

Society for Neuroscience 2015: Structural trajectories of healthy aging in cortical thickness and subcortical morphometry

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>cobraLab
computational brain anatomy
<http://www.cobralab.ca>

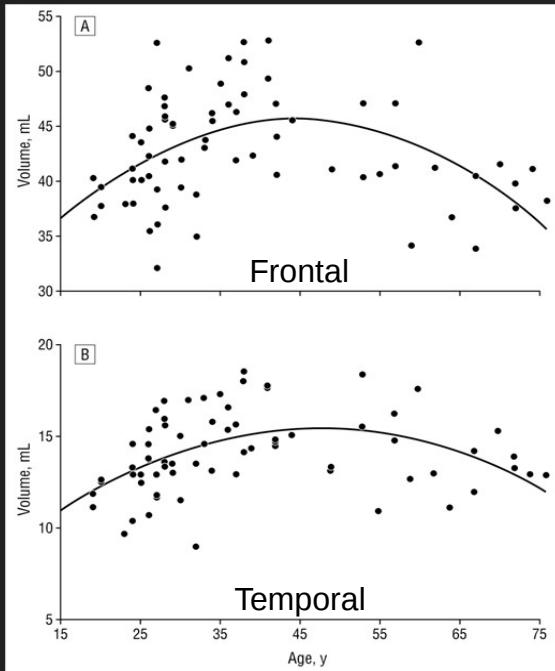


Motivation

Frontal

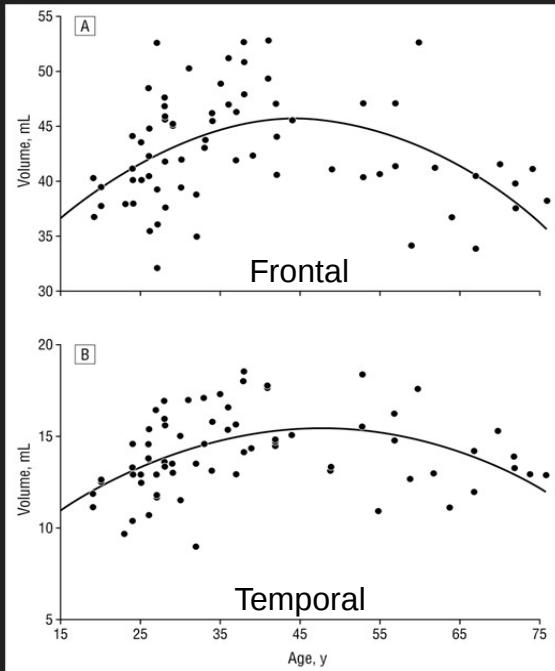
Temporal

Motivation

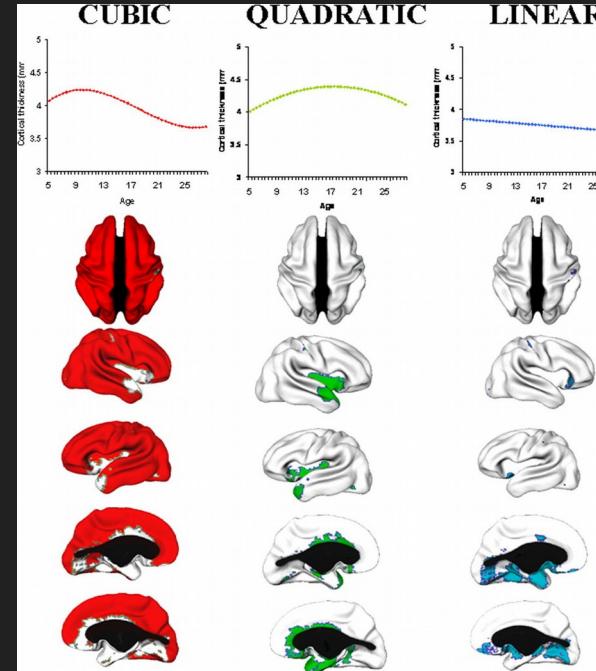


Bartzokis, 2001

Motivation

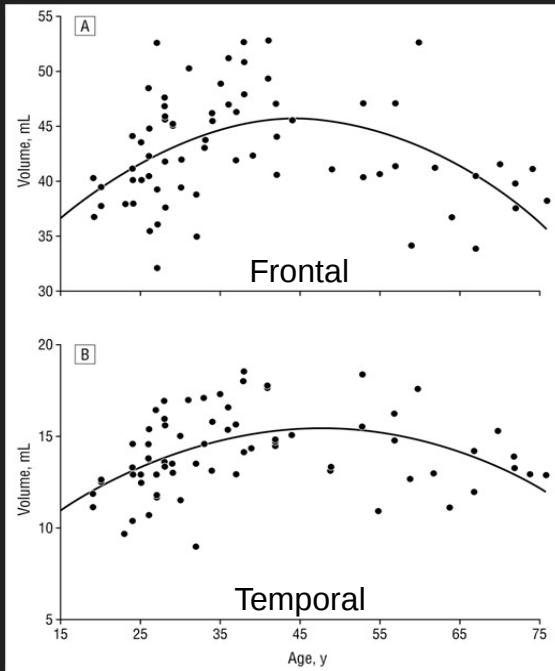


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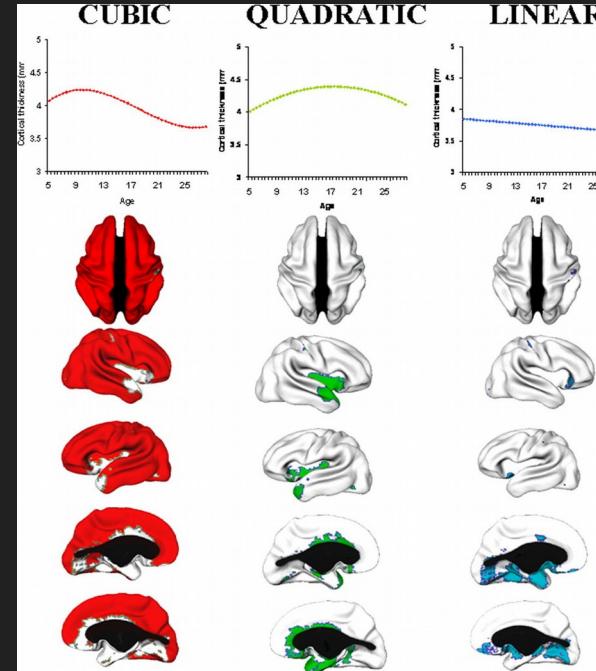


Shaw, 2008

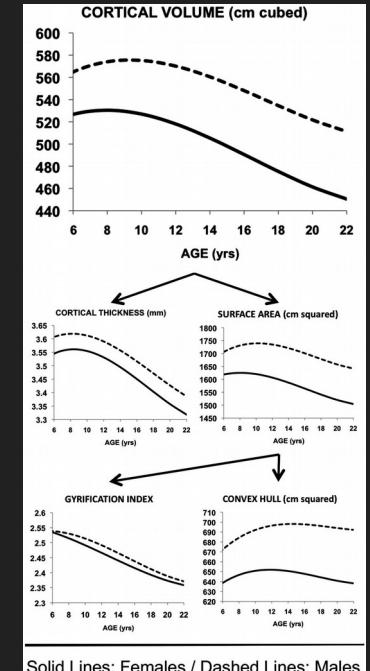
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Shaw, 2008



Raznahan, 2011

Objectives

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- 1 Examine anatomical changes across the adult lifespan

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 - the cortex

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 - subcortex and hippocampal regions

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- Examine non-linear effects of Aging
 - Whole-structure analyses
 - Local (vertex-wise) analyses

Open Access Series of Imaging Studies (OASIS)



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M=168, F=268



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- Age, Sex, CDR demographics



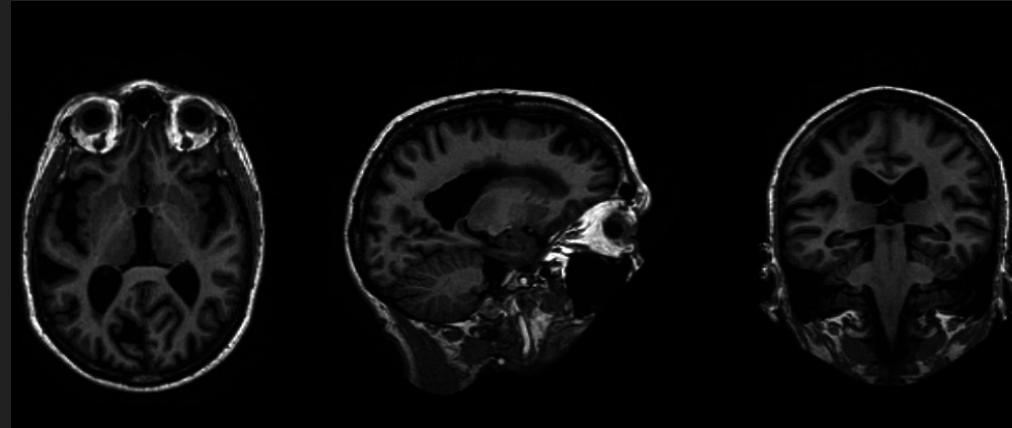
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- Age, Sex, CDR demographics
- Exclude CDR > 0.5 from
analysis



(Pre)processing of raw MRIs

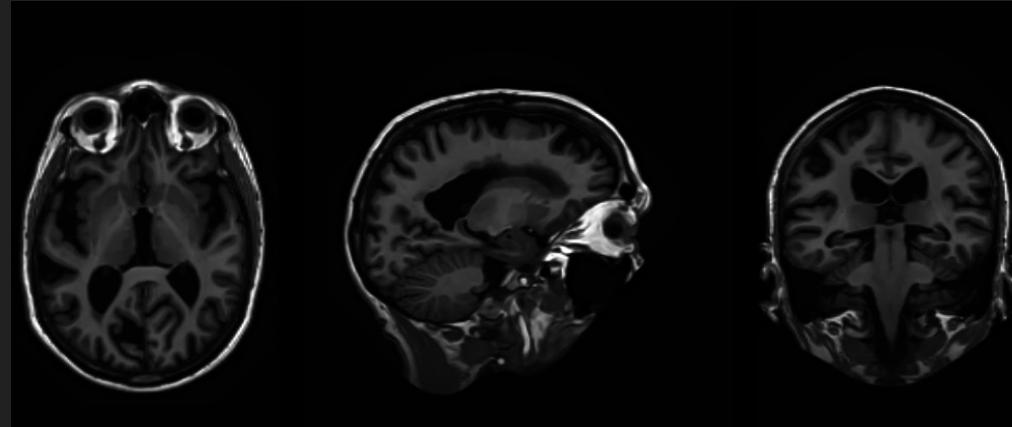
- ¹ Preprocessing of data with minc-bpipe-library¹
 - Adaptive non-local means denoising
 - N4 Bias Field Correction
 - Application of a head mask to remove excess data
 - Brain mask generation using BeAST



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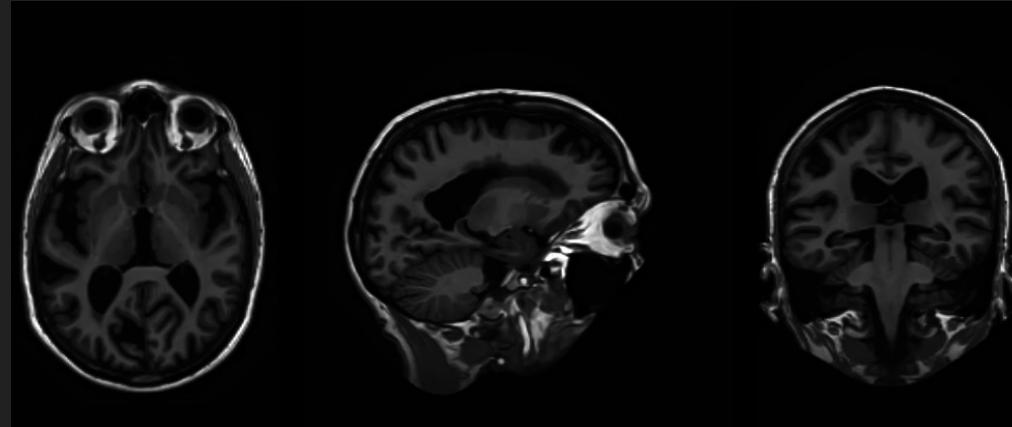
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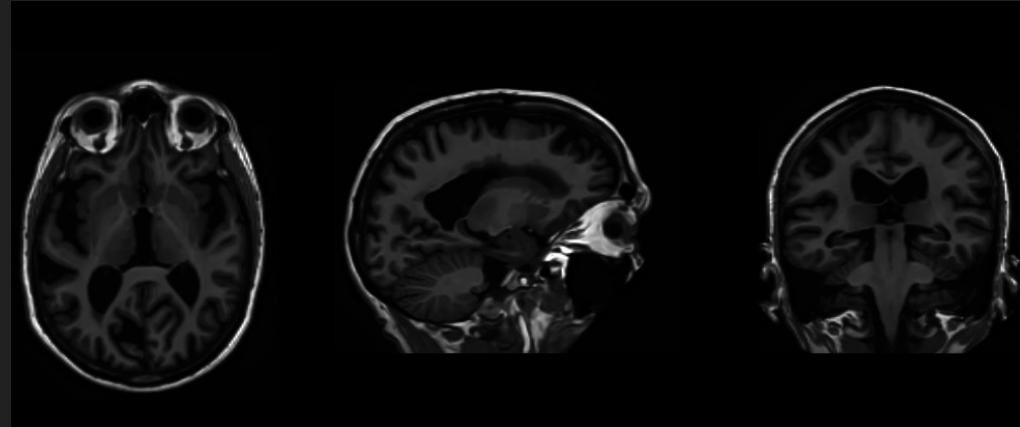
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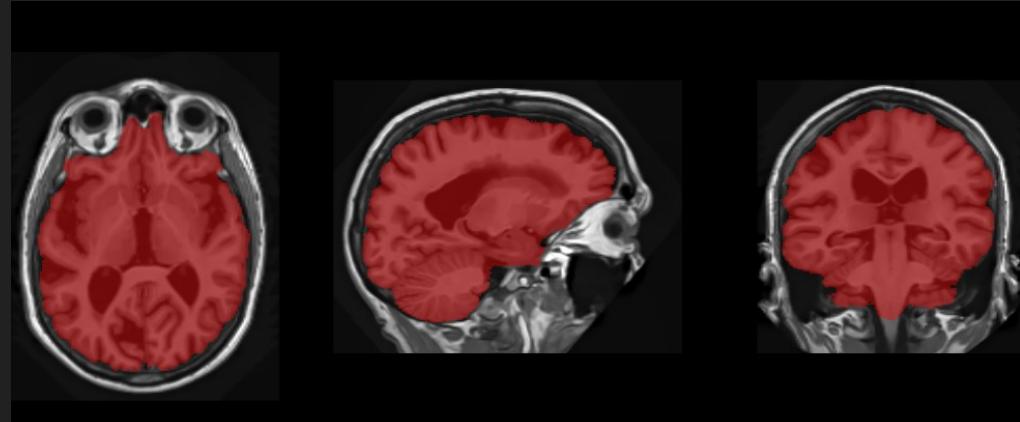
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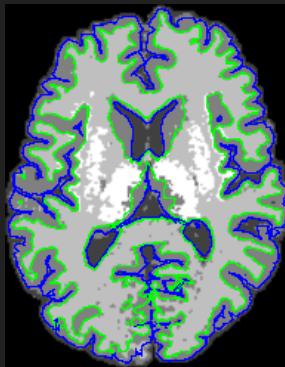
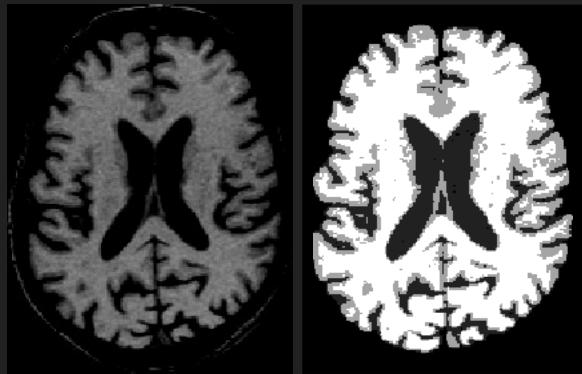
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Cortex Extraction with CIVET



