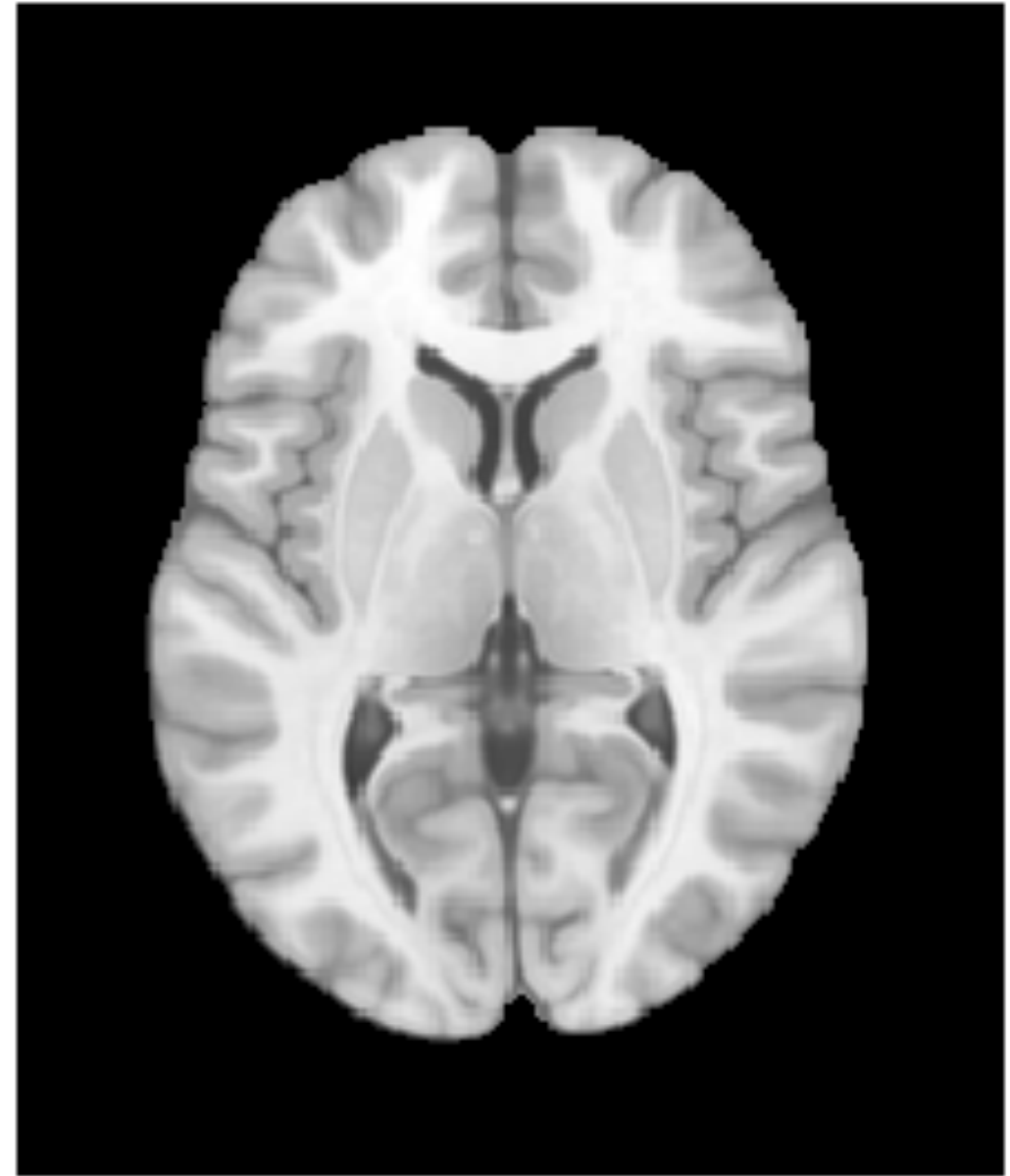Klein and Tourville (2012) Frontiers in Brain Imaging Methods. 6:171

FIG. 2. Region delimitation adopted in different anatomical patterns: continuous and well-defined cingulate gyrus (A), presence of intralimbic sulcus (arrow in B), presence of second cingulate (paracingulate) sulcus (arrow in C), and presence of cingulate sulcus interruptions (arrow in D).

