Lifespan Progress Report
Appendix

Behavioral Data

Toolbox Session

4-6 kids

Cognitive
Picture Sequence
Dimensional Change
Flanker Task
Picture Vocabulary

Emotion
Parent Report Only

Motor
9 Hole Pegboard
2 Minute Walk
4-Meter Walk
Grip Strength

Sensory
Words in Noise (age 6)
Odor Identification
(age modified)

8-9 kids

Cognitive
Picture Sequence
Dimensional Change
Flanker
Picture Vocabulary
Pattern Completion
List Sorting
Oral Reading

Emotion
Self Report Emotion
Parent Report Emotion

Motor
9 Hole Pegboard
2 Minute Walk
4-Meter Walk
Grip Strength

Sensory
Words in Noise
Odor Identification
(age modified)

14-15 teens

Cognitive
Picture Sequence
Dimensional Change
Flanker
Picture Vocabulary
Pattern Completion
List Sorting
Oral Reading

Emotion
Self Report Emotion

Motor
9 Hole Pegboard
2 Minute Walk
4-Meter Walk
Grip Strength

Sensory
Words in Noise
Odor Identification
Taste

25-35 adults

Cognitive
Picture Sequence
Dimensional Change
Flanker
Picture Vocabulary
Pattern Completion
List Sorting
Oral Reading

Emotion
Self Report Emotion

Motor
9 Hole Pegboard
2 Minute Walk
4-Meter Walk
Grip Strength

Sensory
Words in Noise
Odor Identification
Taste

45-55 adults

Cognitive
Picture Sequence
Dimensional Change
Flanker
Picture Vocabulary
Pattern Completion
List Sorting
Oral Reading

Emotion
Self Report Emotion

Motor
9 Hole Pegboard
2 Minute Walk
4-Meter Walk
Grip Strength

Sensory
Words in Noise
Odor Identification
Taste

65-75 adults

Cognitive
Picture Sequence
Dimensional Change
Flanker
Picture Vocabulary
Pattern Completion
List Sorting
Oral Reading

Emotion
Self Report Emotion

Motor
9 Hole Pegboard
2 Minute Walk
4-Meter Walk
Grip Strength

Sensory
Words in Noise
Odor Identification
Taste

Additional Behavioral Session

4-6 kids

Visual/Cognition
Visual Acuity (Eva)

Function
CBCL 1.5 to 5 (PR) or
CBCL 6-18 (PR)
Computer?

Personality
Child Behavioral Questionnaire (PR)

8-9 kids

Visual/Cognition
Visual Acuity (Eva)
Delay Discounting (Eprime Child Version)
Penn Progressive Matrices
Penn Emotion Recognition

Function
CBCL 6-18 (PR)
Computer?

Personality
Temperament in Middle Childhood (PR)

14-15 teens

Visual/Cognition
Visual Acuity (Eva)
Delay Discounting (Gur)
Penn Progressive Matrices
Penn Emotion Recognition

Function
CBCL 6-18 (PR)
Computer?
YSR

Personality
NEO-FFI-60 (Gur)

25-35 adults

Visual/Cognition
Visual Acuity (Eva)
Delay Discounting (Gur)
Penn Progressive Matrices
Penn Emotion Recognition

Function
ASR 18-59 (Gur)

Personality
NEO-FFI-60 (Gur)

45-55 adults

Visual/Cognition
Visual Acuity (Eva)
Delay Discounting (Gur)
Penn Progressive Matrices
Penn Emotion Recognition

Function
ASR 18-59 (Gur)

Personality
NEO-FFI-60 (Gur)

65-75 adults

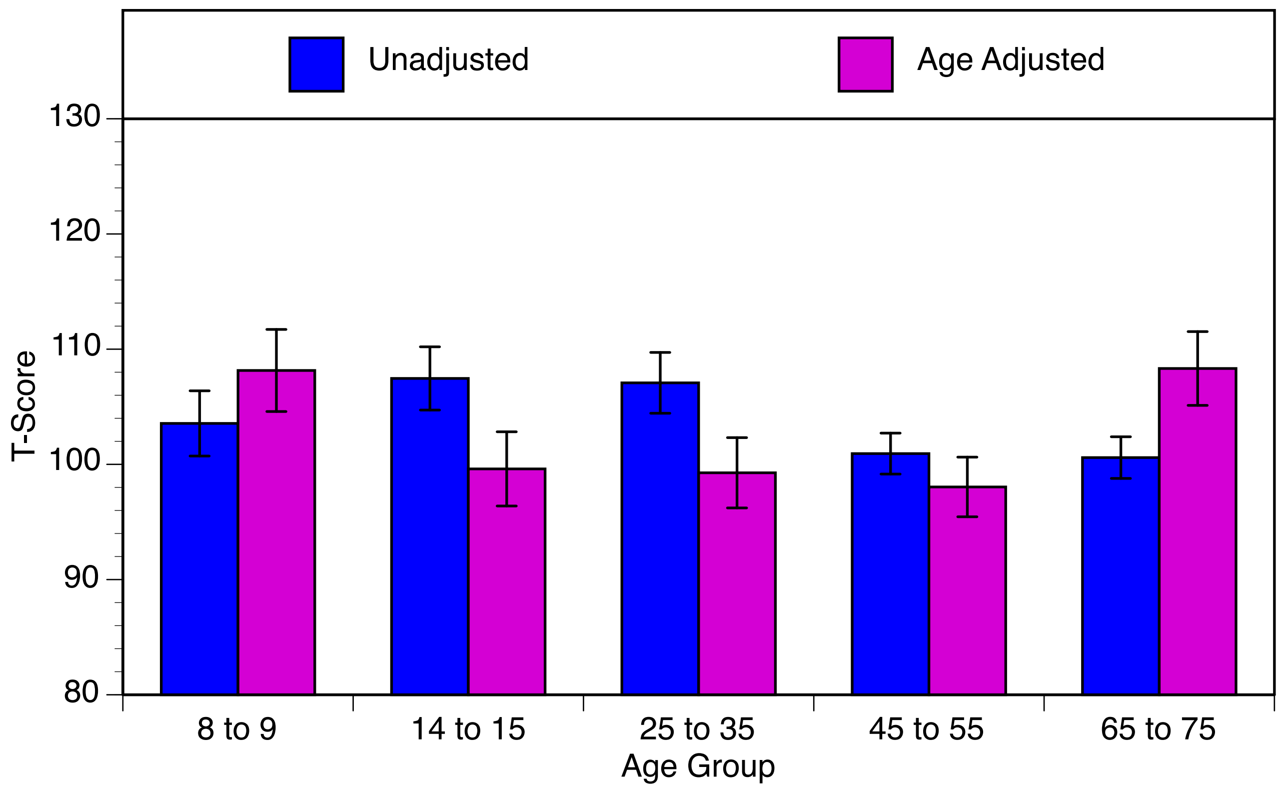
Visual/Cognition
Visual Acuity (Eva)
Delay Discounting (Gur)
Penn Progressive Matrices
Penn Emotion Recognition

Function
ASR 60+

Personality
NEO-FFI-60 (Gur)