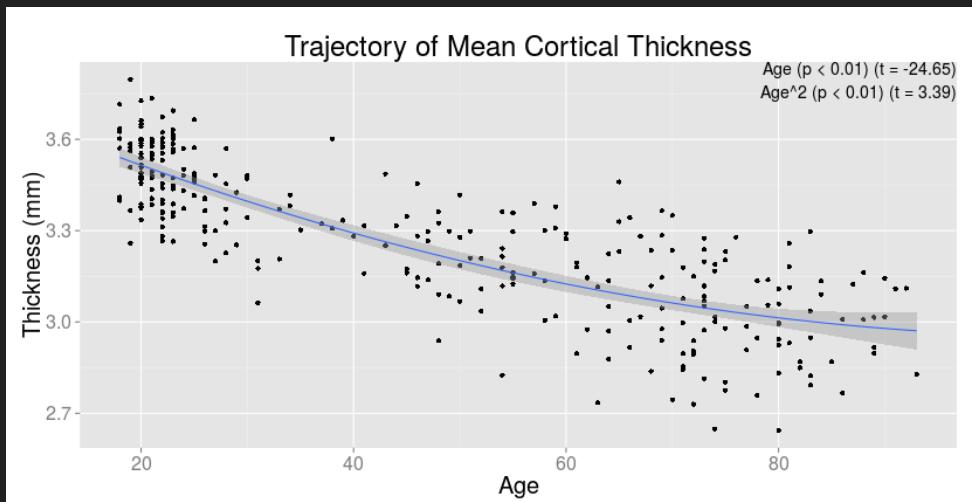
Lerch et al. Cerebral Cortex 2005

Cortical Thickness

- Cortical thickness at 40 962 verticies per hemisphere
- General Linear Model
 - Age, Age² and Age³
 - Sex
- Age³ showed no correlation with cortical thickness
- All results corrected for False Discovery Rate (FDR) and displayed at 5% level

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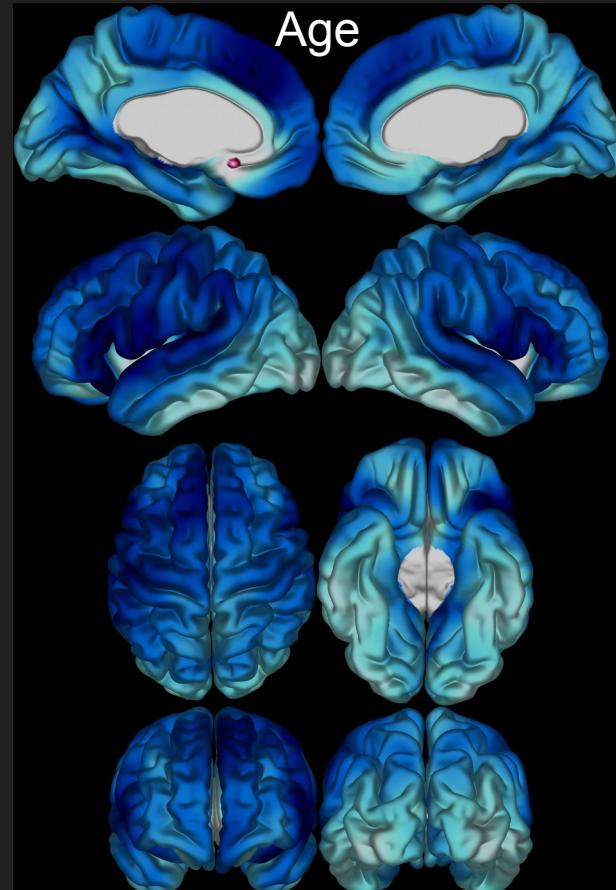
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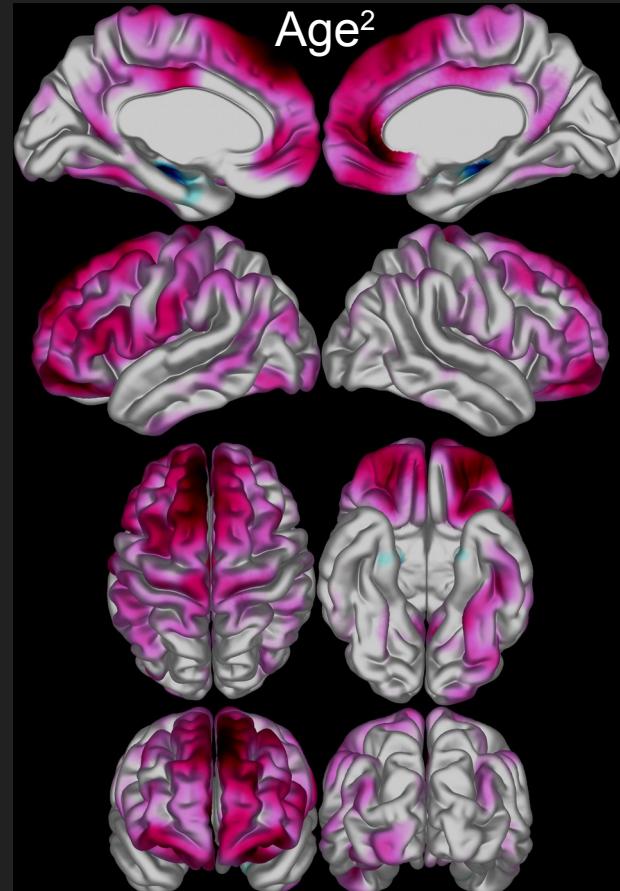
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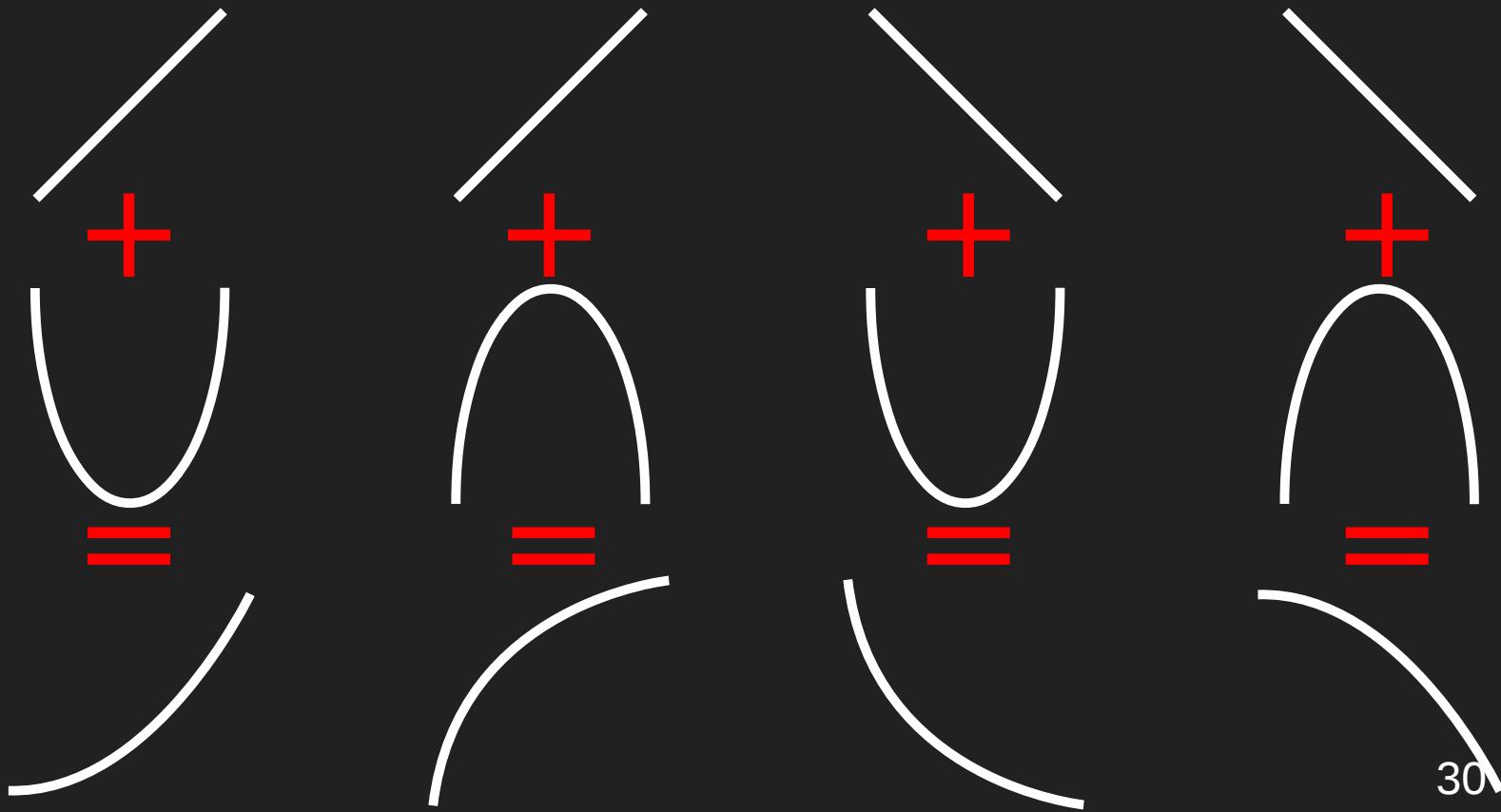


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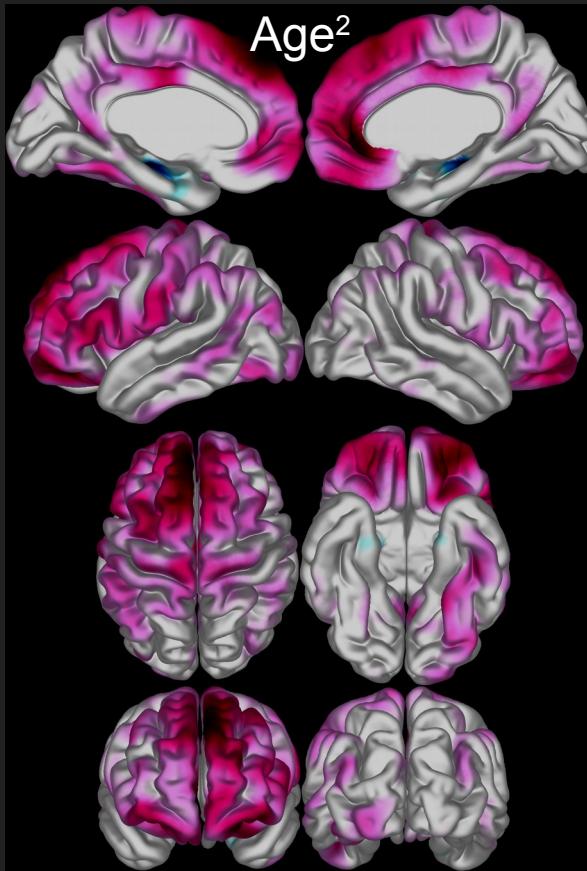
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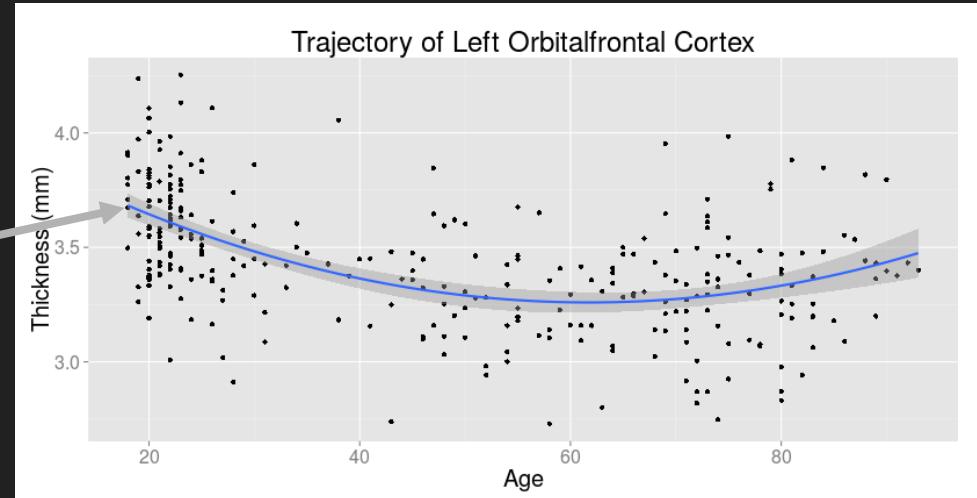
A Note on Non-Linear Effects