Pujol et al (2002) NeuroImage 15:847

Individual

Template

Slides kindly provided by Michael Waskom
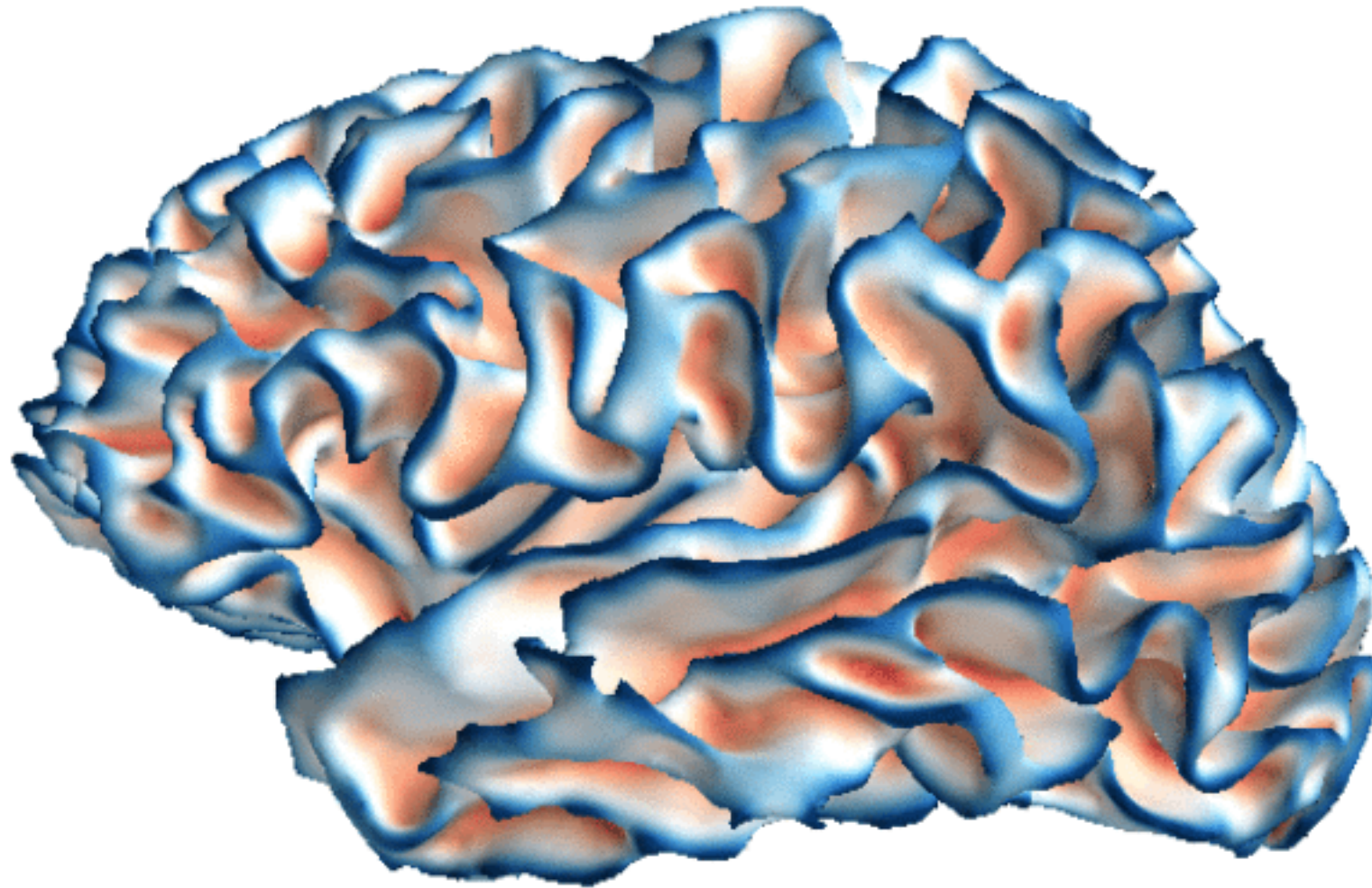http://stanford.edu/~mwaskom

High-Resolution Intersubject Averaging and a Coordinate System for the Cortical Surface

Bruce Fischl,[1] **Martin I. Sereno,**[2] **Roger B.H. Tootell,**[1] **and Anders M. Dale**[1]*