NIH Toolbox Performance

Toolbox – Working Memory

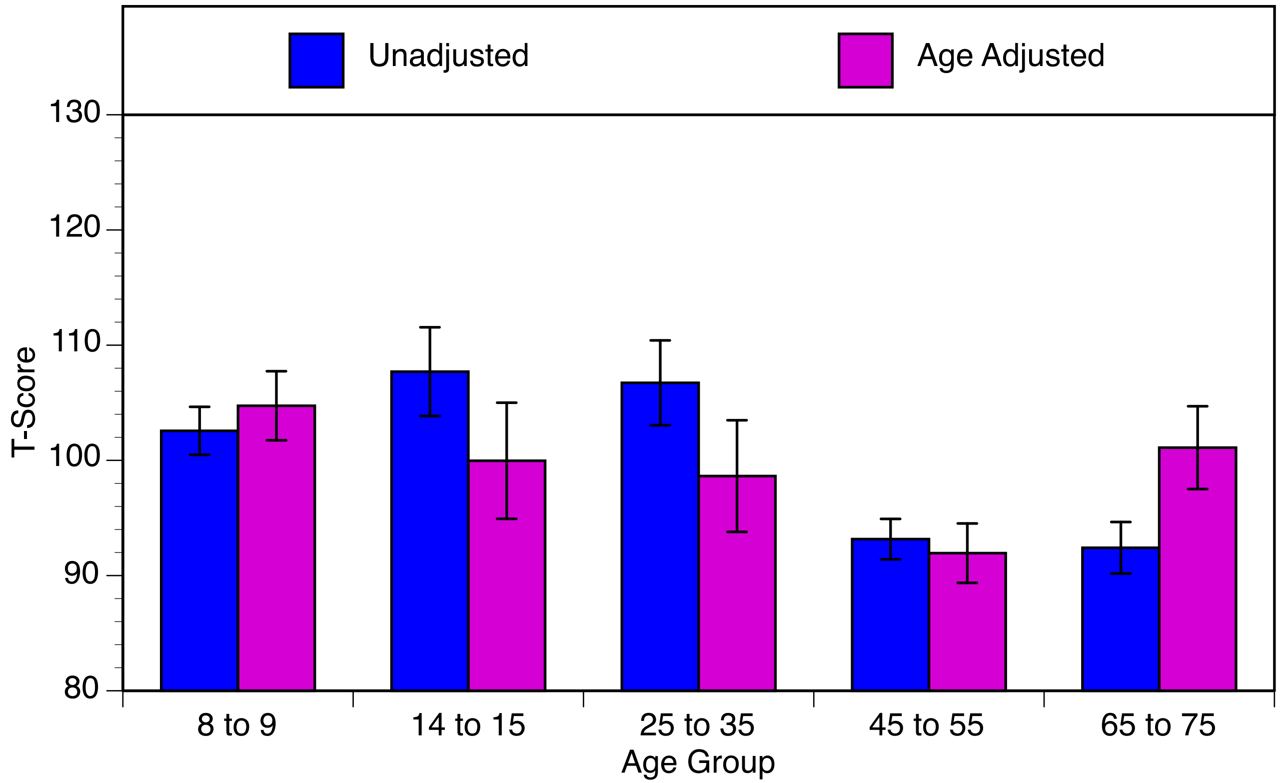


UNADJUSTED FOR AGE: Main effect of Age *p = .175*

ADJUSTED FOR AGE: Main effect of Age *p* = .042

8-9 < all others

Toolbox – Episodic Memory

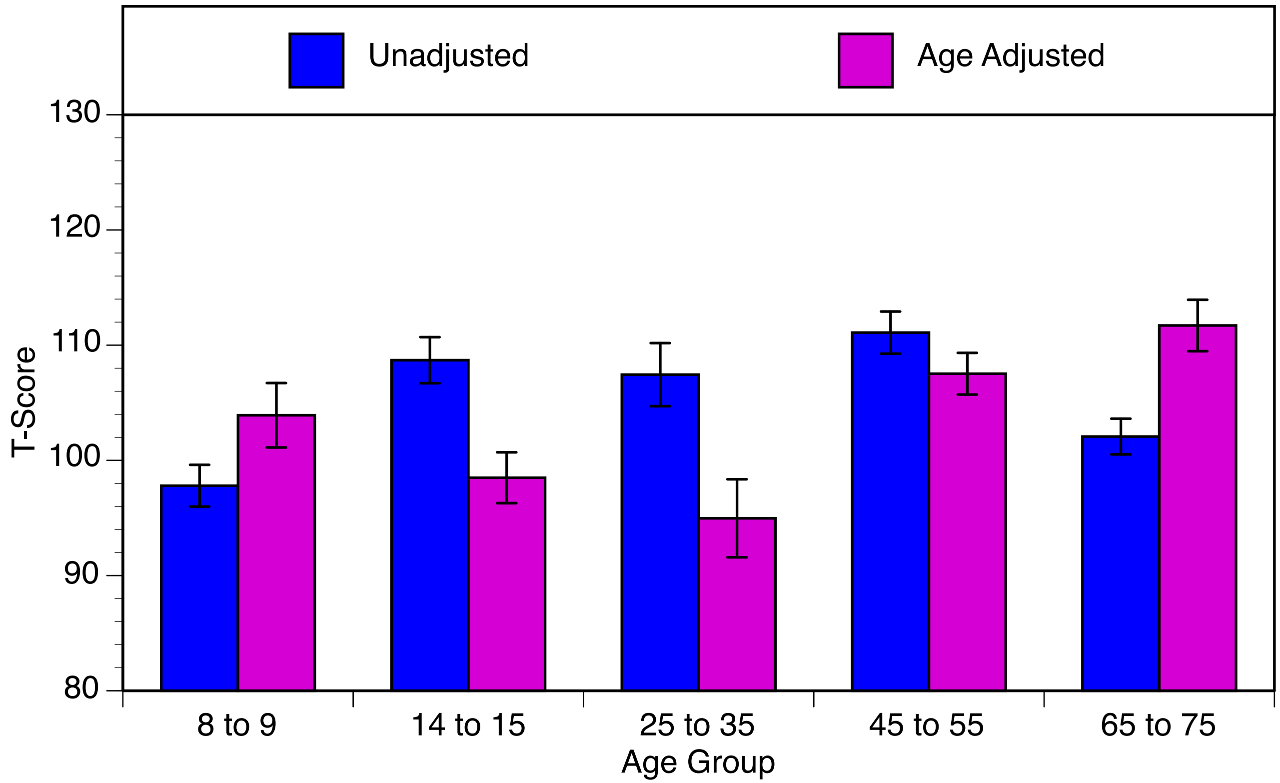


UNADJUSTED FOR AGE: Main effect of Age *p = .001*

ADJUSTED FOR AGE: Main effect of Age *p* = .191

65-75 < 8-9, 14-15, 25-35; 45-55 < 8-9, 14-15, 25-35

Toolbox – Dimensional Card Sort

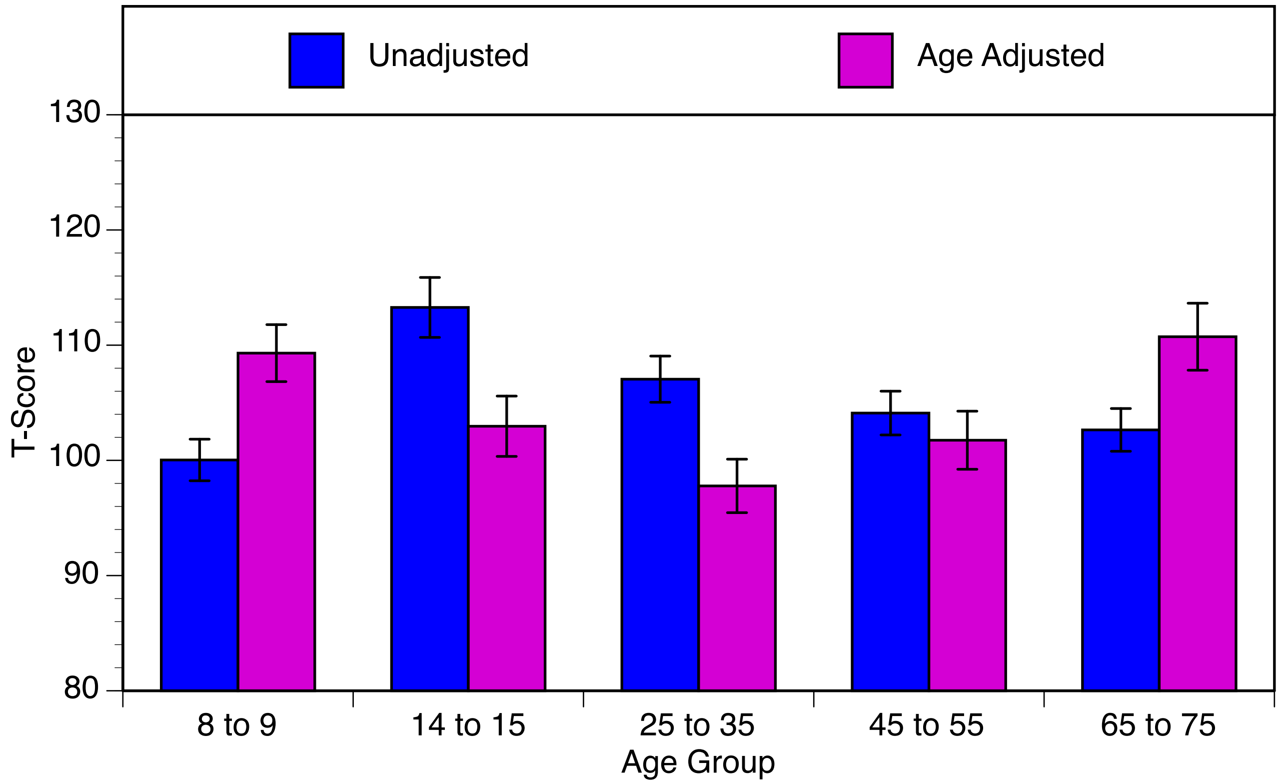


UNADJUSTED FOR AGE: Main effect of Age *p = .001*

ADJUSTED FOR AGE: Main effect of Age *p* = .001

65-75 > 8-9,14-15,25-35; 8-9>25-35

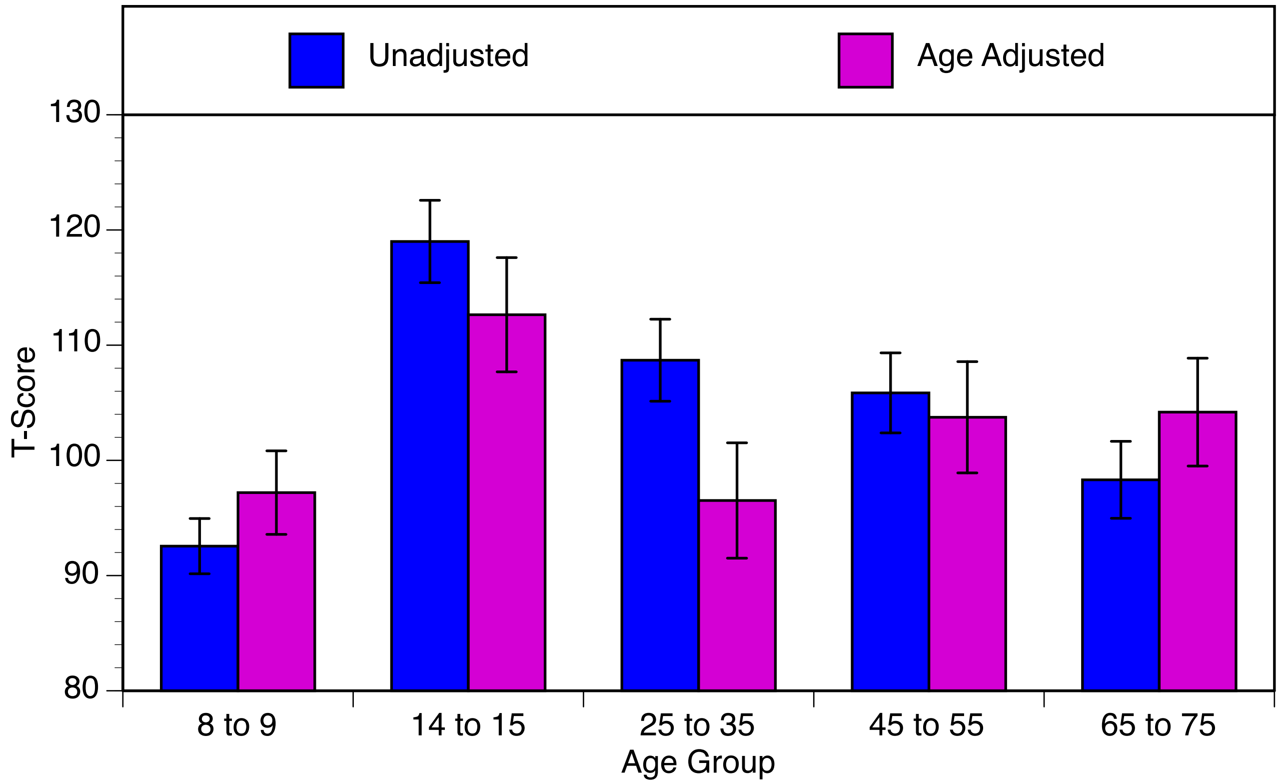
Toolbox – Flanker



UNADJUSTED FOR AGE: Main effect of Age *p = .001*
ADJUSTED FOR AGE: Main effect of Age *p* = .001