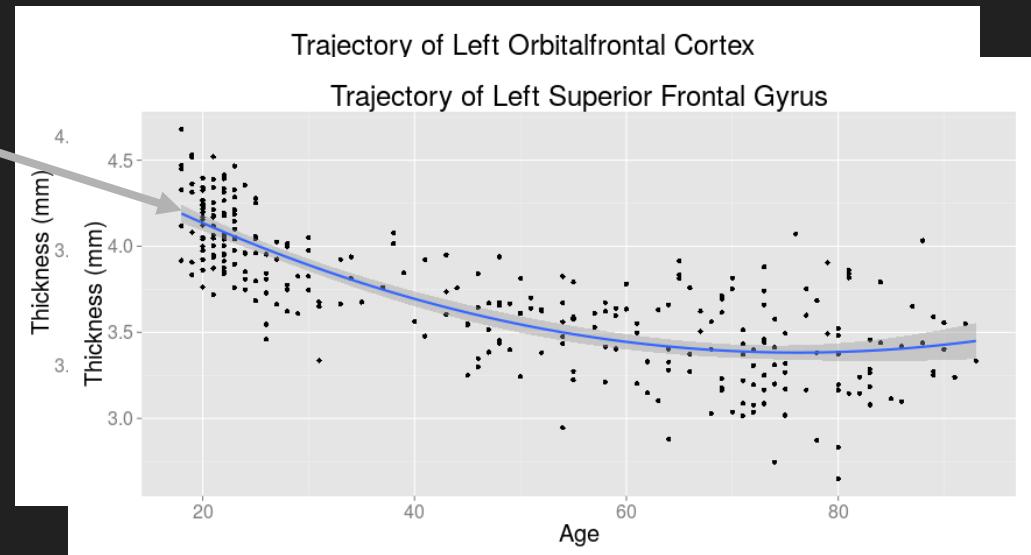
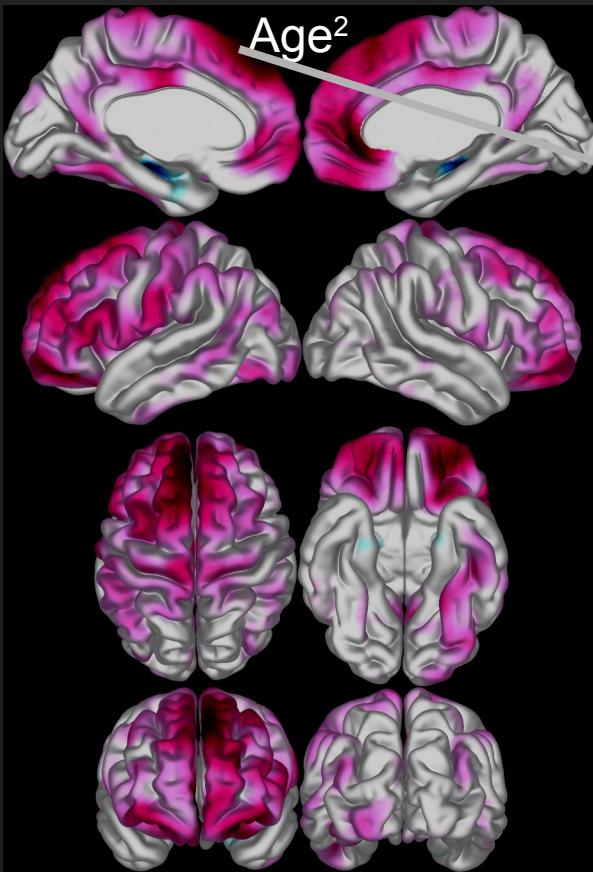
Regions of Nonlinear Cortical Thickness Changes



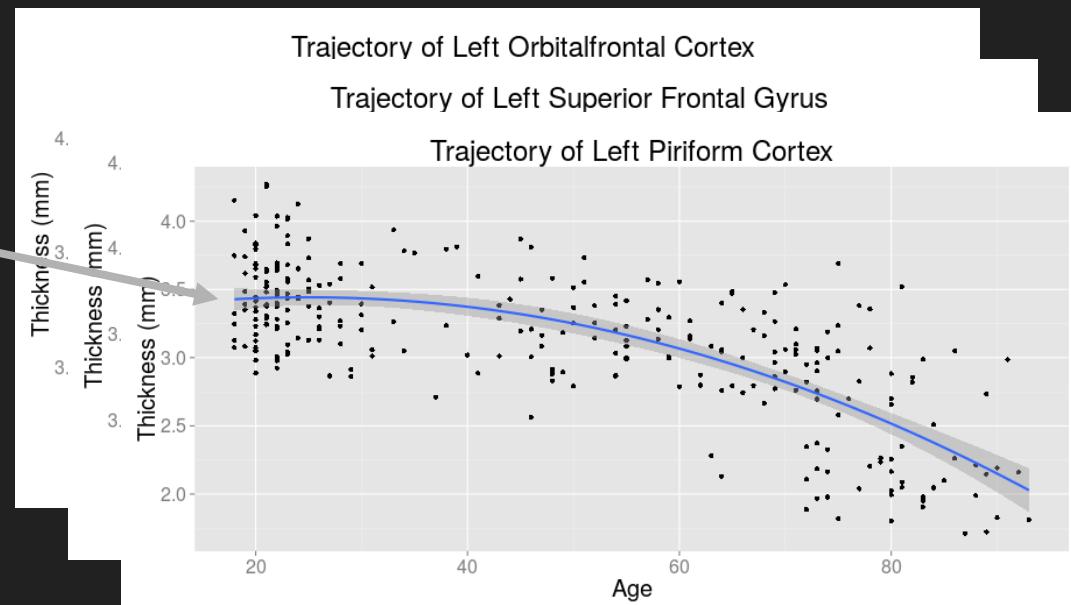
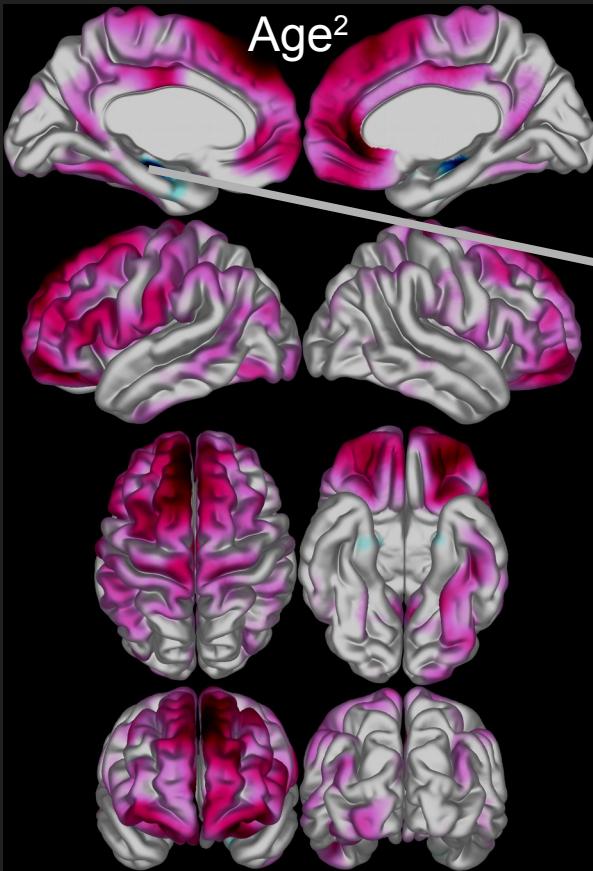
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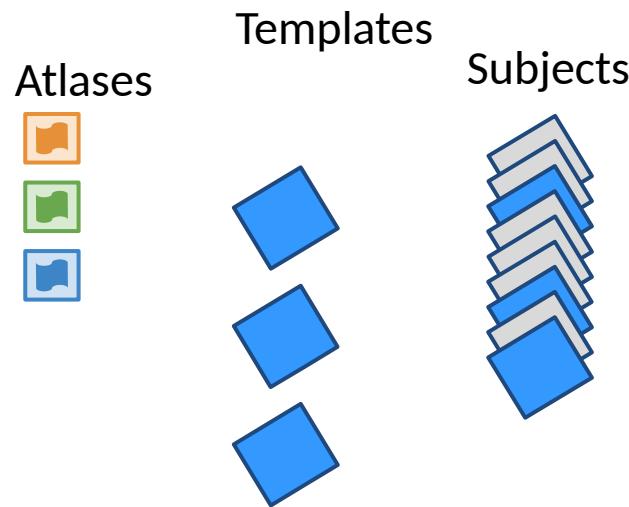
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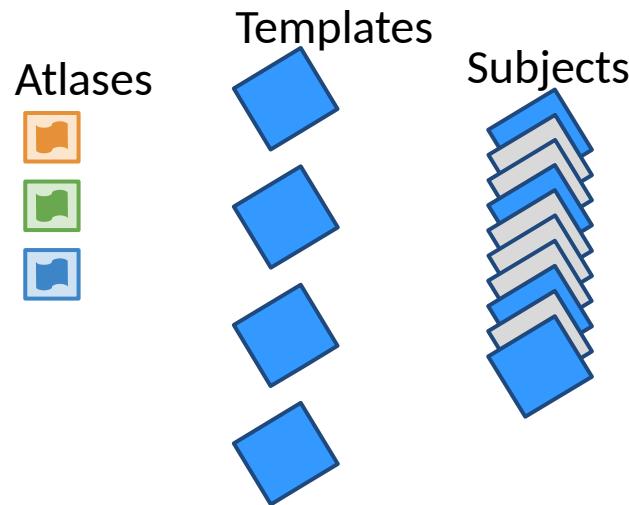
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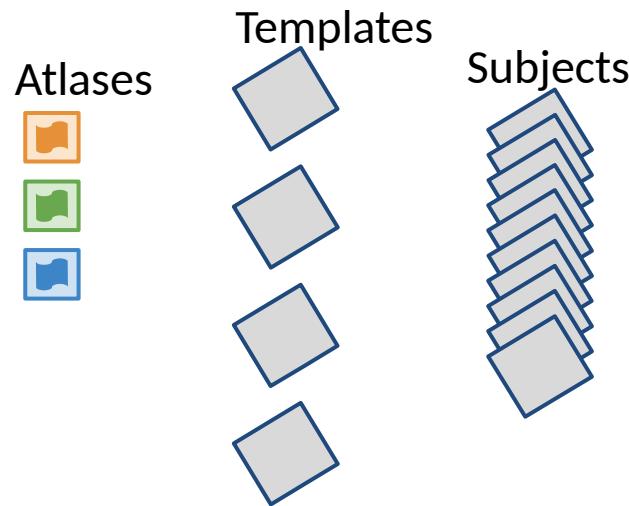
Volume and Shape Segmentation with MAGeTbrain