[1]*Nuclear Magnetic Resonance Center, Massachusetts General Hospital/Harvard Medical School, Charlestown, Massachusetts*
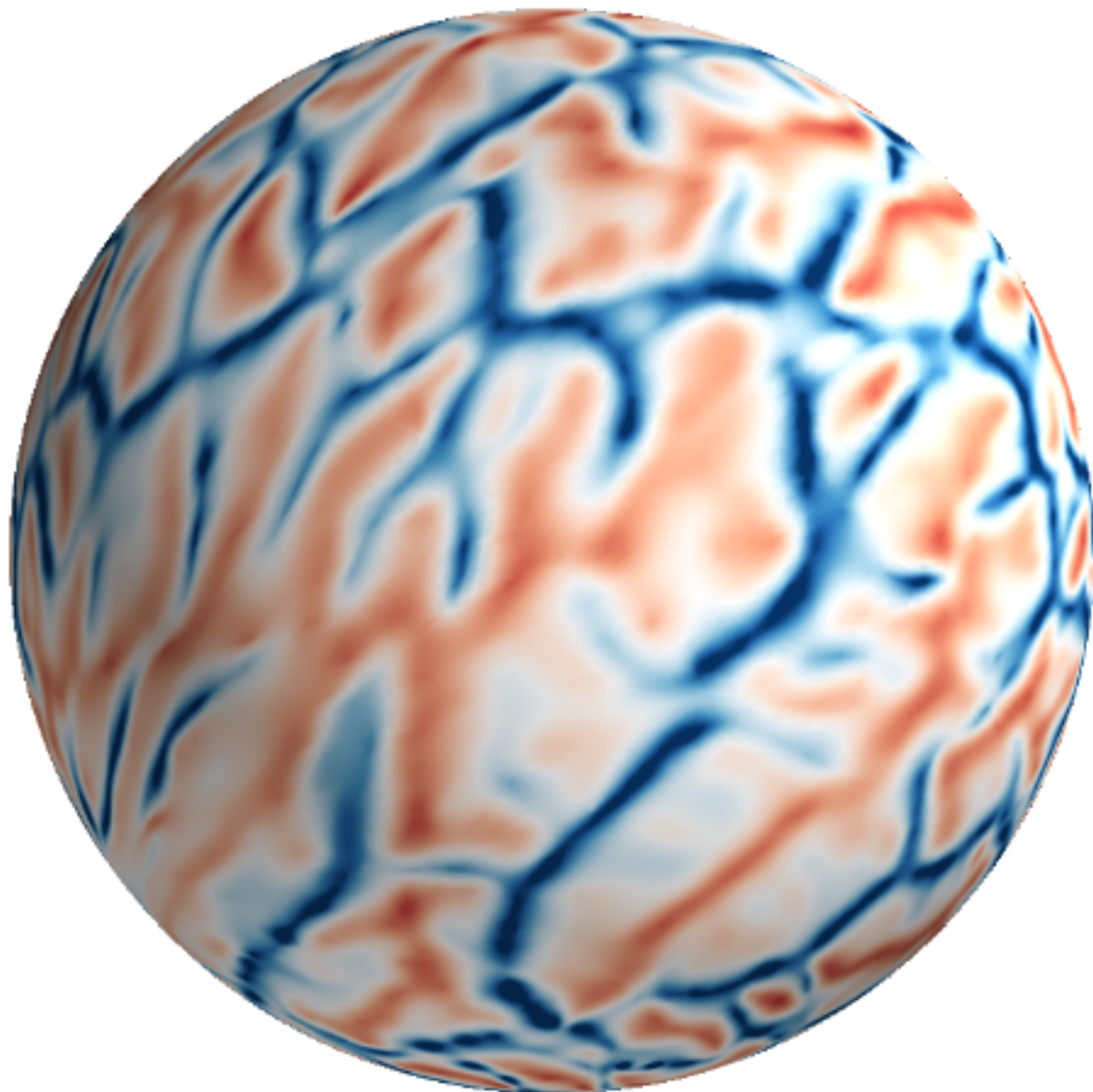[2]*Department