Unadjusted 14-15 > all others
Adjusted 65-75 > 25-35; 45-55; 8-9 > 25-35; 45-55

Toolbox – Pattern Completion

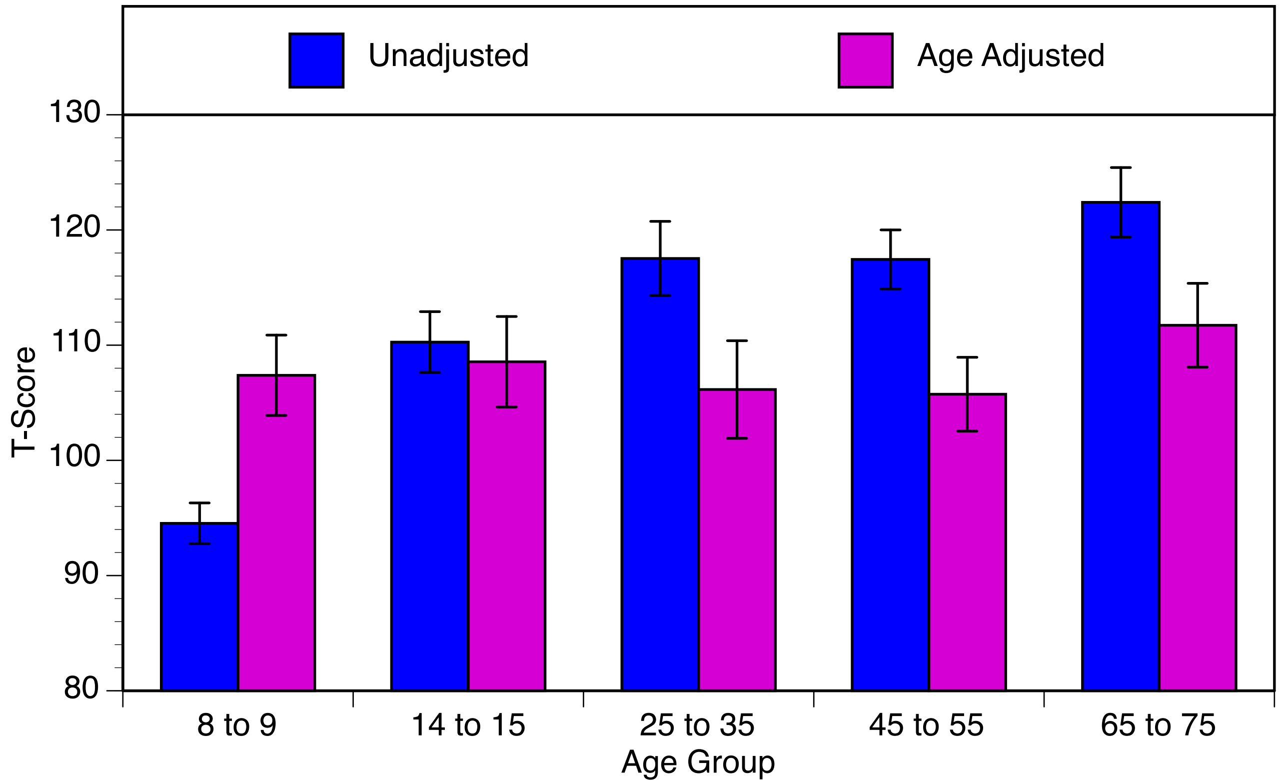


UNADJUSTED FOR AGE: Main effect of Age *p = .001*

ADJUSTED FOR AGE: Main effect of Age *p* = .198

Unadjusted 8-9 < 14-15, 25-35, 45-55

Toolbox – Oral Reading

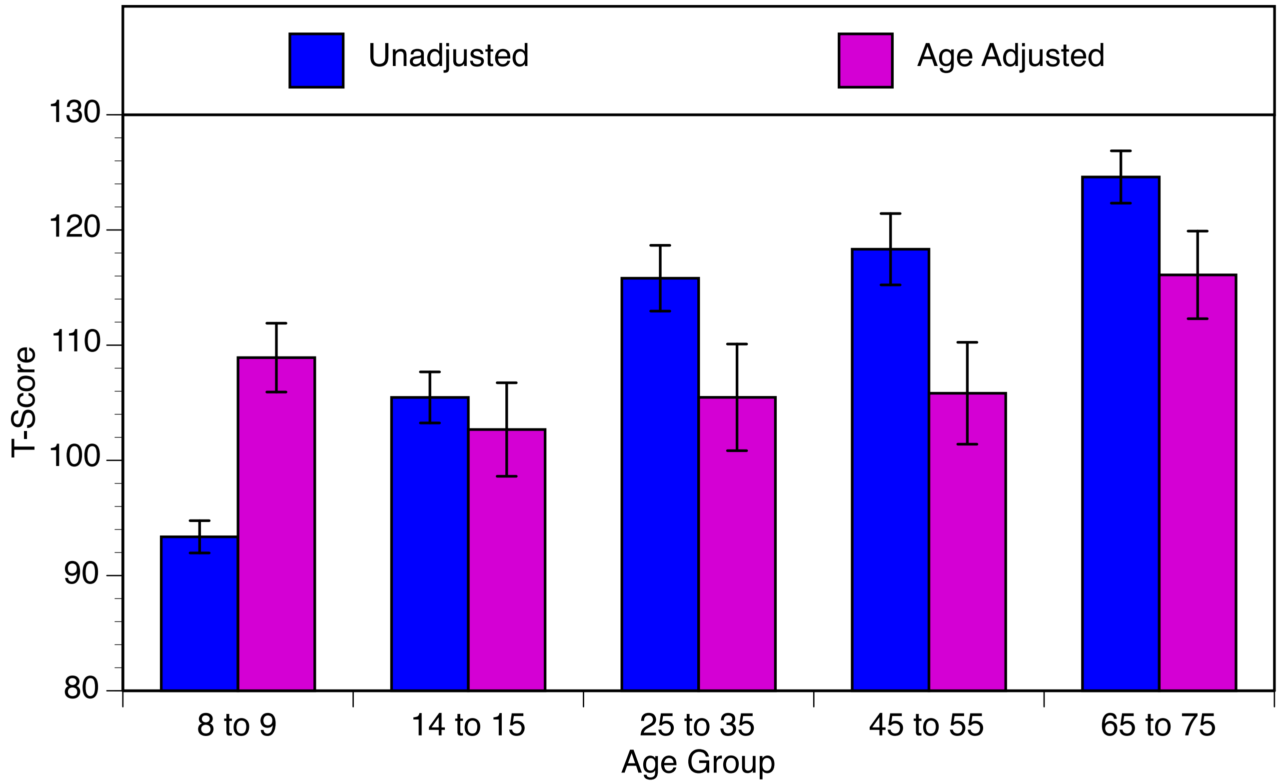


UNADJUSTED FOR AGE: Main effect of Age *p = .001*

ADJUSTED FOR AGE: Main effect of Age *p* = .806

8-9 < all others; 65-75 > 8-9, 14-15

Toolbox – Picture Vocabulary

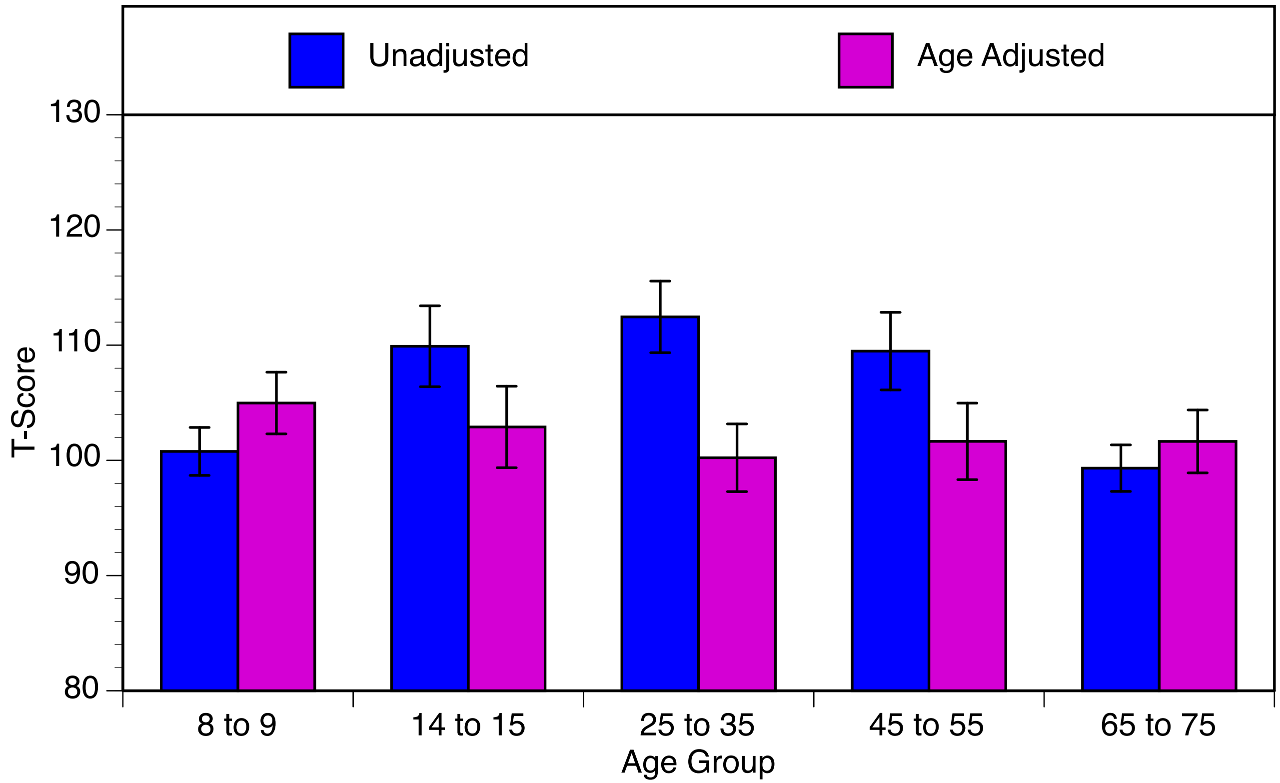