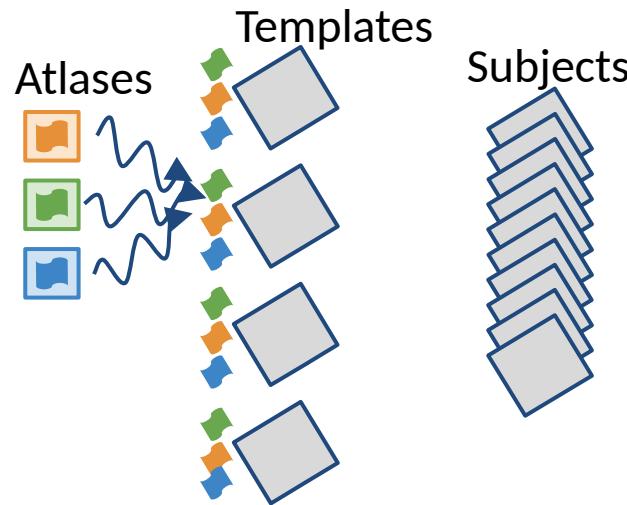
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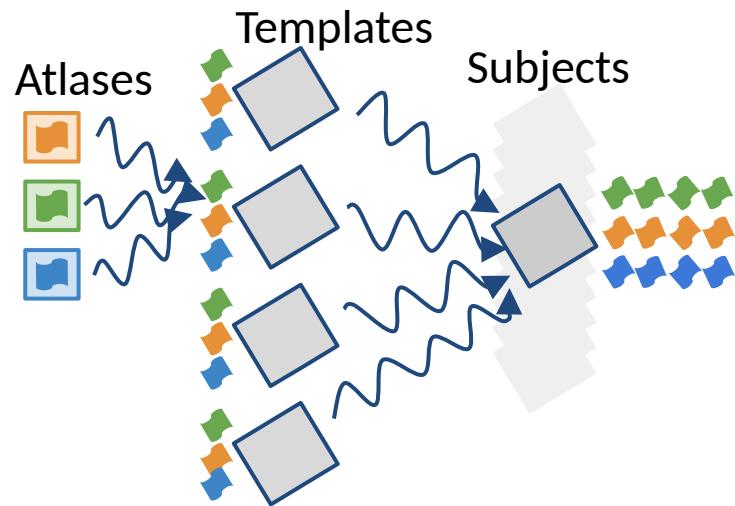
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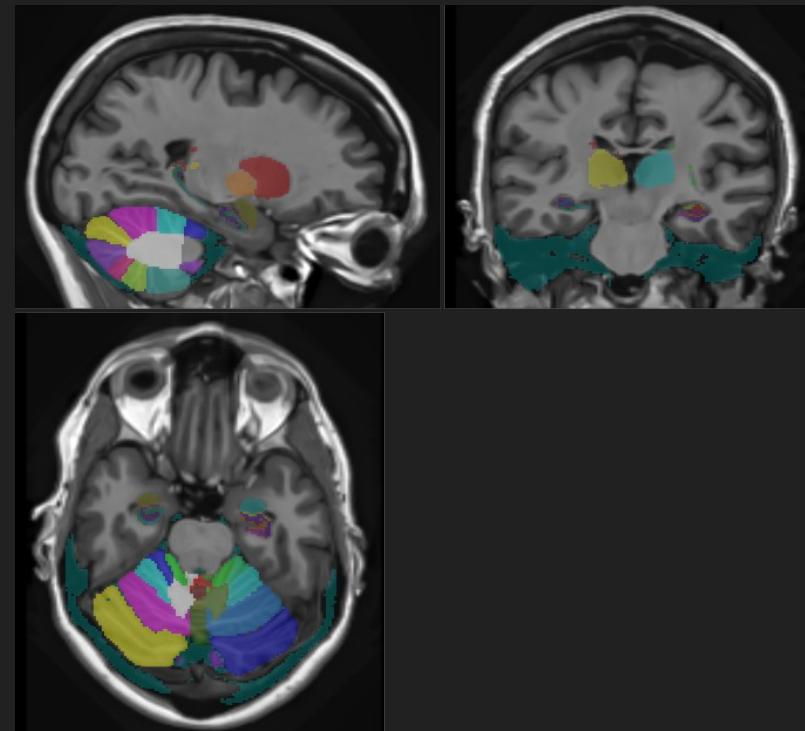
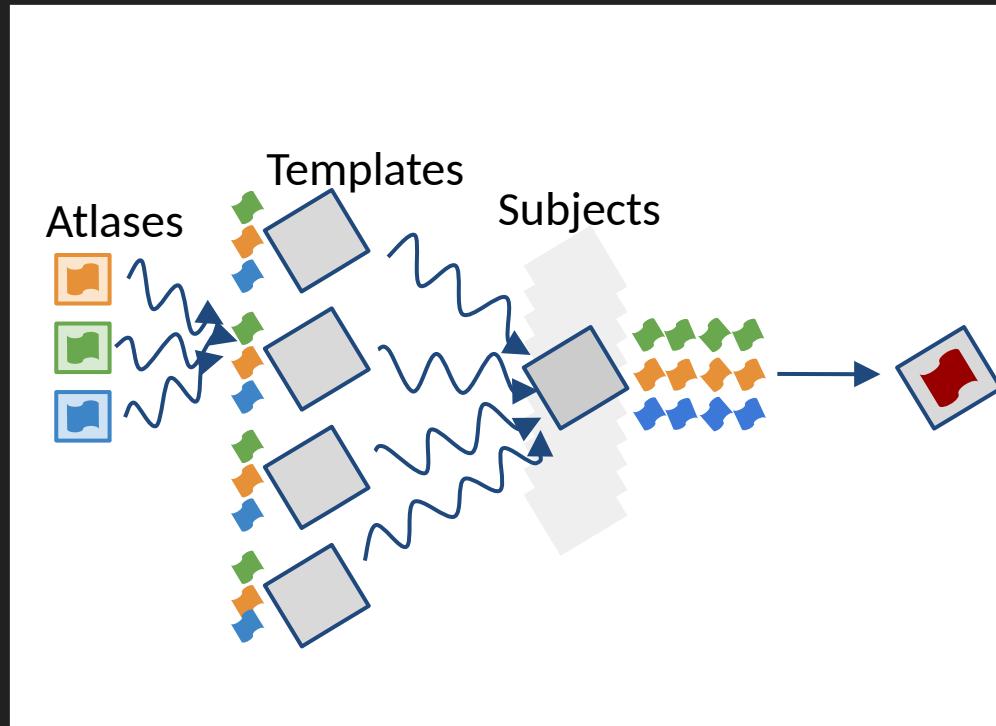
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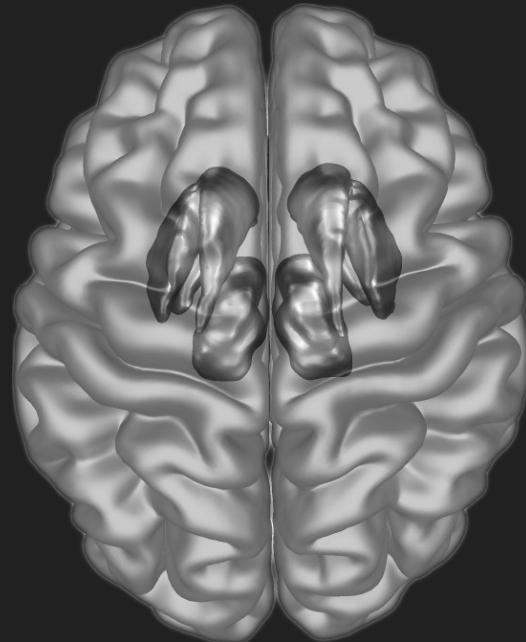
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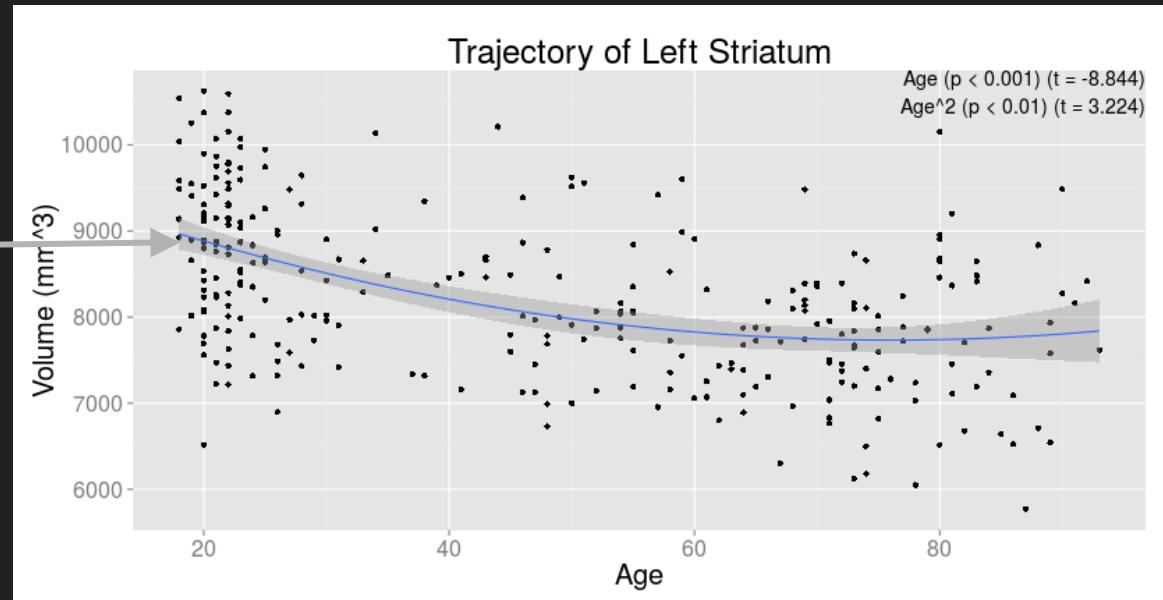
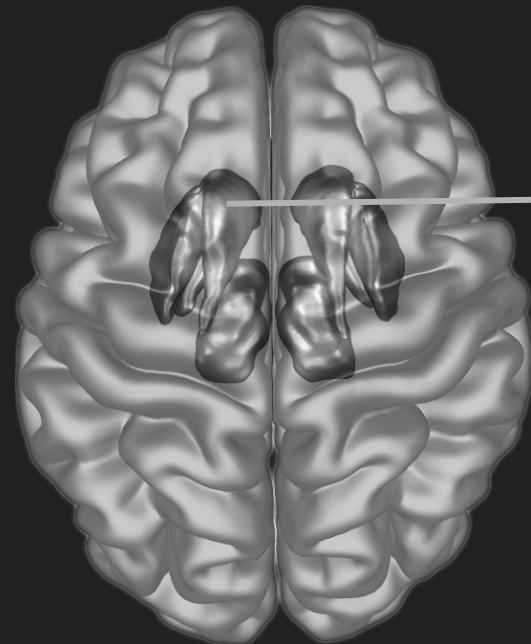
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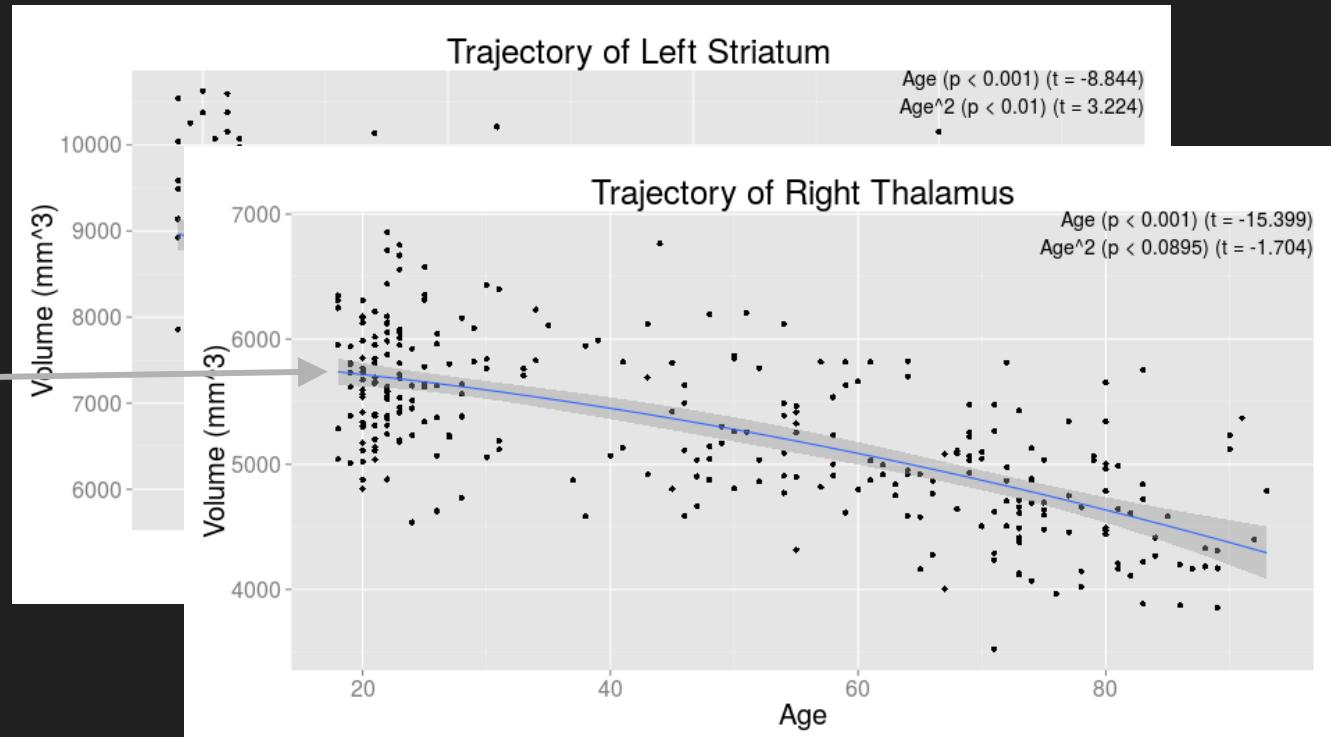
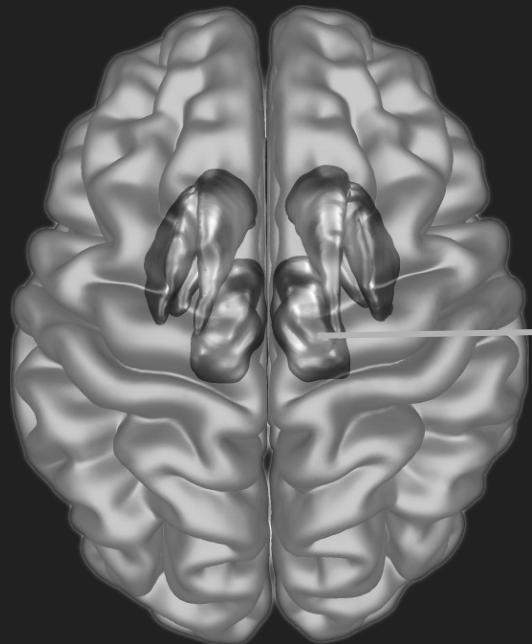
Subcortical Volumes