of Cognitive Science, University of California at San Diego, La Jolla, California*
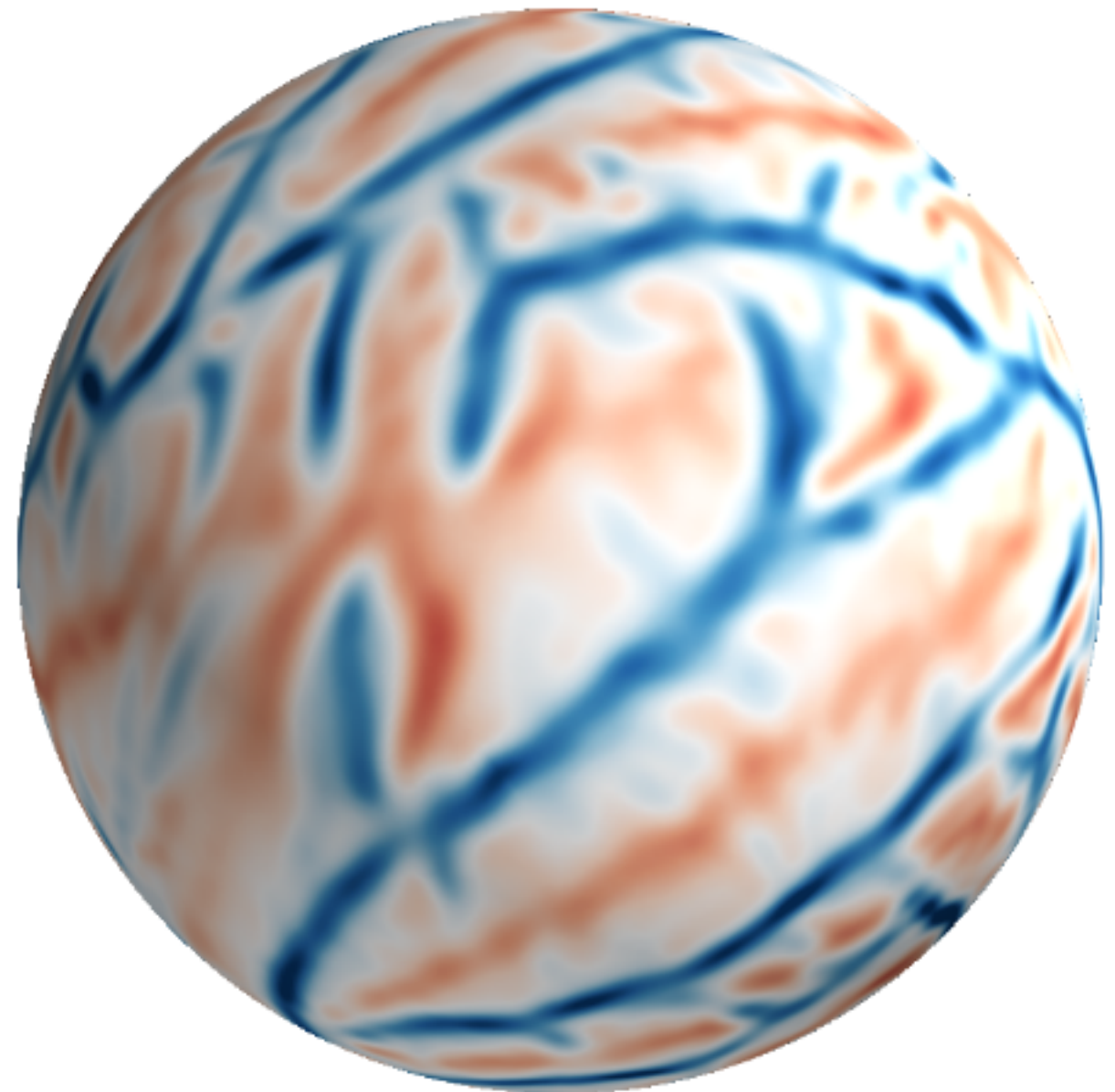
Inflation of surface mesh model