UNADJUSTED FOR AGE: Main effect of Age *p = .001*

ADJUSTED FOR AGE: Main effect of Age *p* = .245

8-9 < 14-15 < 25-35, 45-55 < 65-75

Toolbox – Pegboard

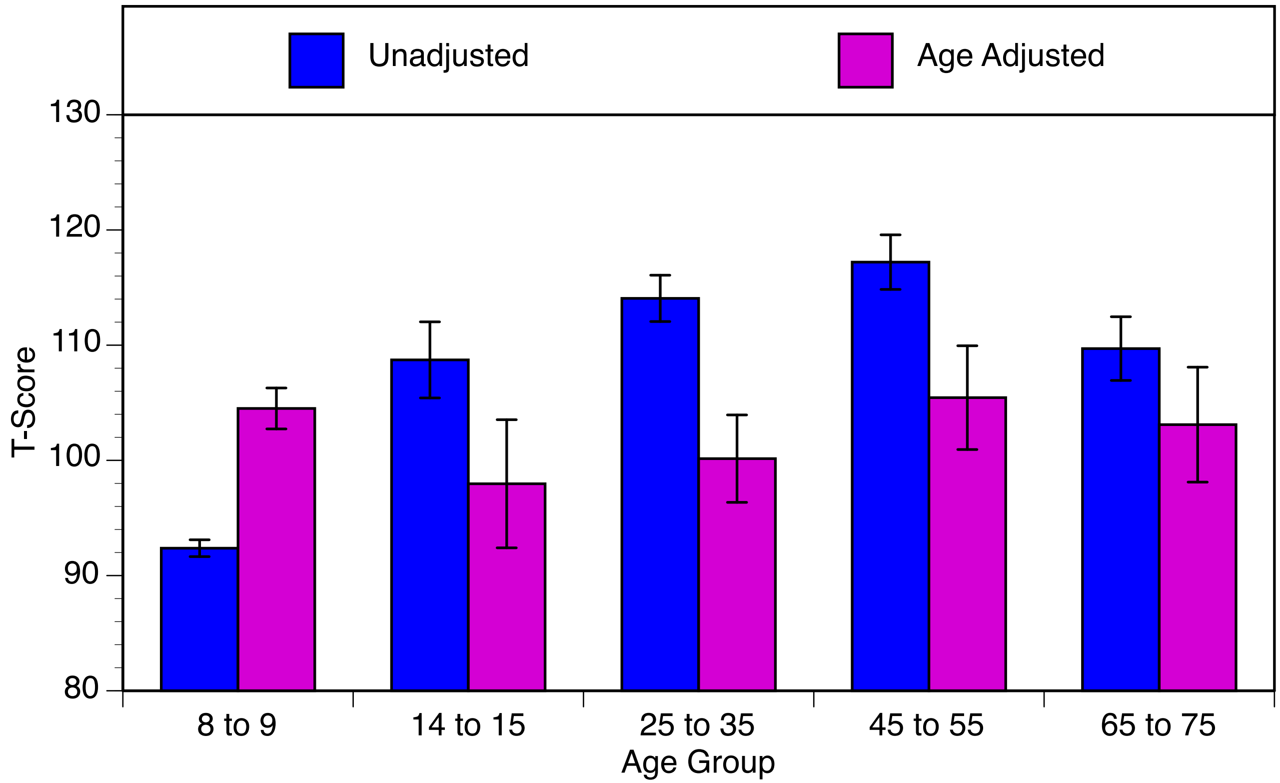


UNADJUSTED FOR AGE: Main effect of Age $p = .003$

ADJUSTED FOR AGE: Main effect of Age $p = .810$

8-9 < 14-15; 25-35; 45-55 > 65-75

Toolbox – Grip

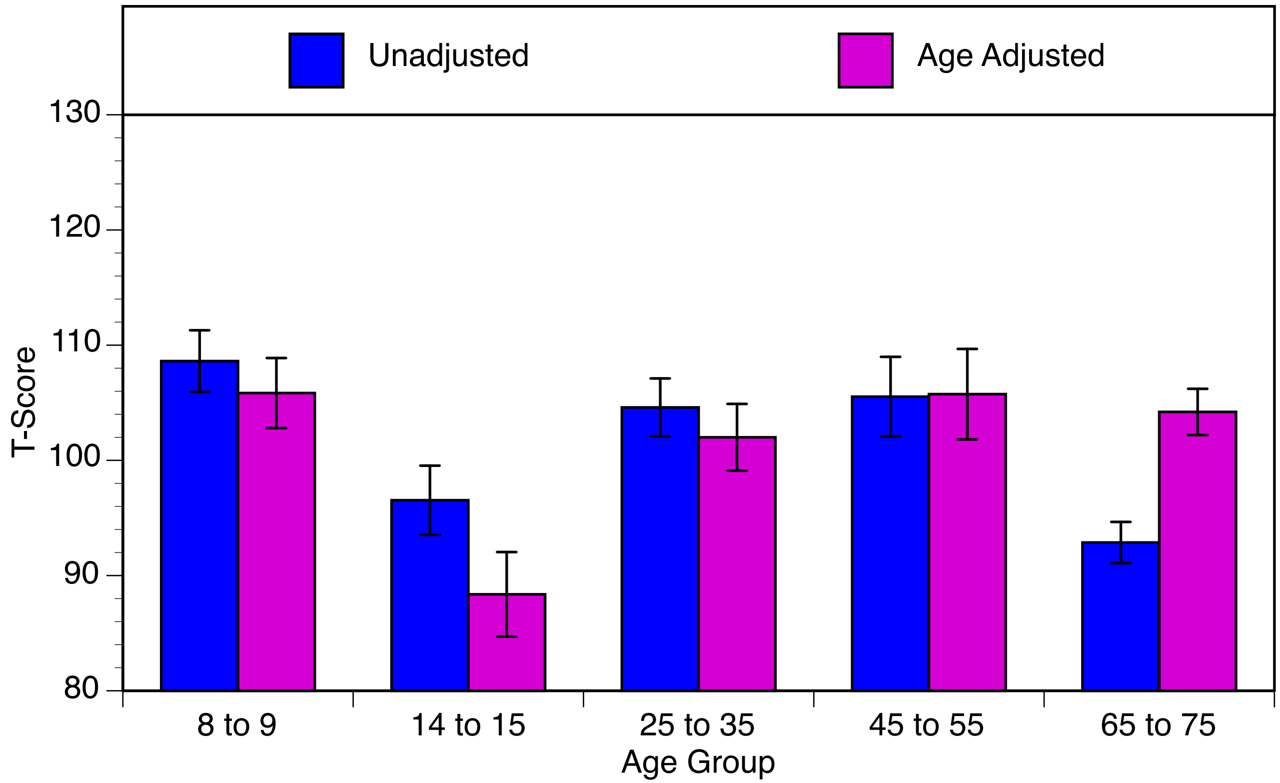


UNADJUSTED FOR AGE: Main effect of Age *p = .001*

ADJUSTED FOR AGE: Main effect of Age *p* = .730

8-9 < 14-15; 25-35; 45-55, 65-75; 45-55 > 14-15, 65-75

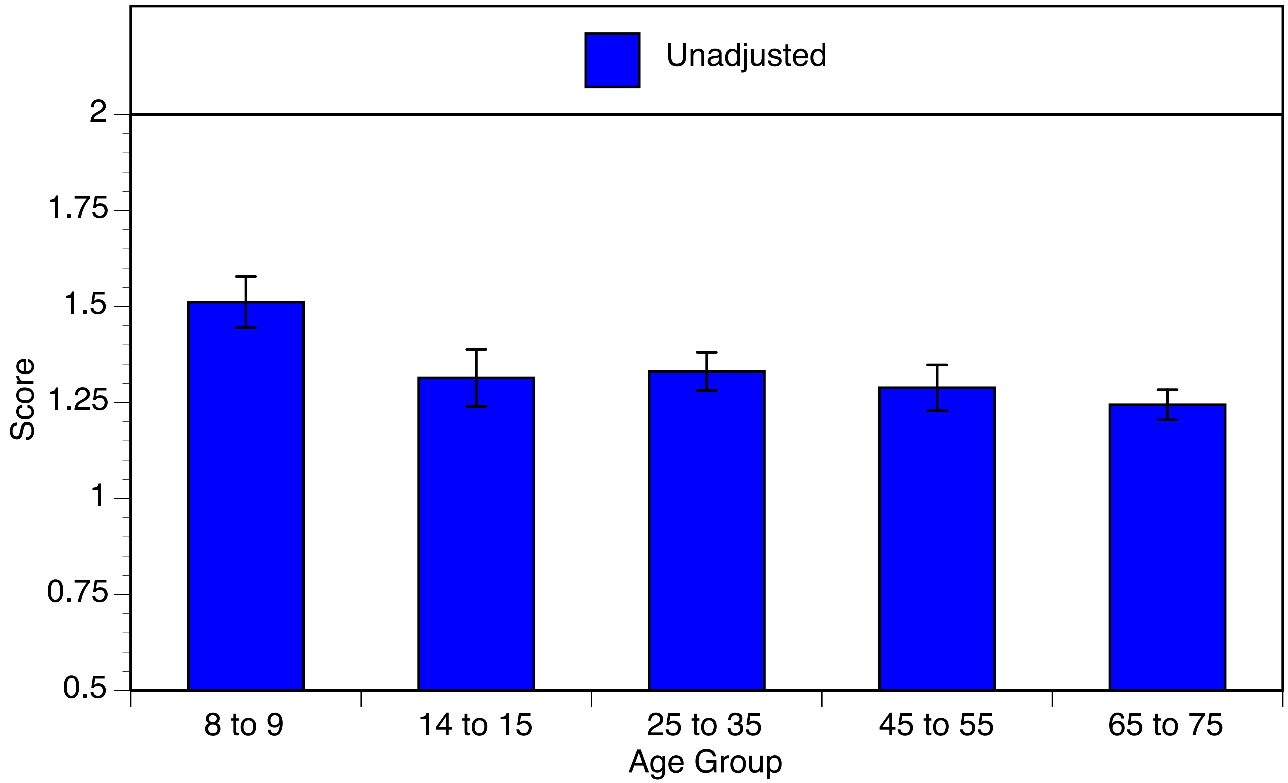