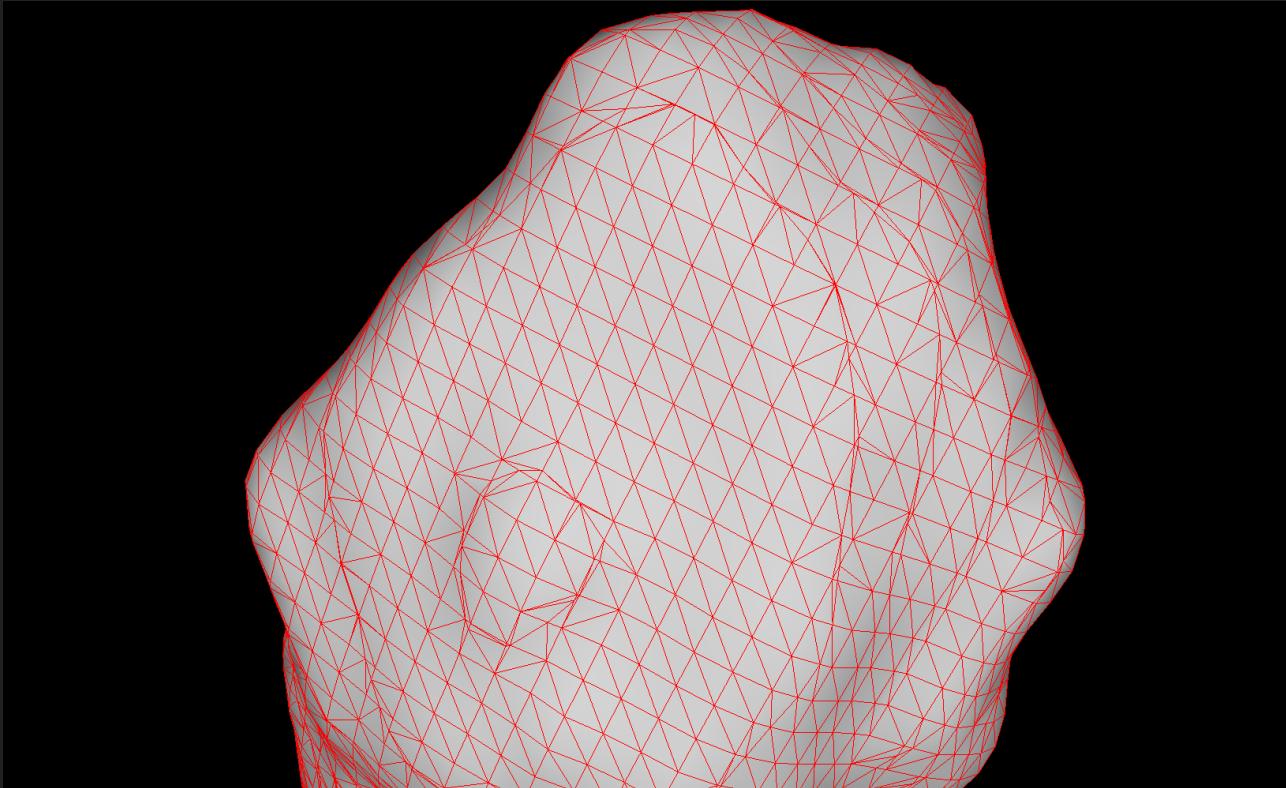
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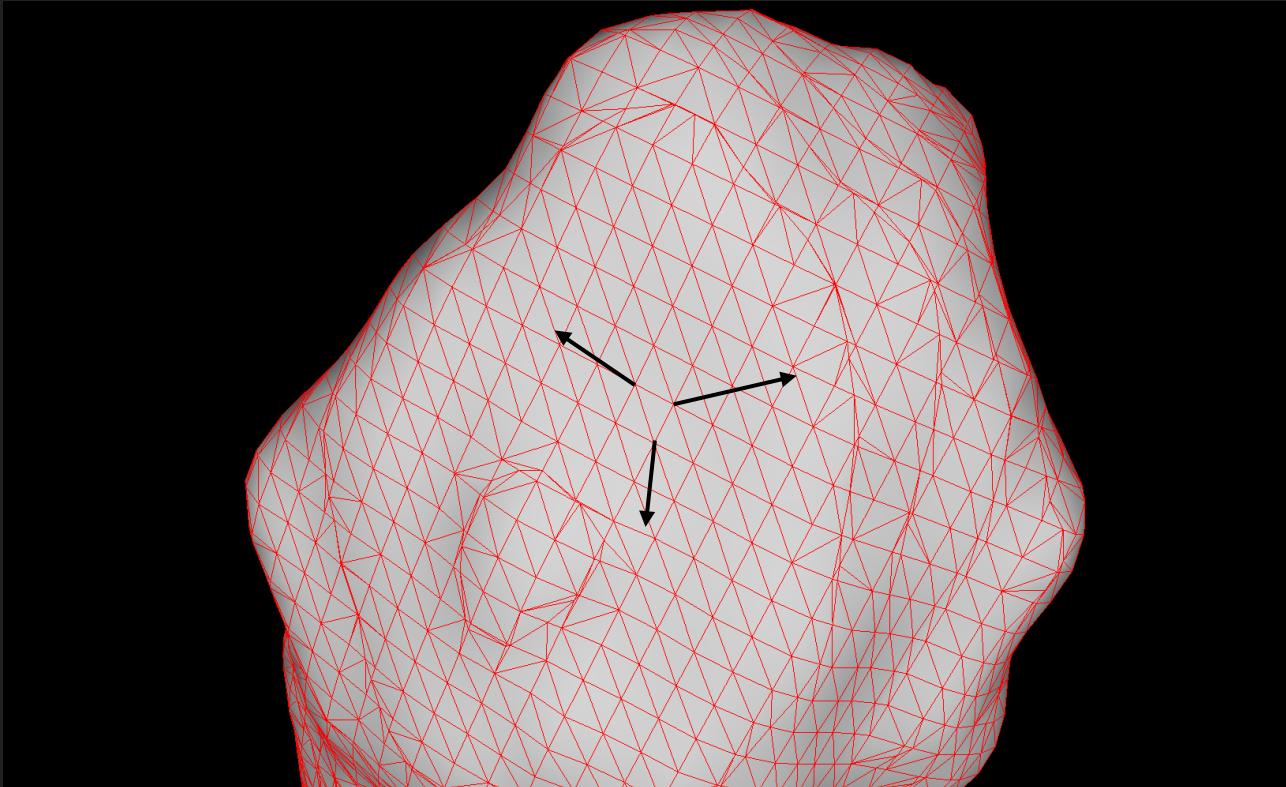
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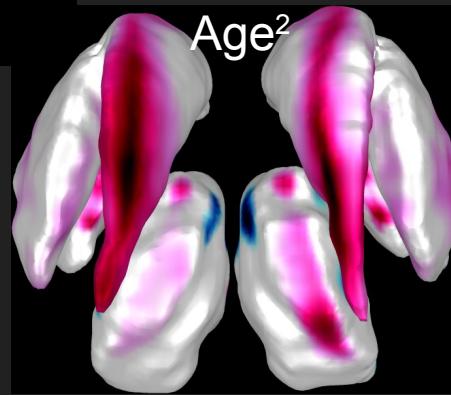
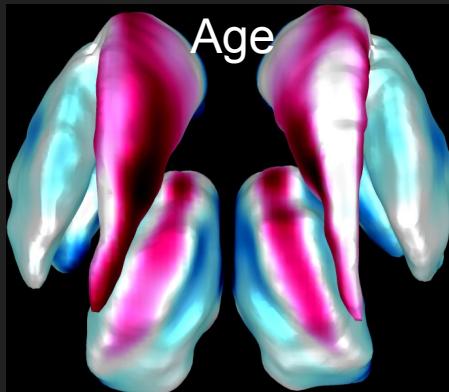
A Note on Local Surface Area Measures