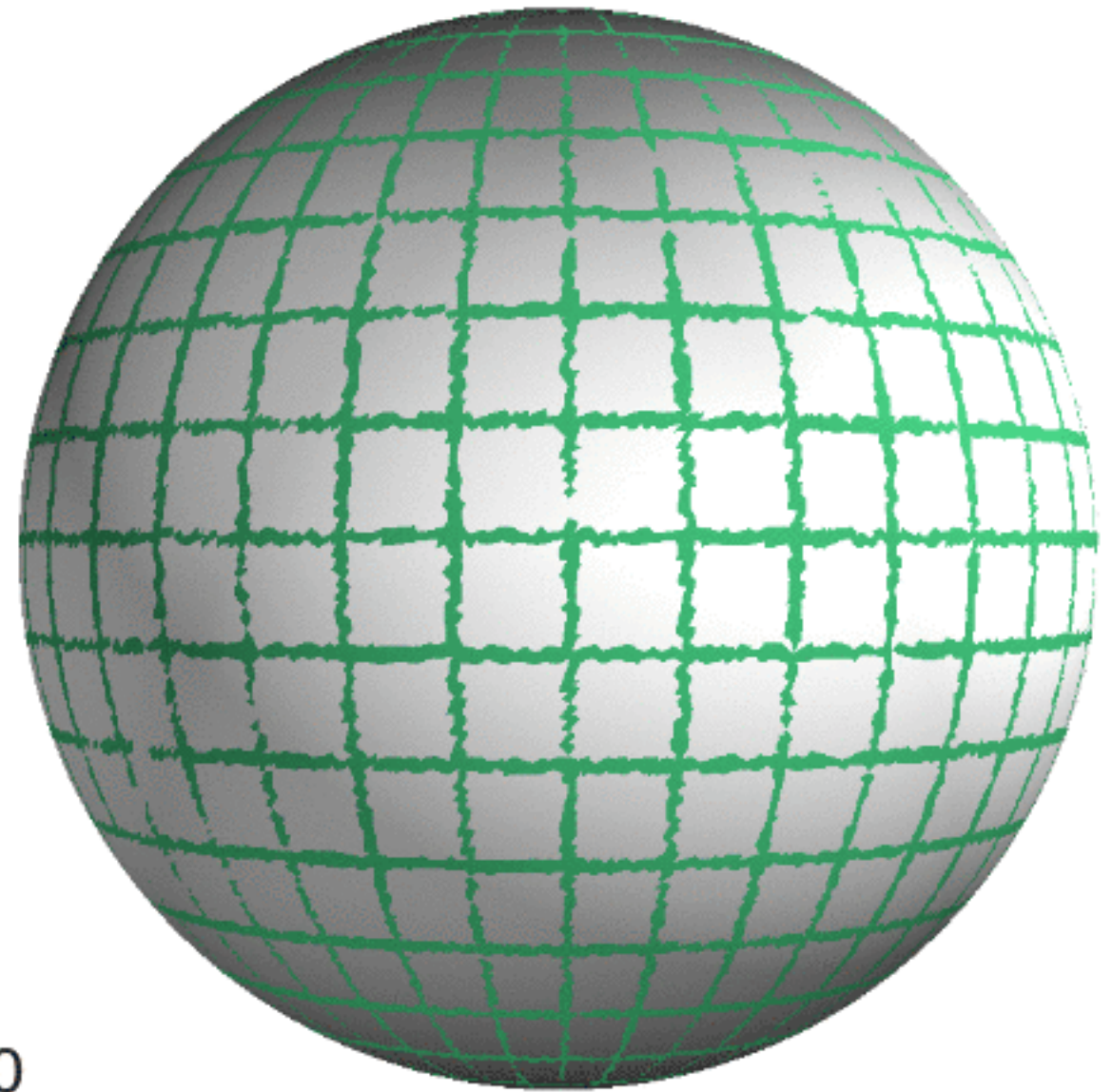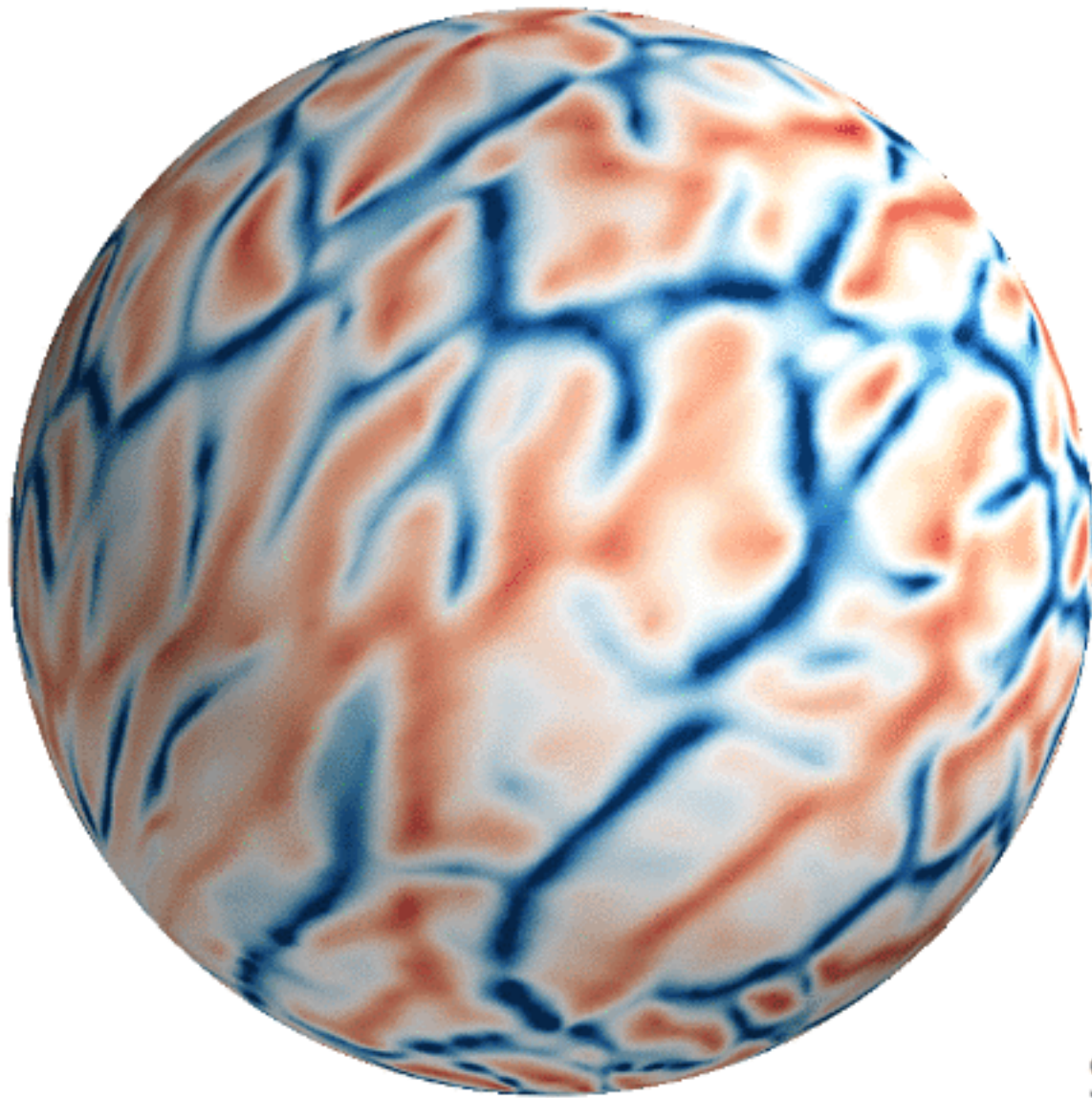
Curvature-based registration problem
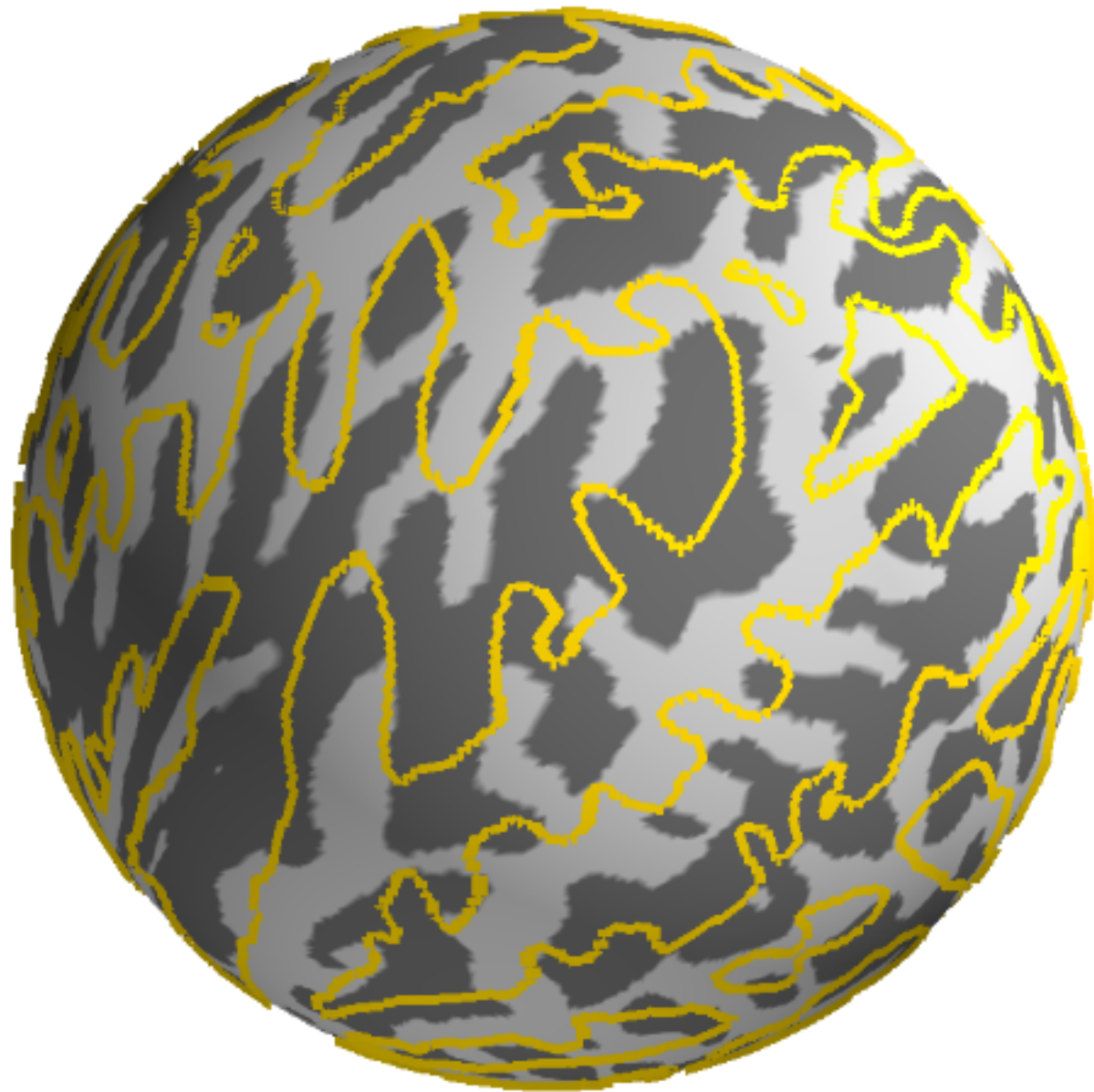
Single-subject sphere