Toolbox – 2 minute Walk



UNADJUSTED FOR AGE: Main effect of Age *p = .001*
ADJUSTED FOR AGE: Main effect of Age *p* = .015

UNADJUSTED: 14-15 < 8-9, 25-35; 45-55; 65-75 < 8-9, 25-35, 45-55
ADJUSTED: 14-15 < 8-9, 25-35; 45-55, 65-75

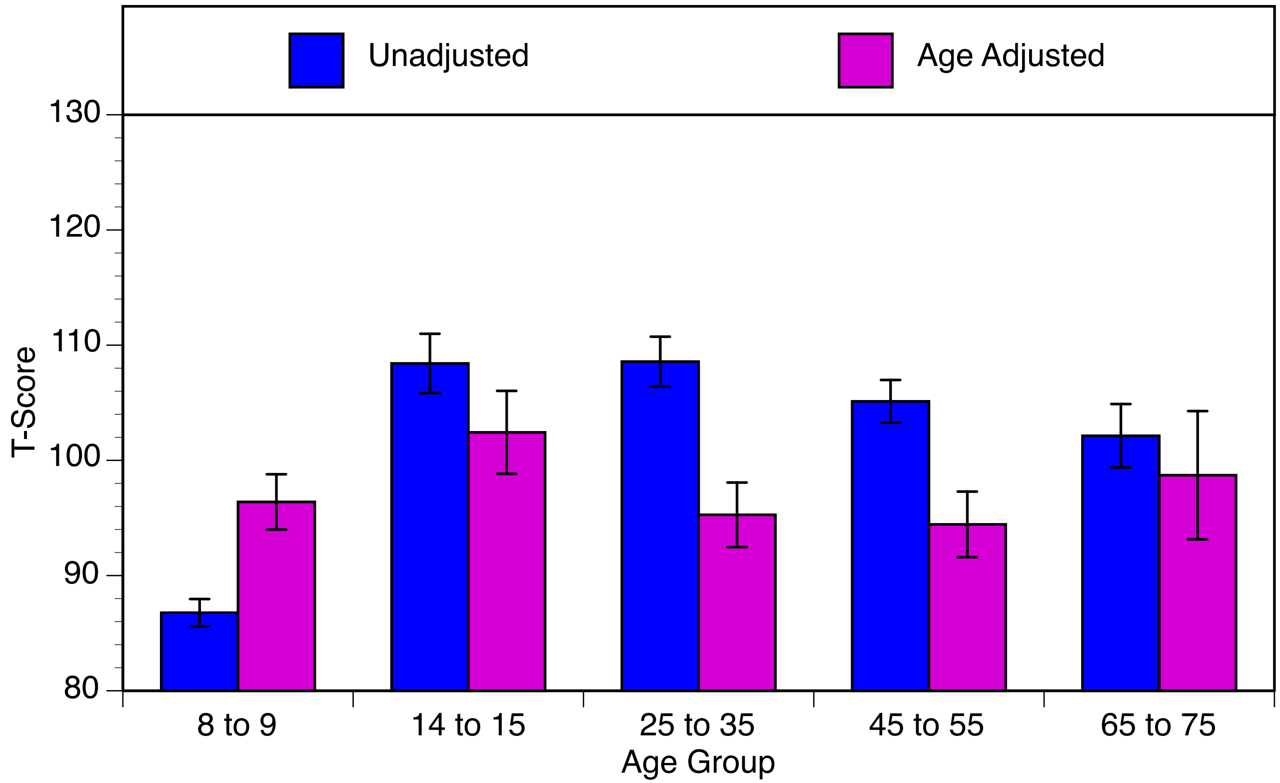
Toolbox – 4 meter Walk



UNADJUSTED FOR AGE: Main effect of Age *p = .003*
ADJUSTED FOR AGE: Main effect of Age *p* = .810

8-9 < 14-15; 25-35; 45-55 > 65-75

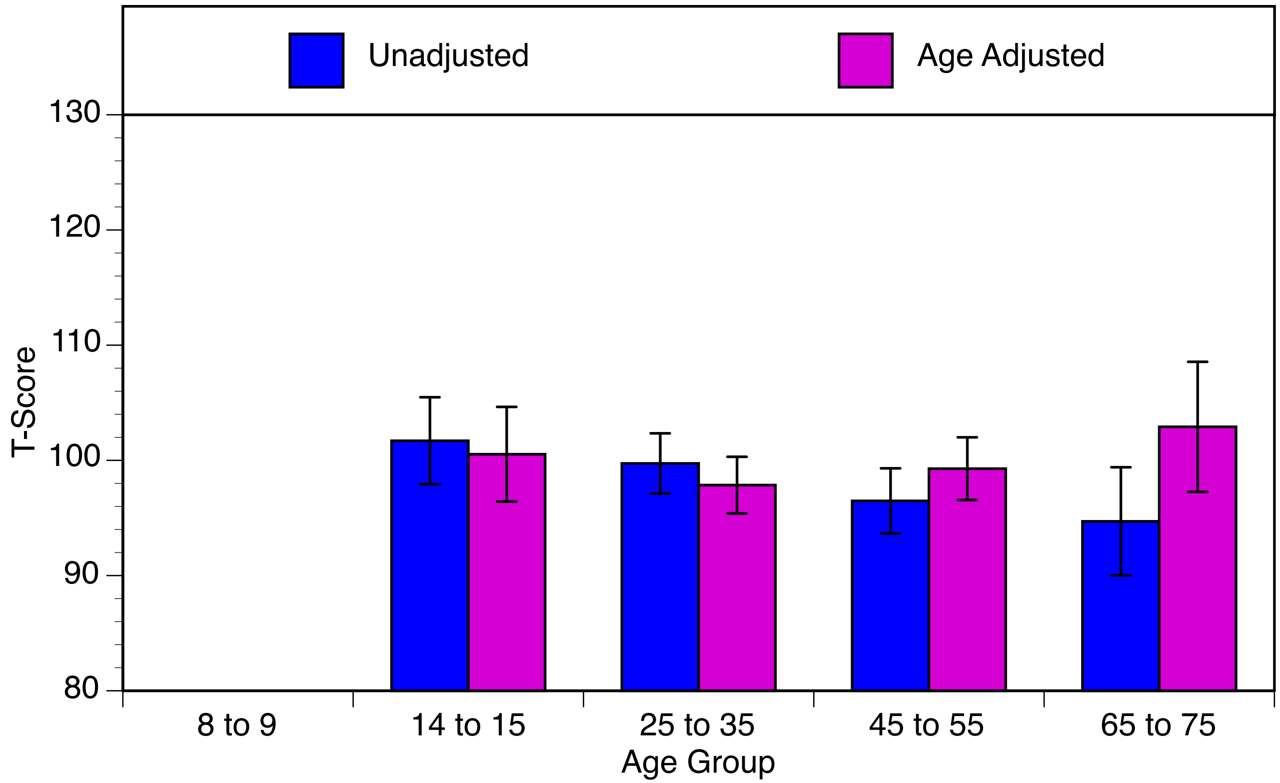
Toolbox – Odor



UNADJUSTED FOR AGE: Main effect of Age *p = .001*
ADJUSTED FOR AGE: Main effect of Age *p* = .655