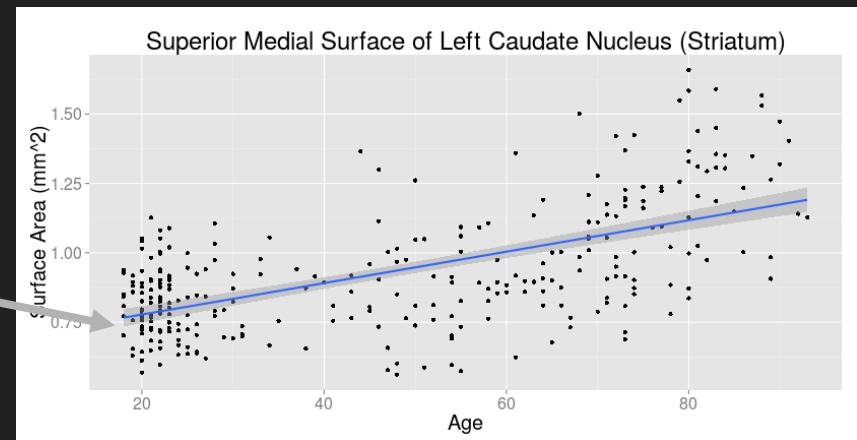
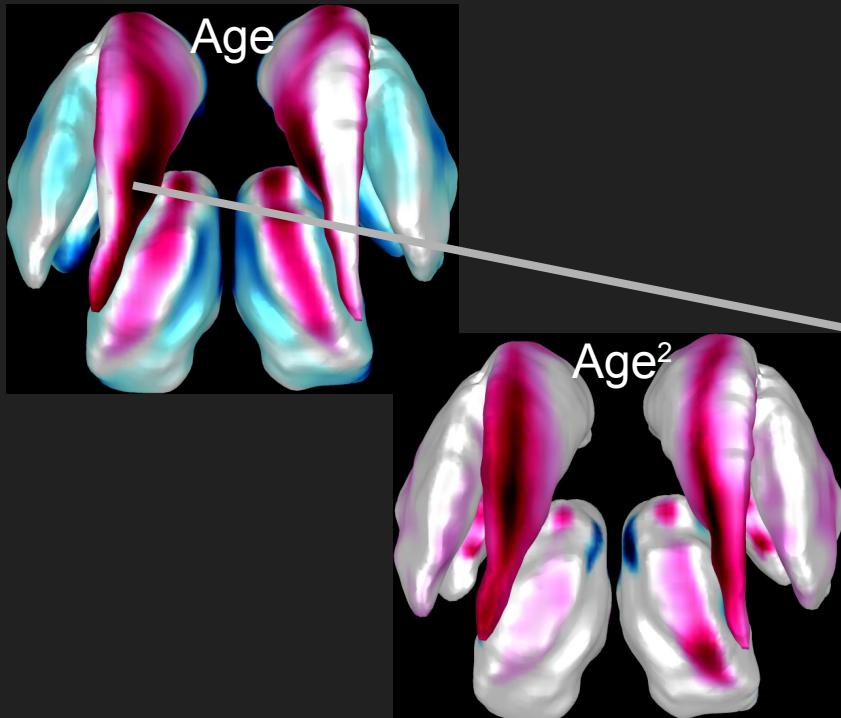
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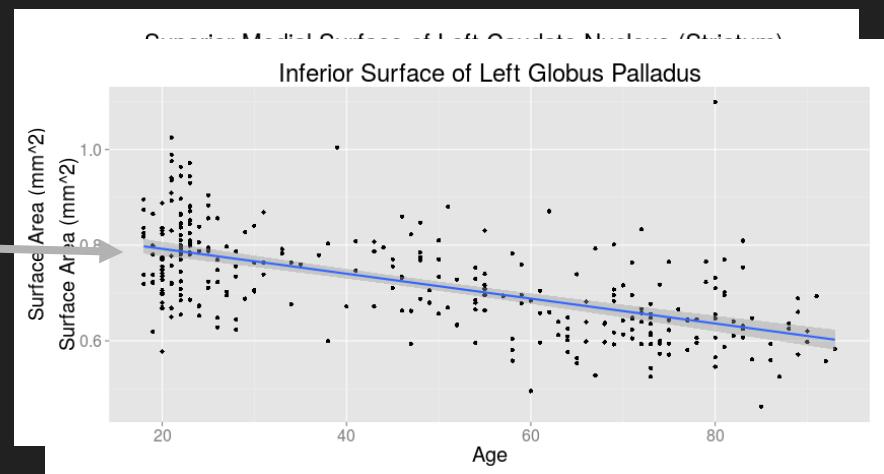
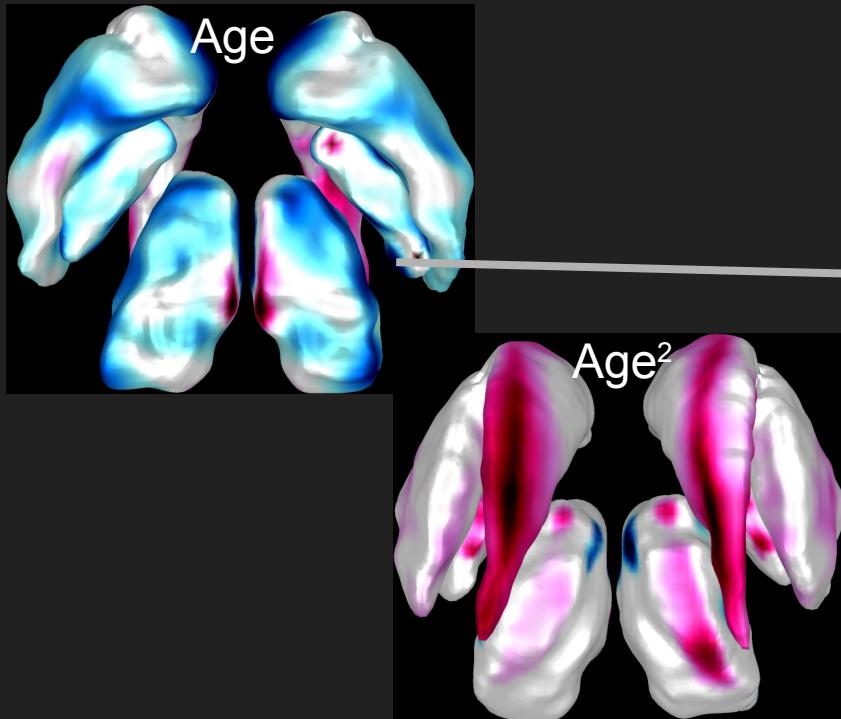
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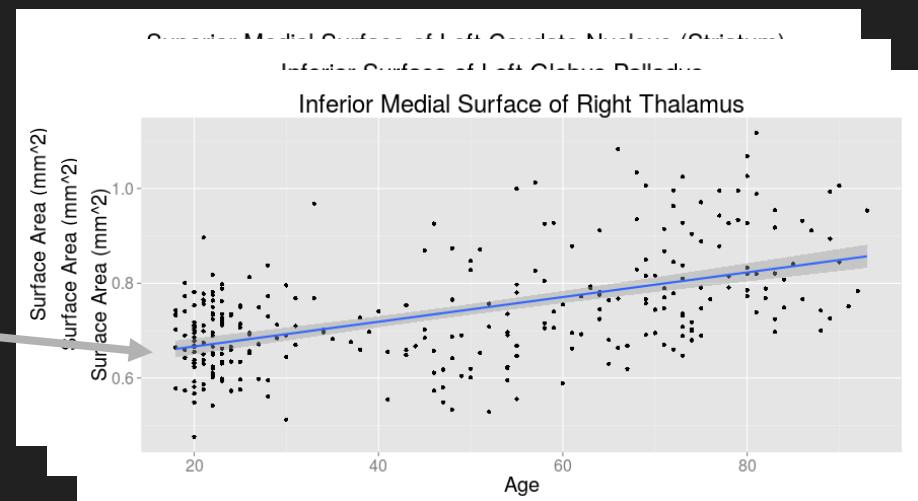
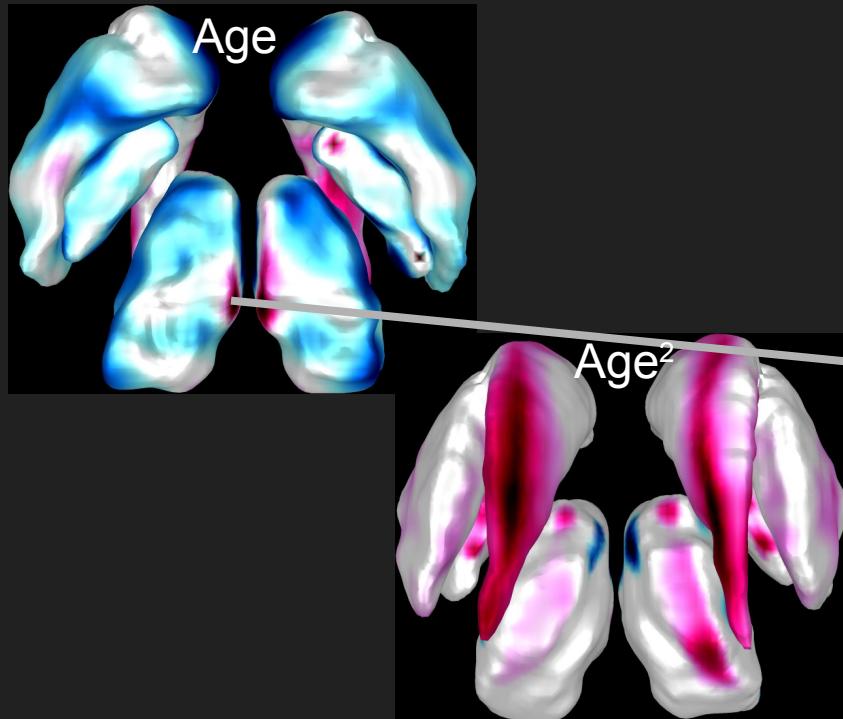
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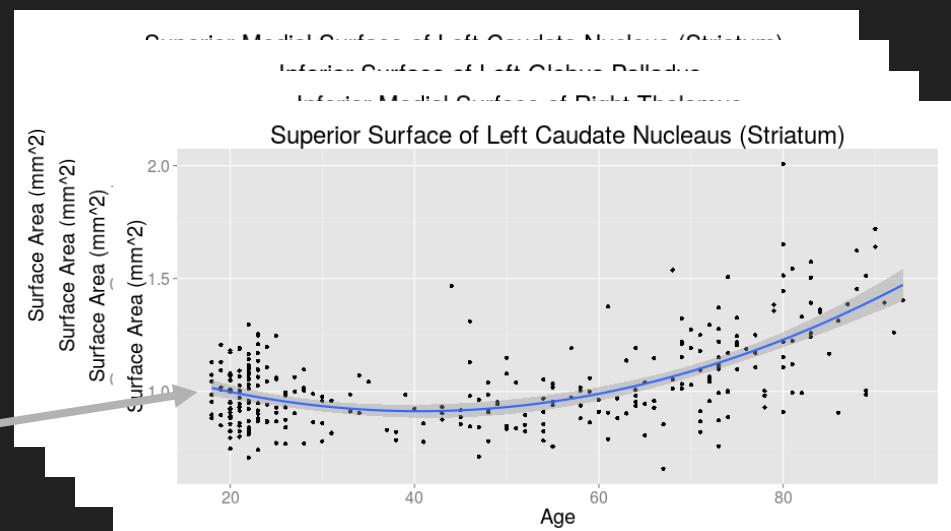
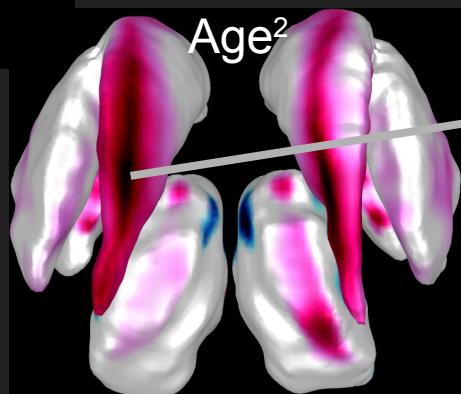
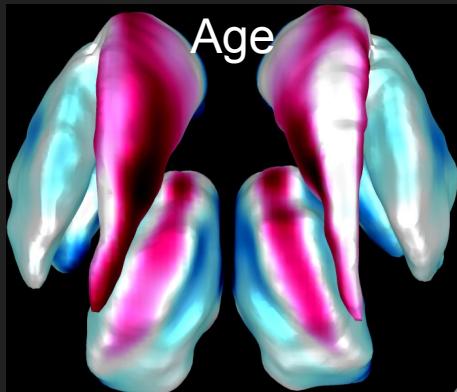
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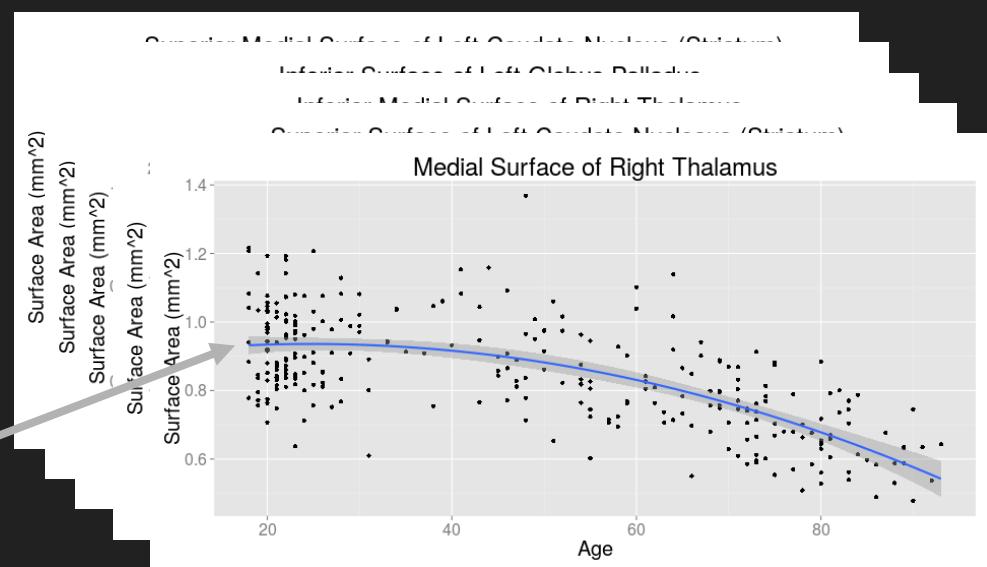
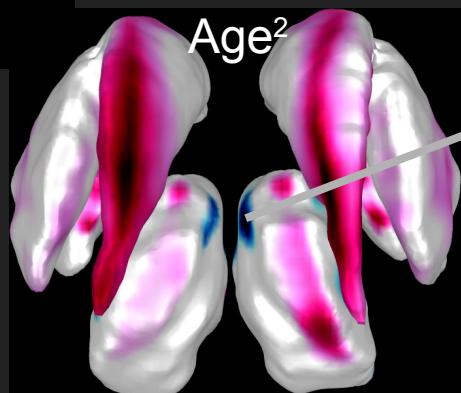
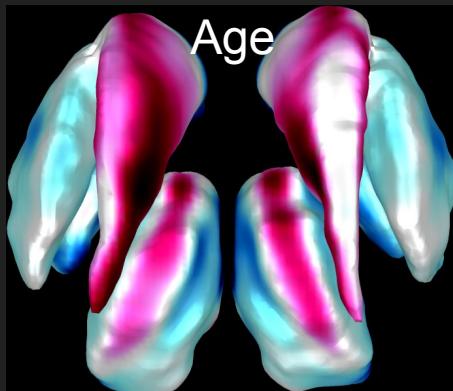
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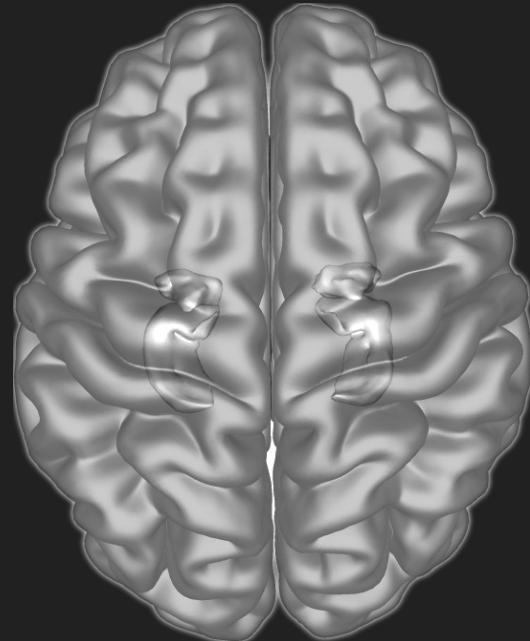
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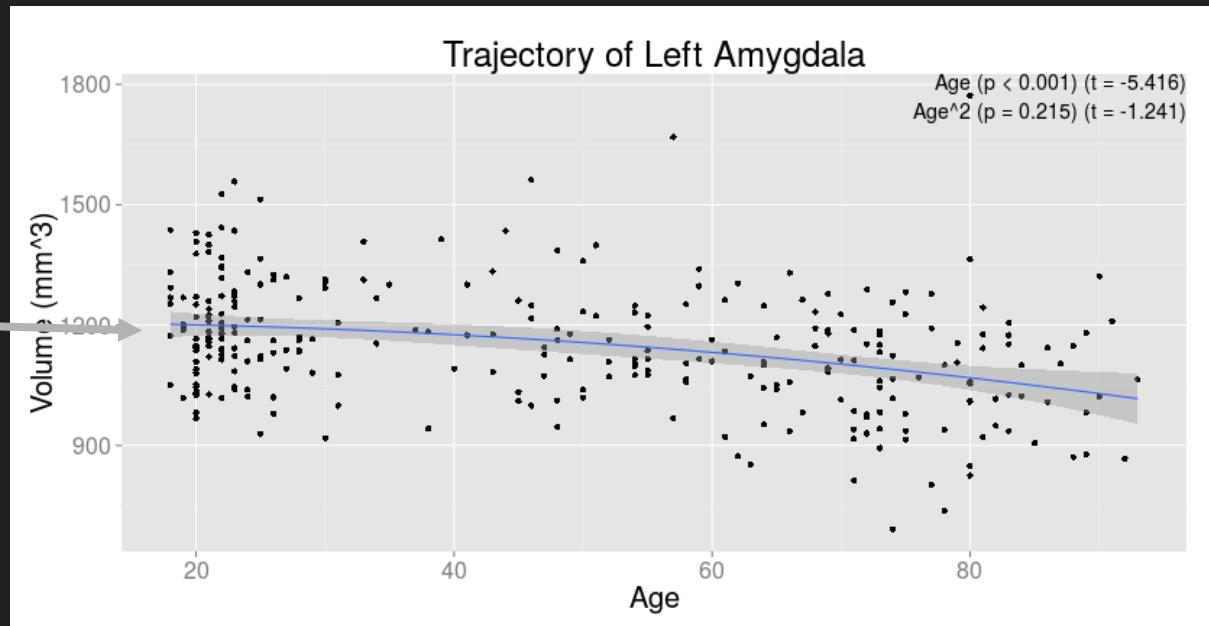
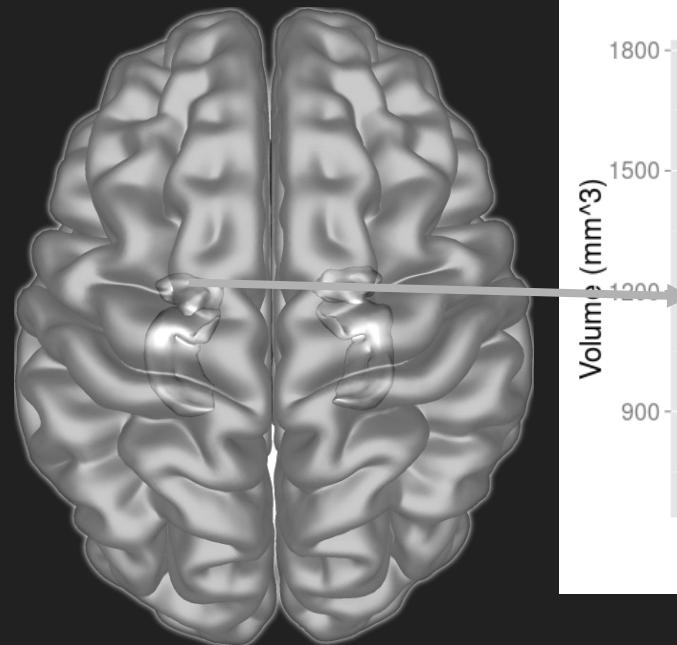
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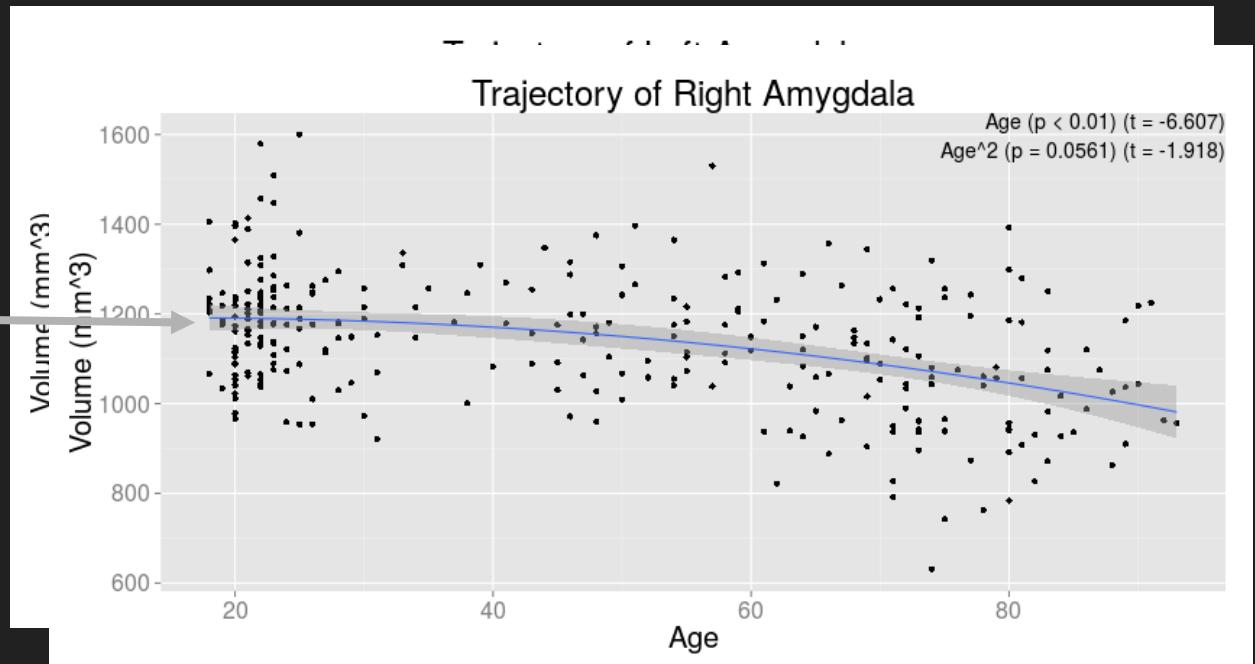
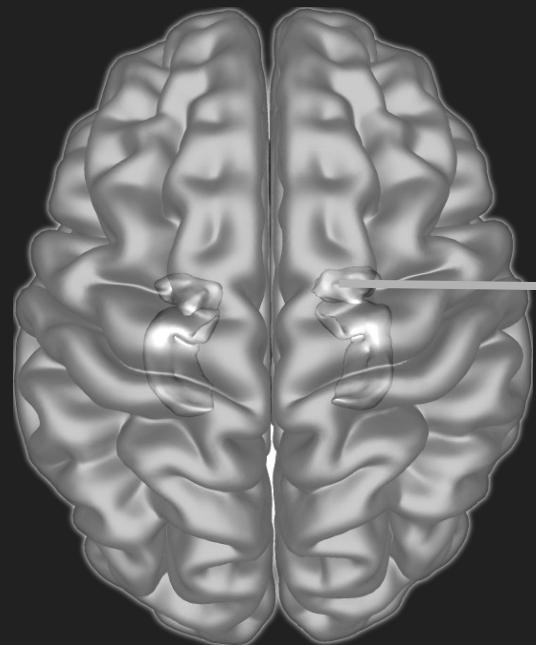
Amygdala and Hippocampal Volumes