Group-average sphere

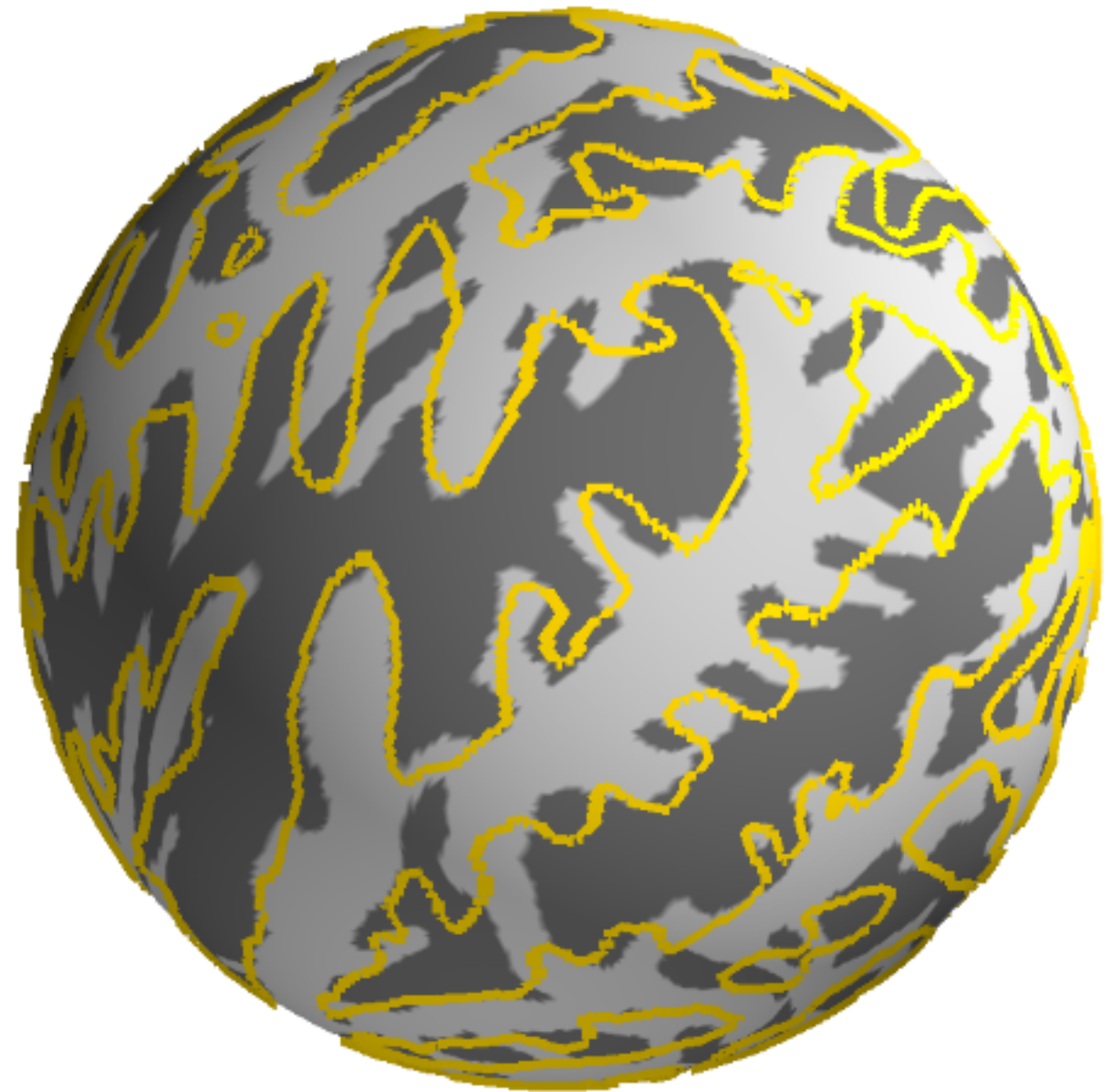# Regularized nonlinear deformation of spherical surface