UNADJUSTED: 8-9 < all; 65-75 > 25-35, 45-55

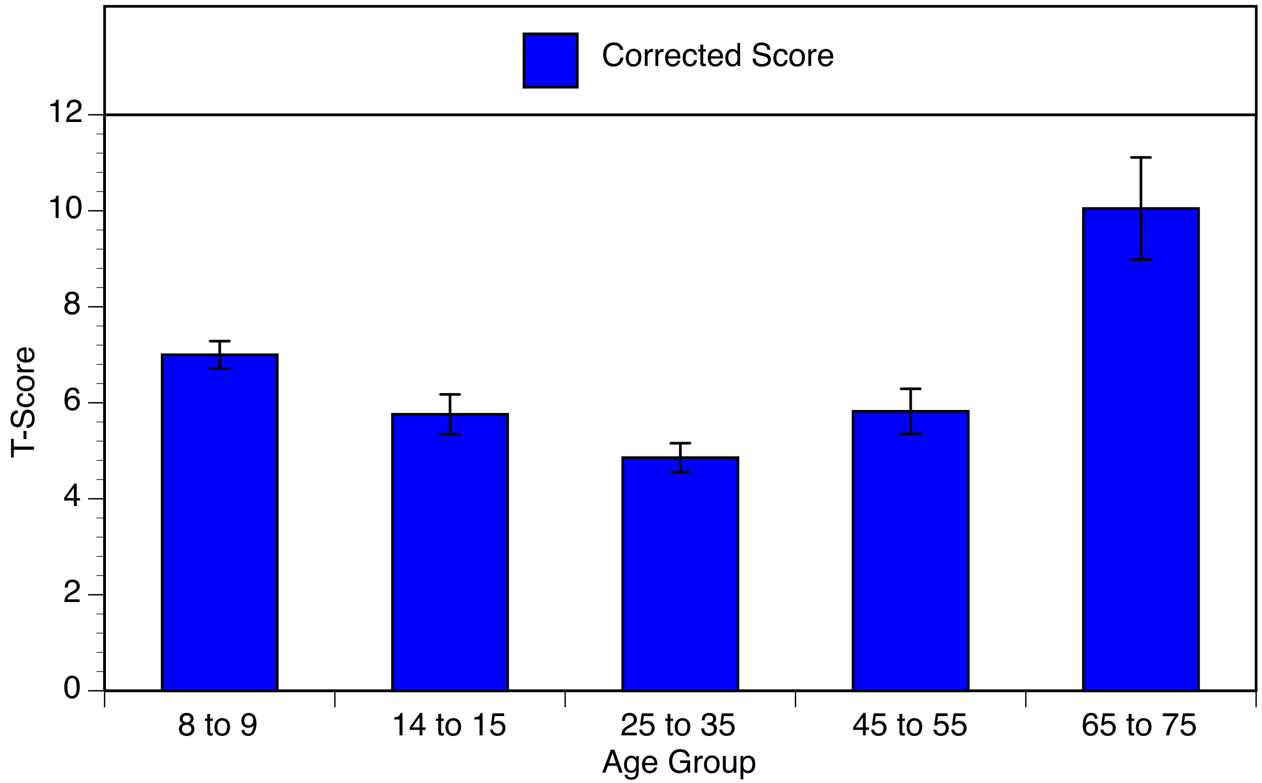
Toolbox – Taste



UNADJUSTED FOR AGE: Main effect of Age *p = .550*

ADJUSTED FOR AGE: Main effect of Age *p* = .786

Toolbox – Words in Noise

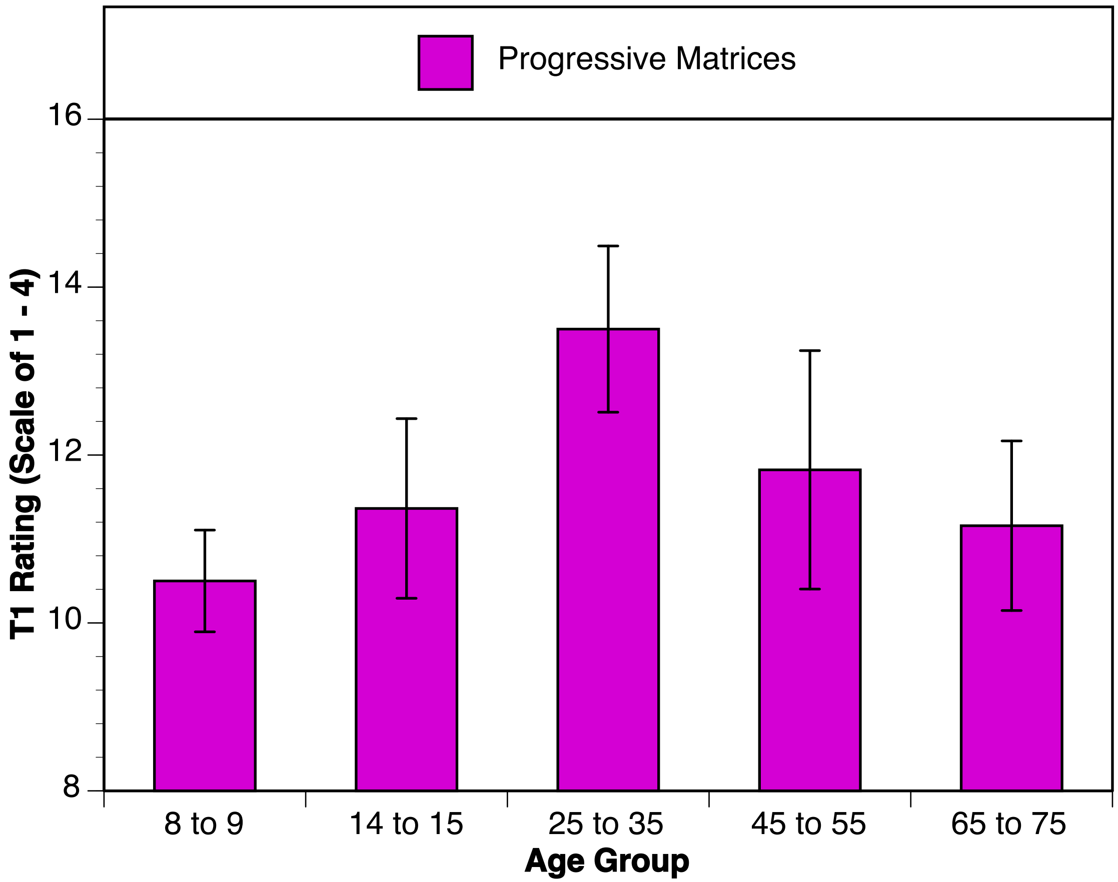


UNADJUSTED FOR AGE: Main effect of Age *p = .001*

UNADJUSTED: 65-75 > all

Non Toolbox Behavioral Performance

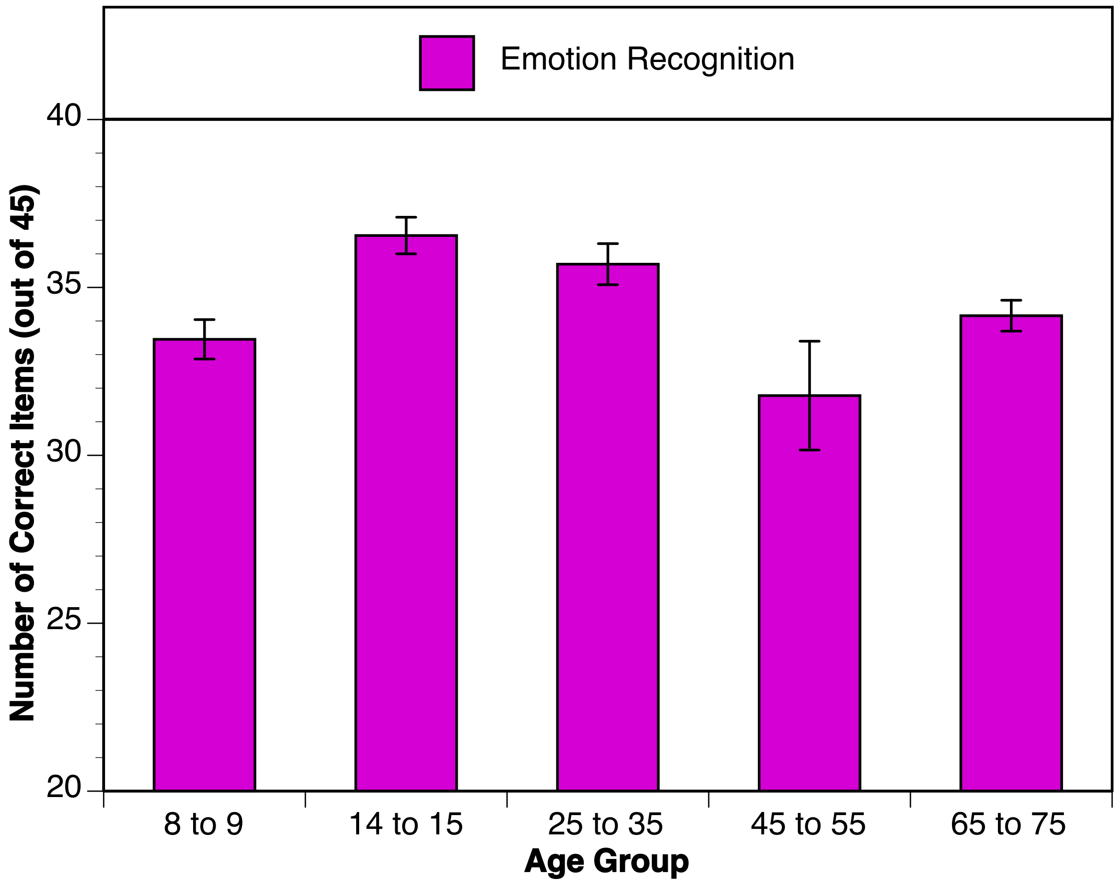