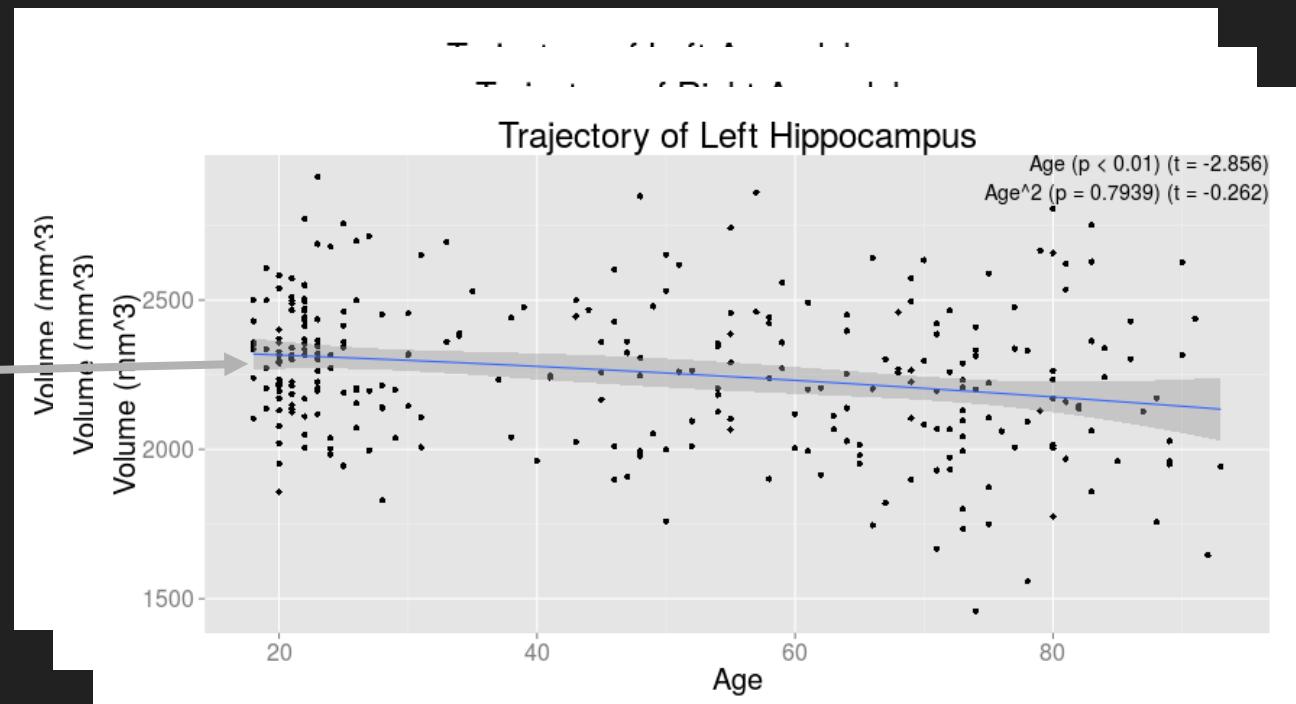
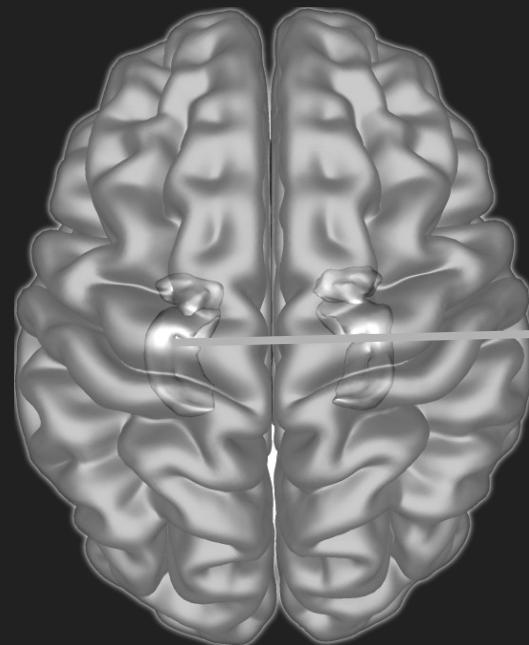
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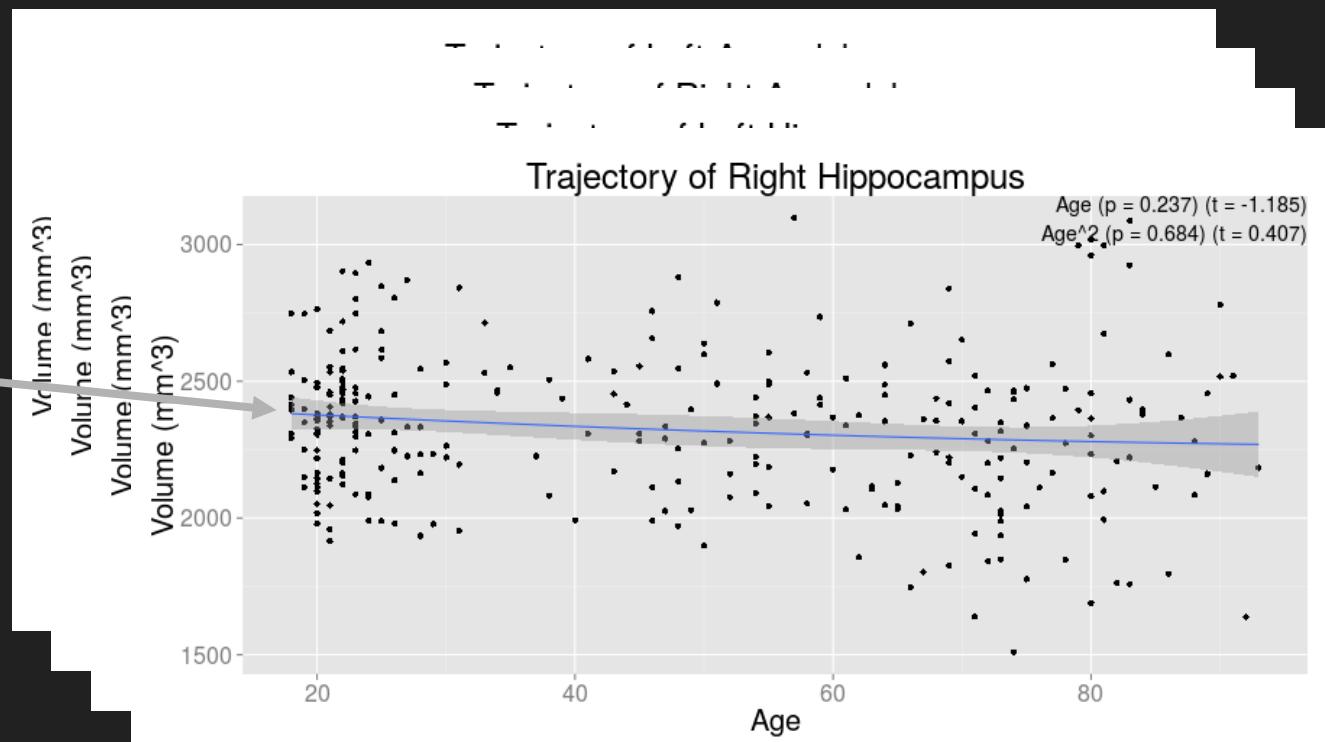
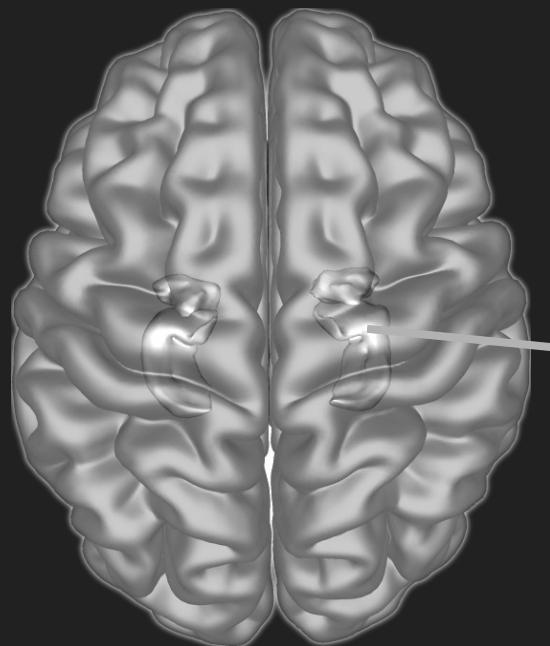
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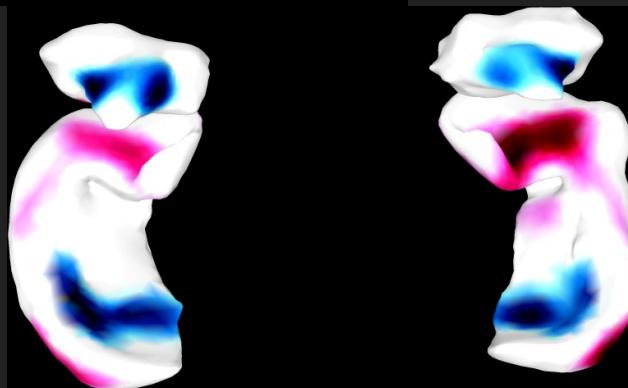
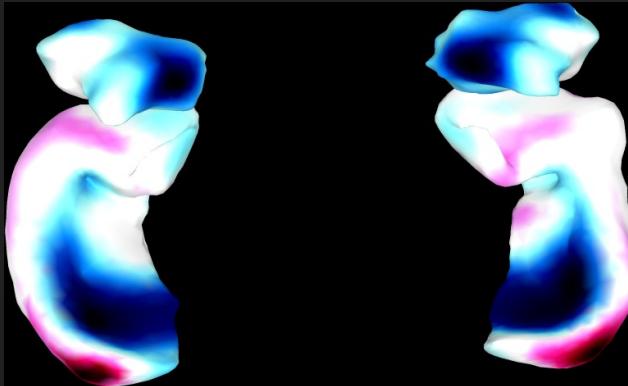
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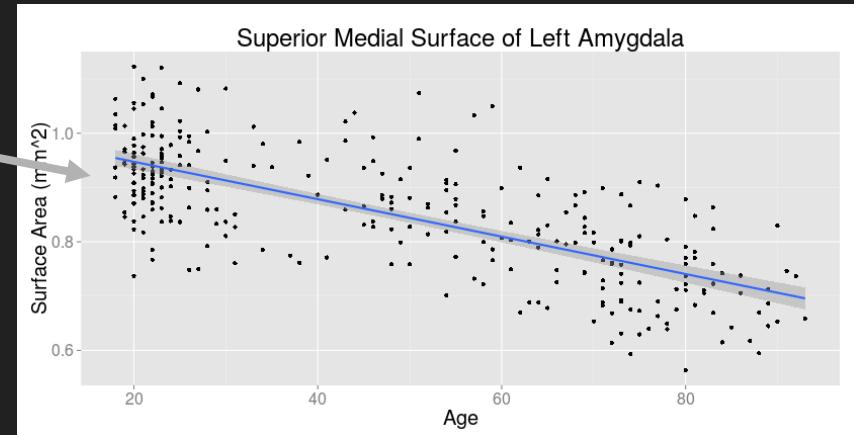
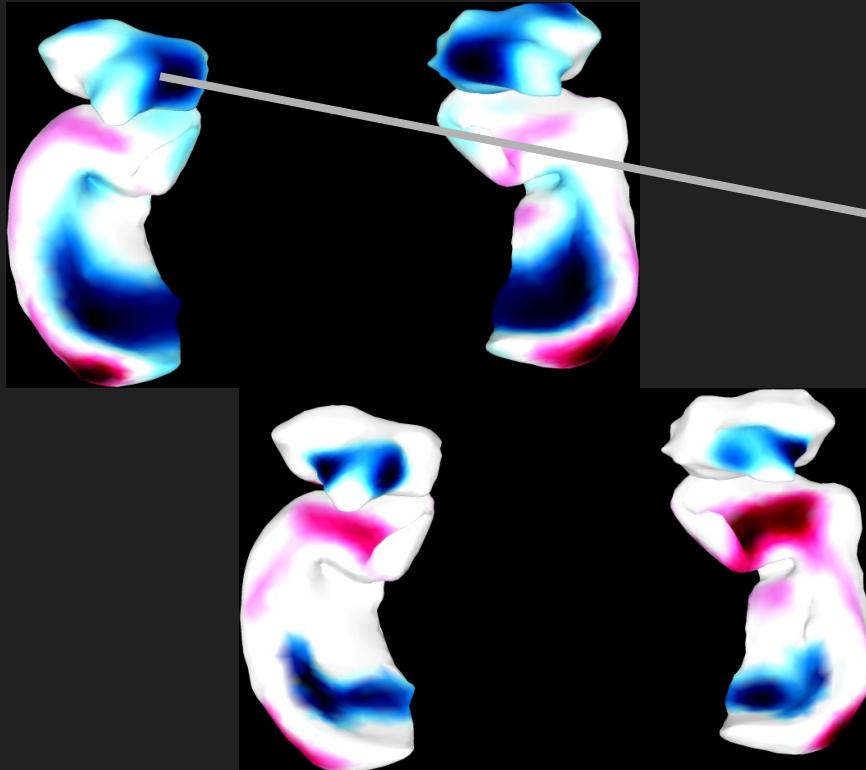
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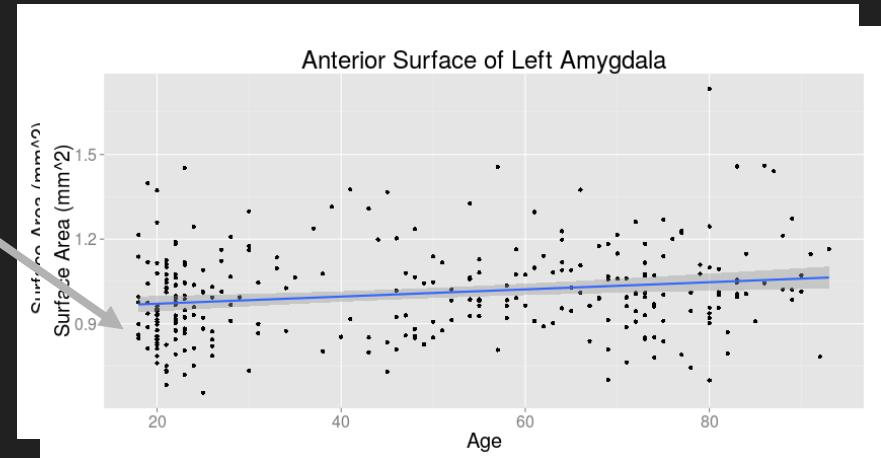
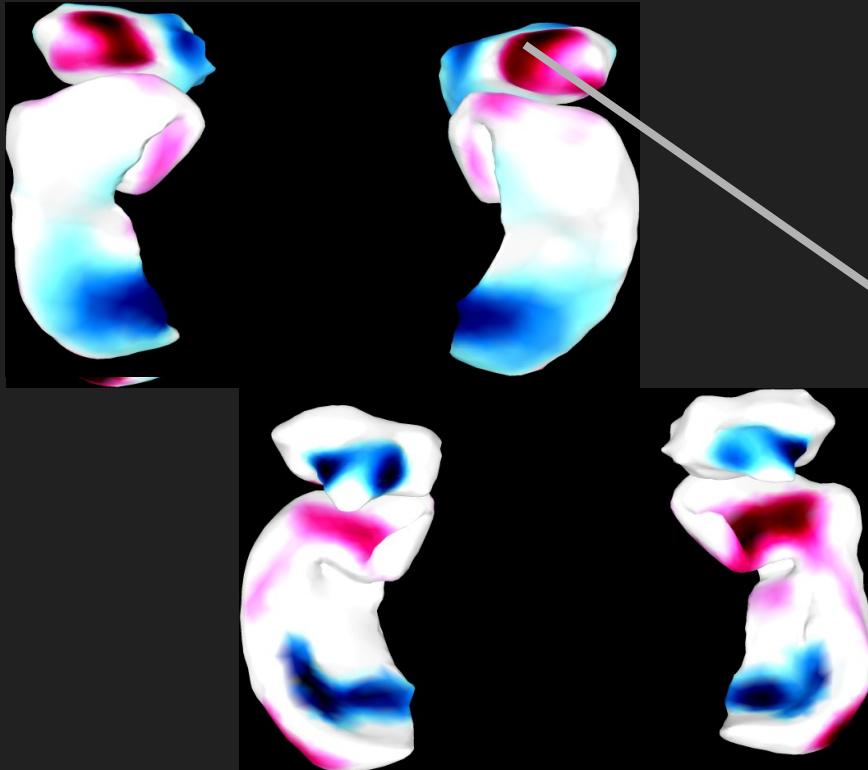
Hippocampal and Amygdala Surface Area