Step 0

Registration aligns folding patterns

Before registration

After registration

Average curvature contour overlaid on subject data

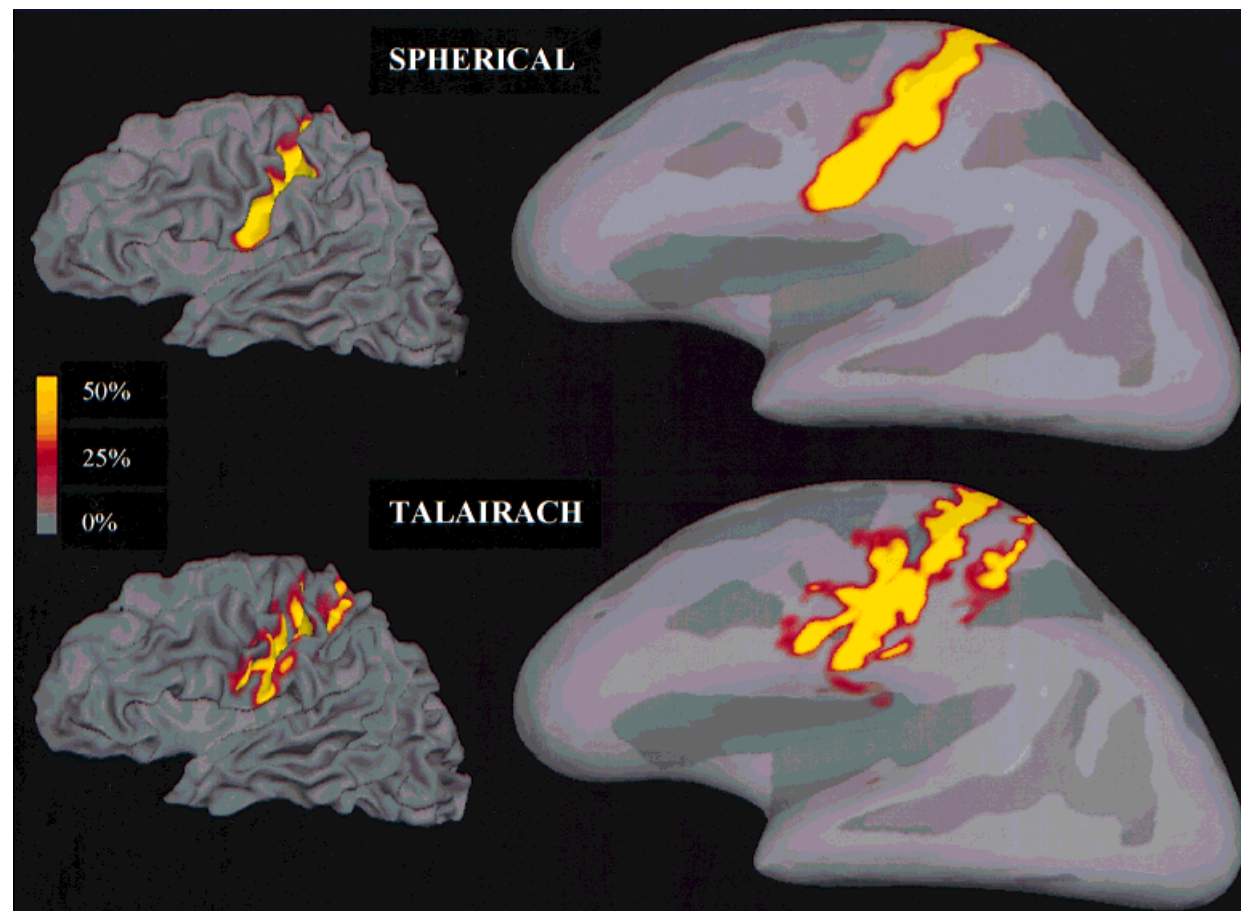# Improved localization with surface-based registration(?)

Figure 3.
Mapping of the central sulcus of 11 subjects onto an individual using spherical (top row) and Talairach (bottom row) coordinates. The white matter (left) and inflated (right) surfaces are given for comparison purposes.
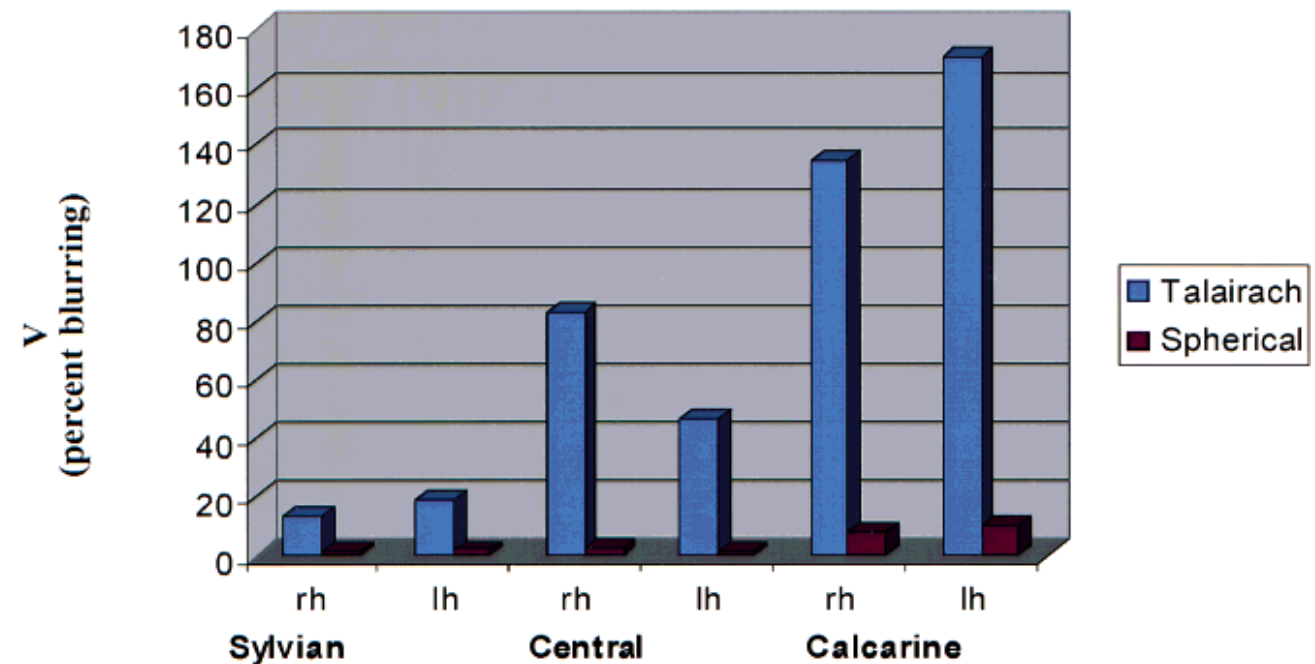