Progressive Matrices



Main Effect of Age Group *p* = .21

Trend for 25-35 to be better than 8-9 and 65-75

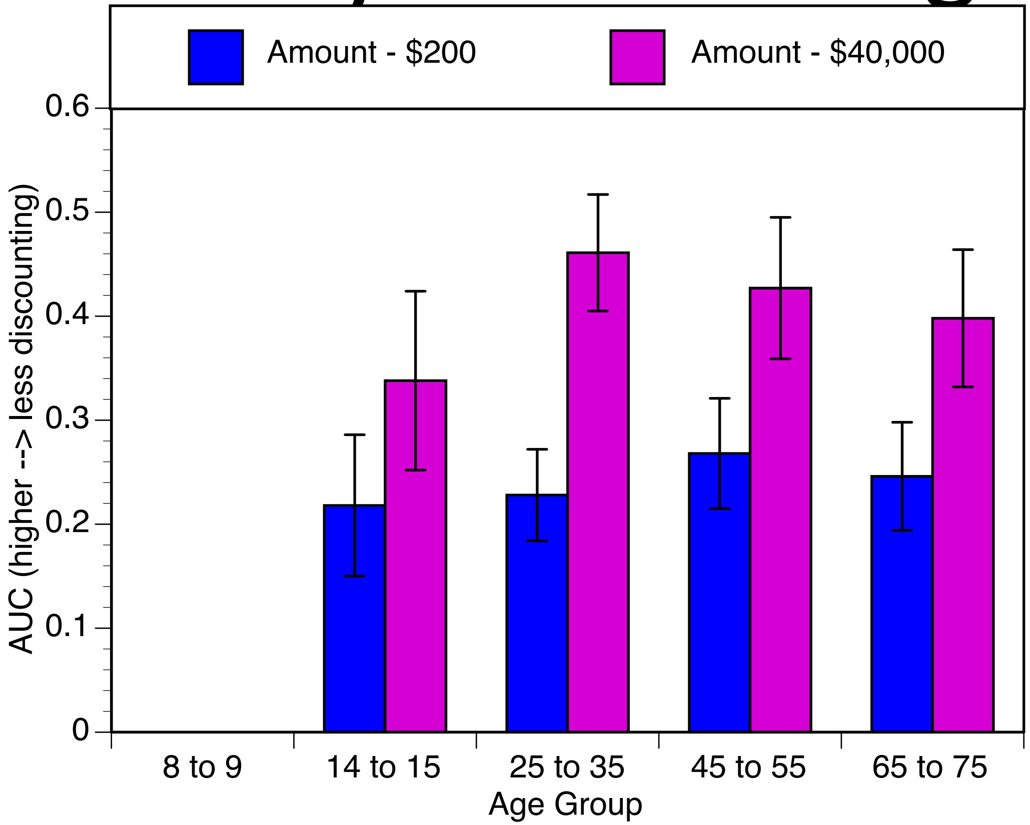
Emotion Recognition



Main Effect of Age Group $p = .004$

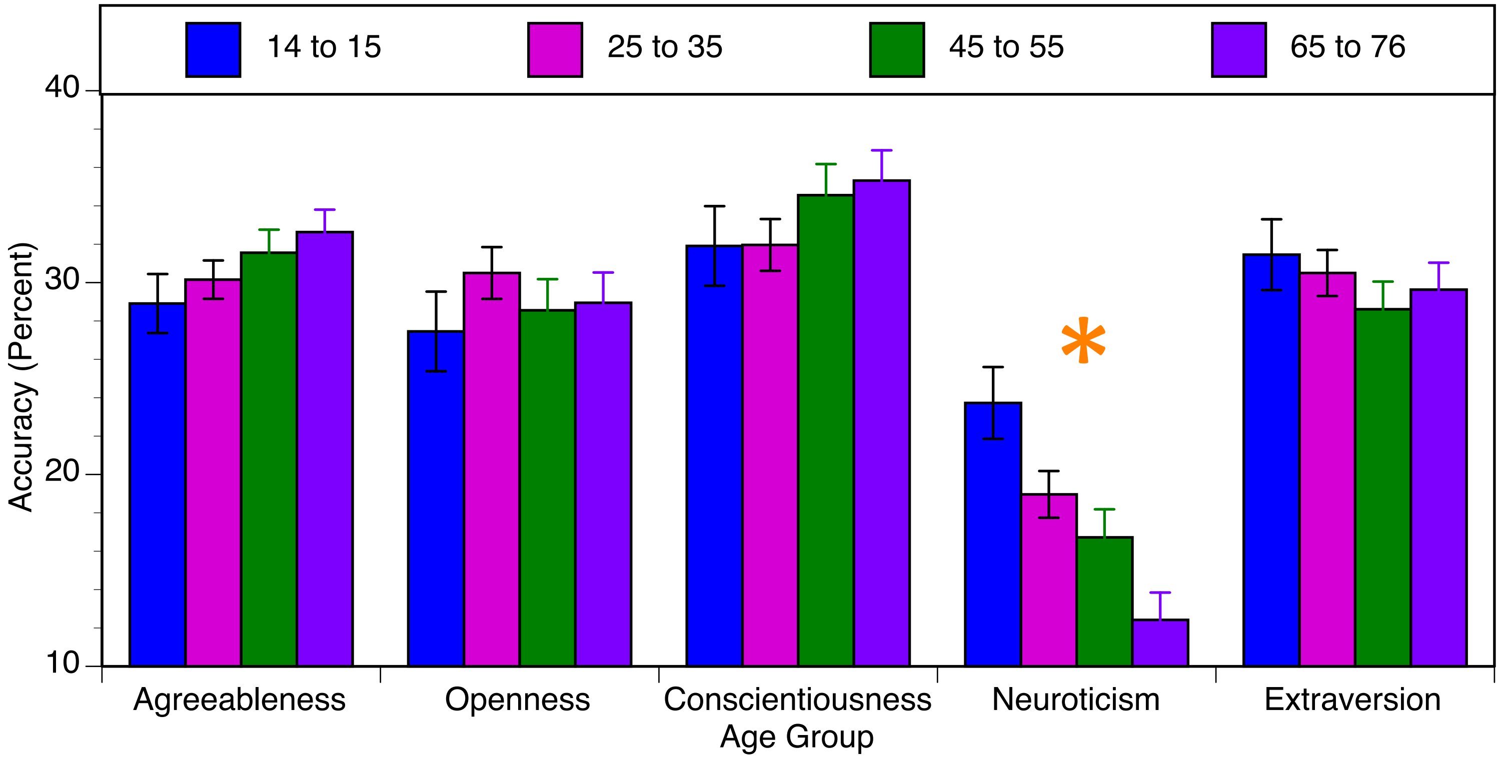
14-15 better than 8-9, 45-55; 25-35 better than 45-55

Delay Discounting



Main Effect of Age Group p = .87
Main Effect of Amount p = .001
Age Group X Amount p = .258