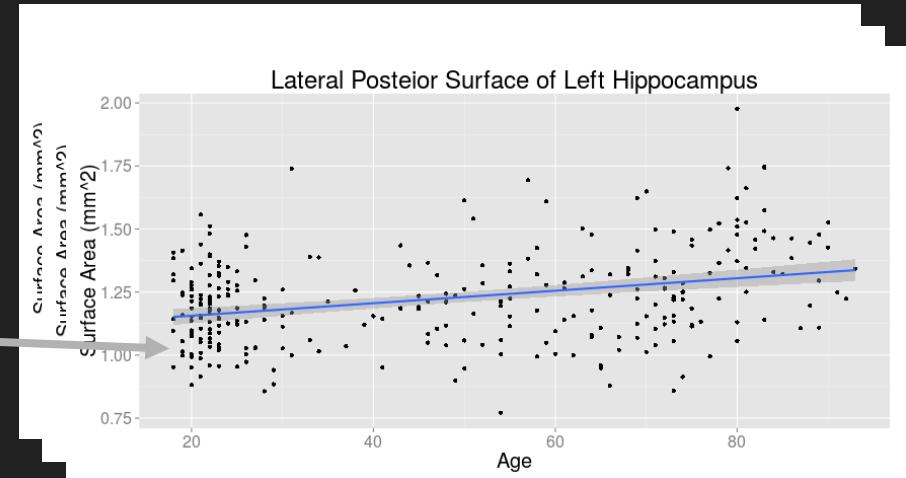
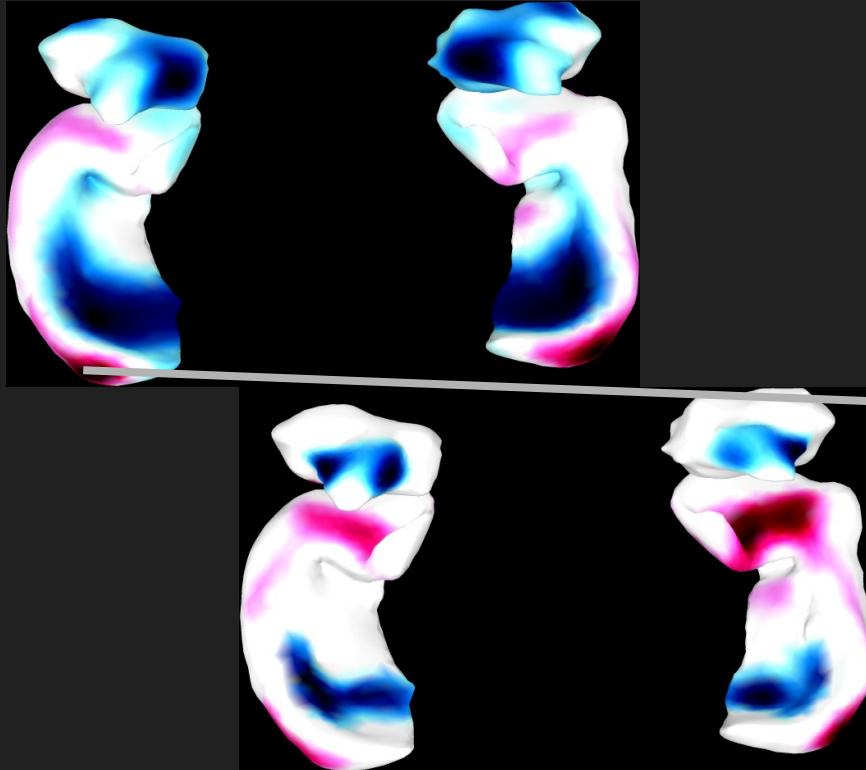
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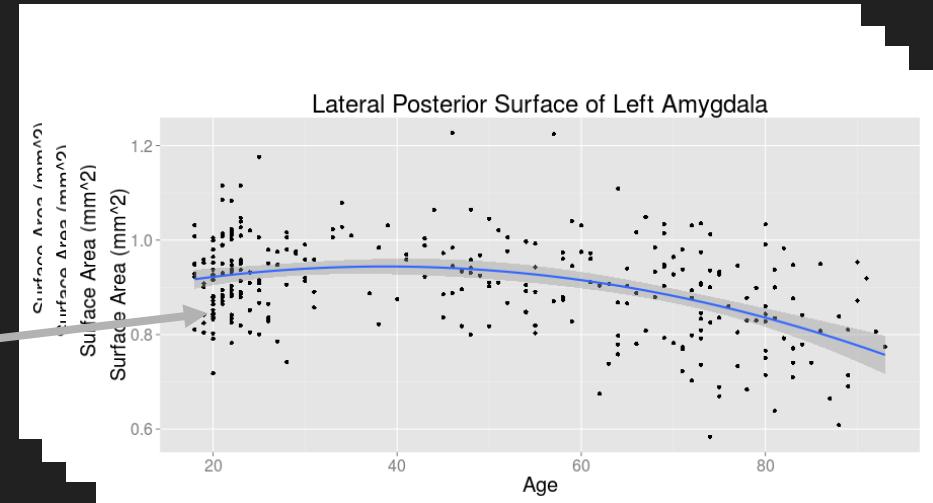
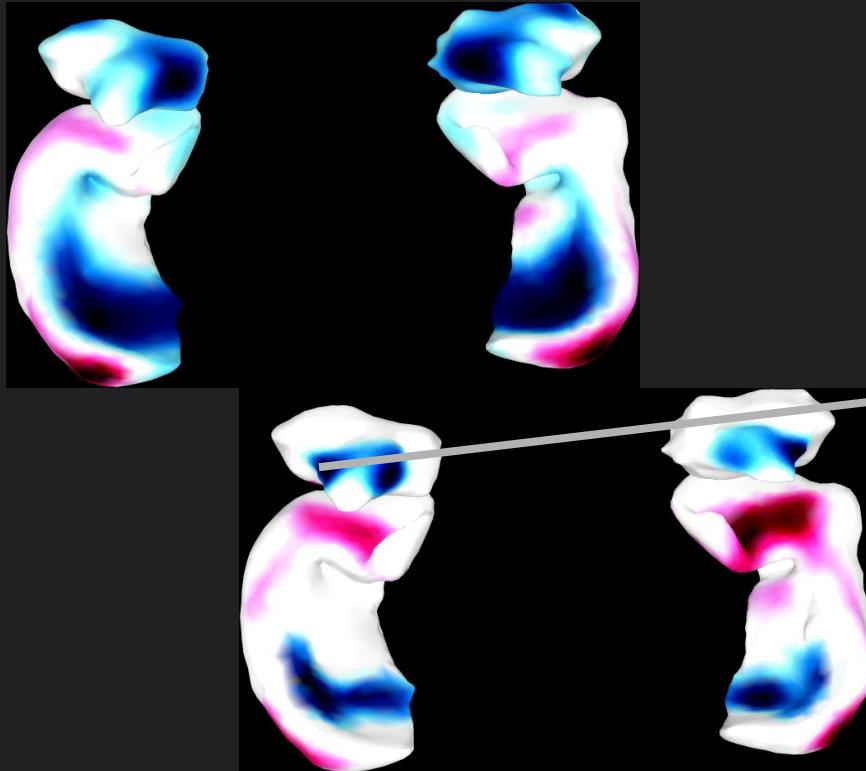
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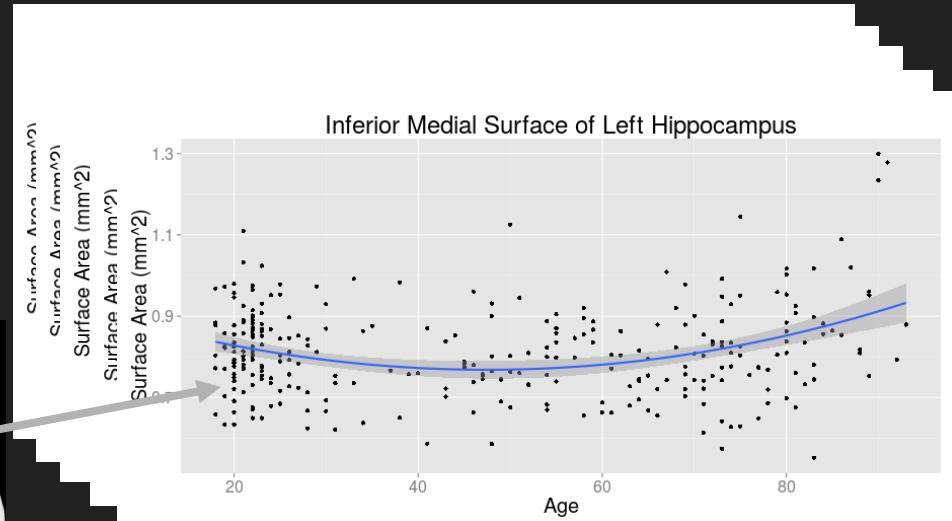
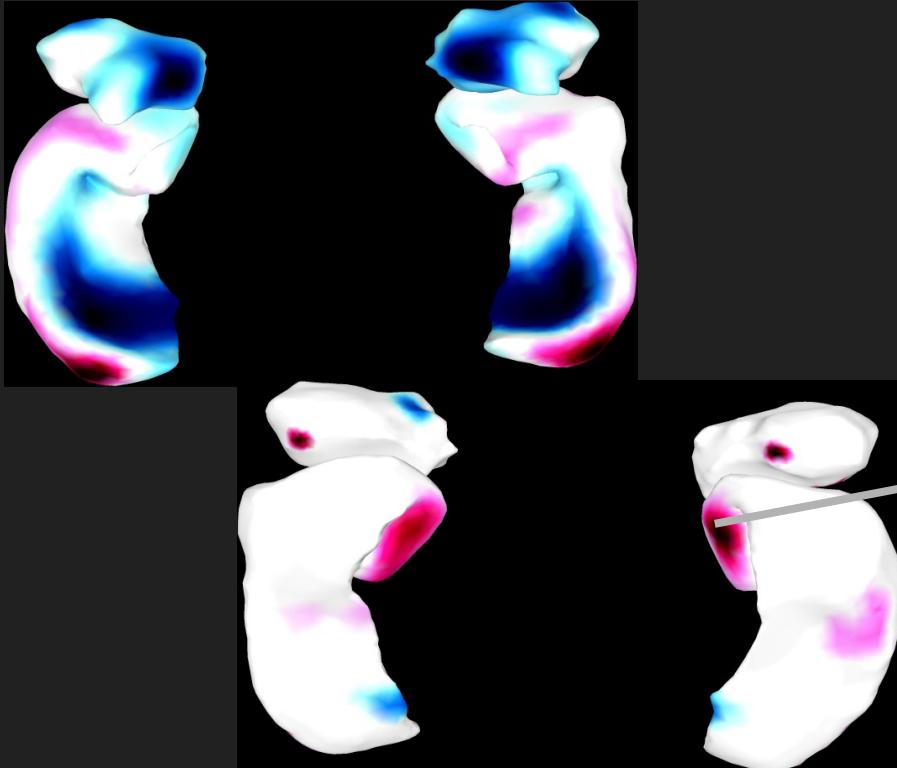
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- Non-linear trajectories with Age appear localized in a number of cortical, subcortical and hippocampal structures
- Volumetric measures can miss substantial changes in the shape of structures through aging
- Common trajectories between different regions could indicate functional and structural connectivity between regions

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