Figure 4.
Percent blurring of three different sulci resulting from averaging in Talairach and spherical coordinates.
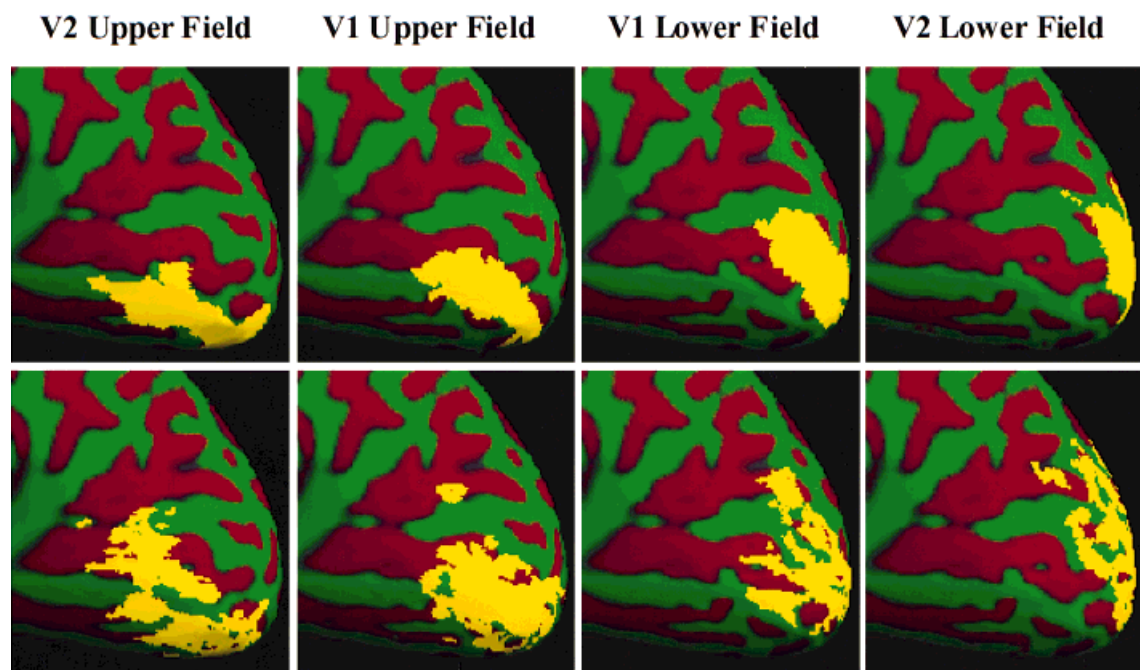
th surface-based registration(?)

Figure 5.
Pooled visual areas of 11 subjects averaged in spherical (top row) and Talairach (bottom row) coordinates, painted onto a medial view of an individual inflated surface. Anterior is to the left, the occipital pole is at the right.
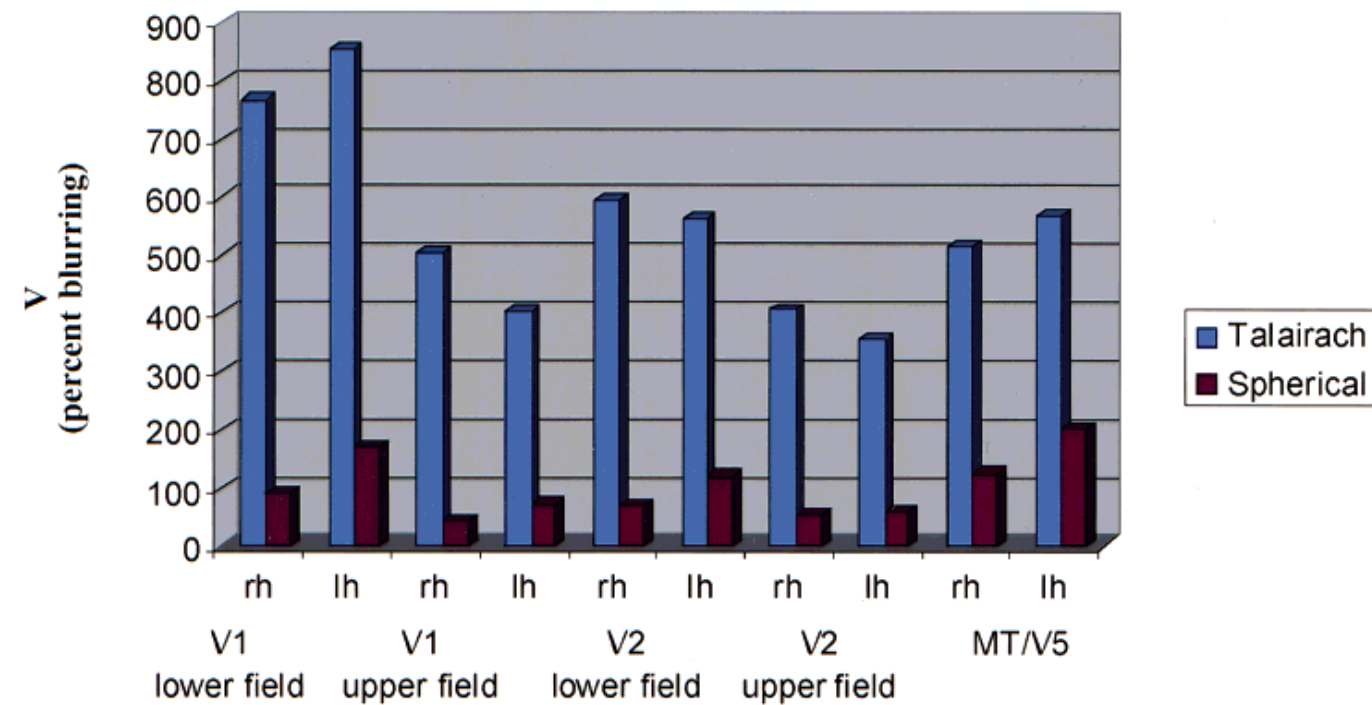
Figure 6.
Percent blurring of visual areas resulting from averaging in Talairach and spherical coordinates.