NEO - Neuroticism

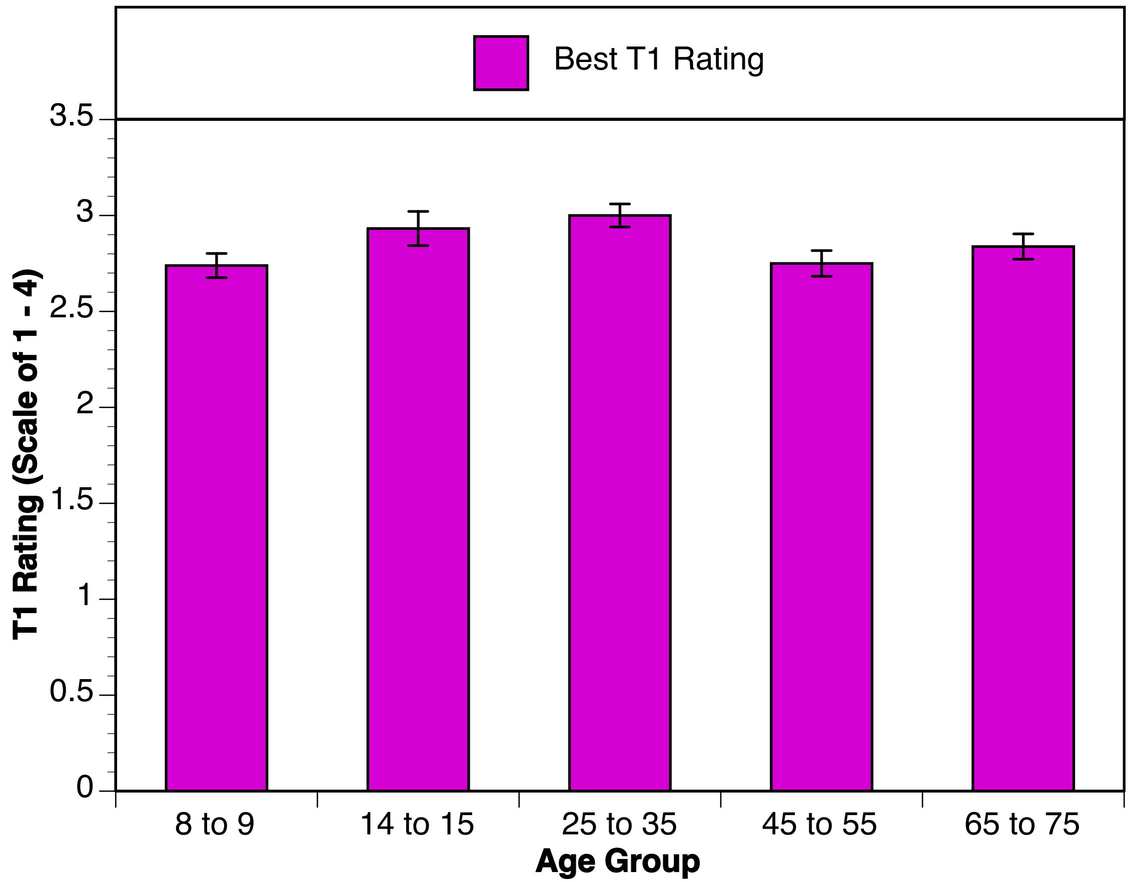


Main Effect of Age Group p = .83; Main Effect of Domain p = .001
Age Group X Domain p = .001

DIFFERENCES ARE IN NEUROTOCISM

T1 and T2 Images

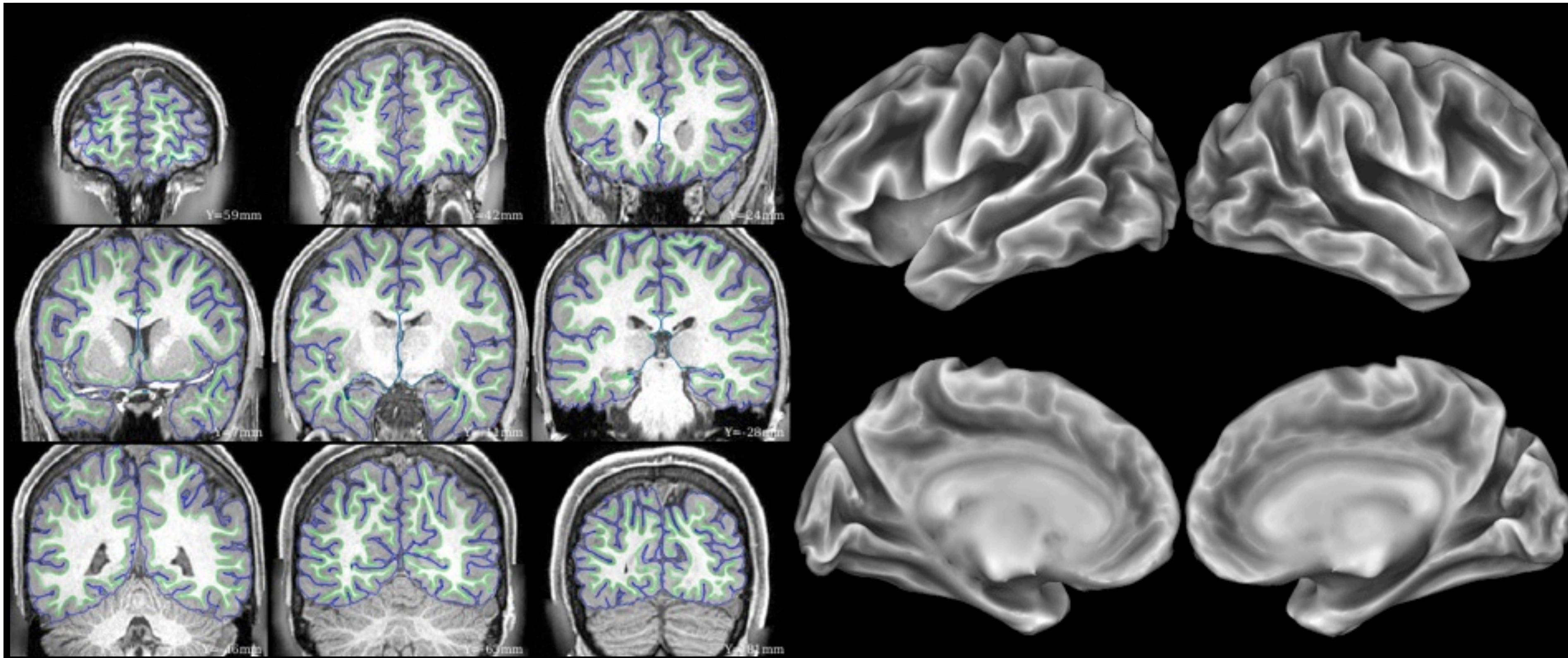
Expert Structural Scan Ratings for T1 Images



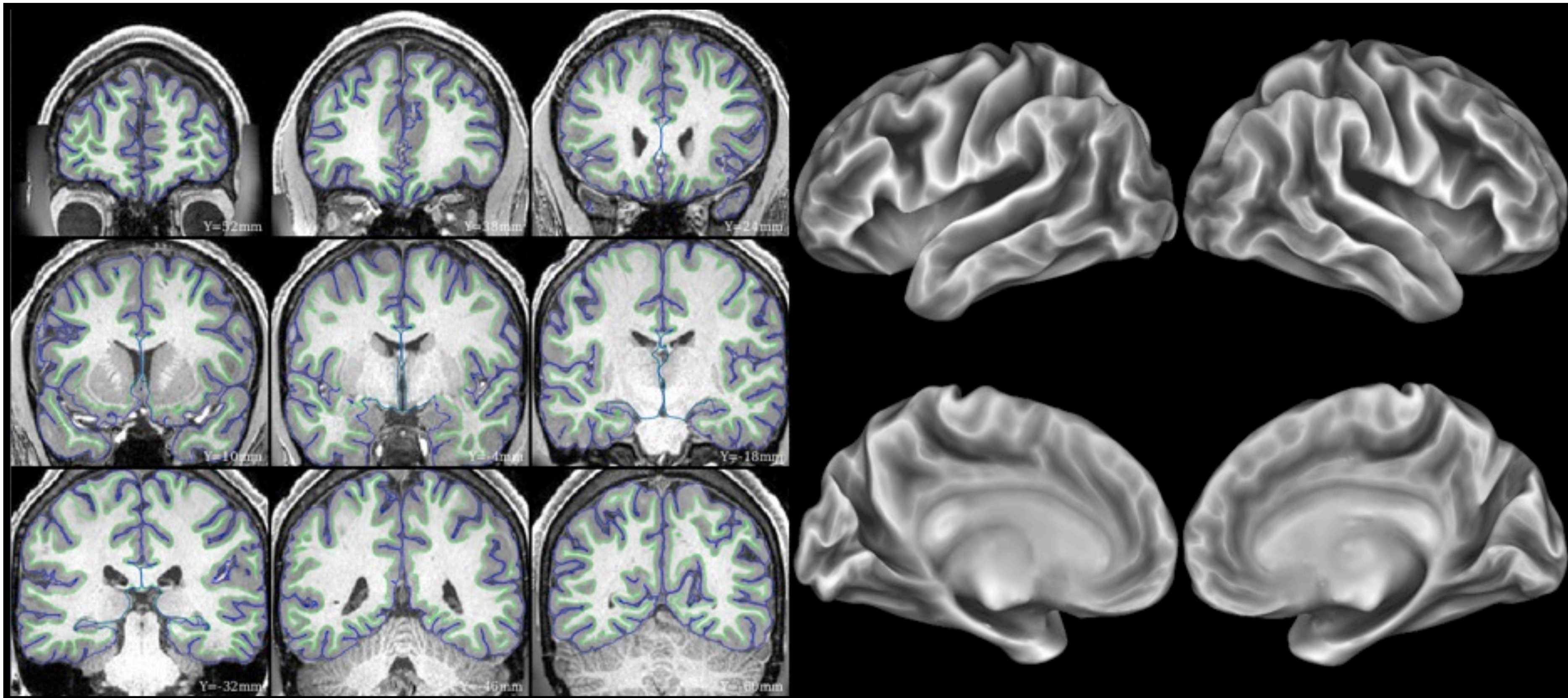
Main Effect of Age Group p = .019
25-35 better than 8-9, 45-55 and 65-75 (trend)

Surfaces

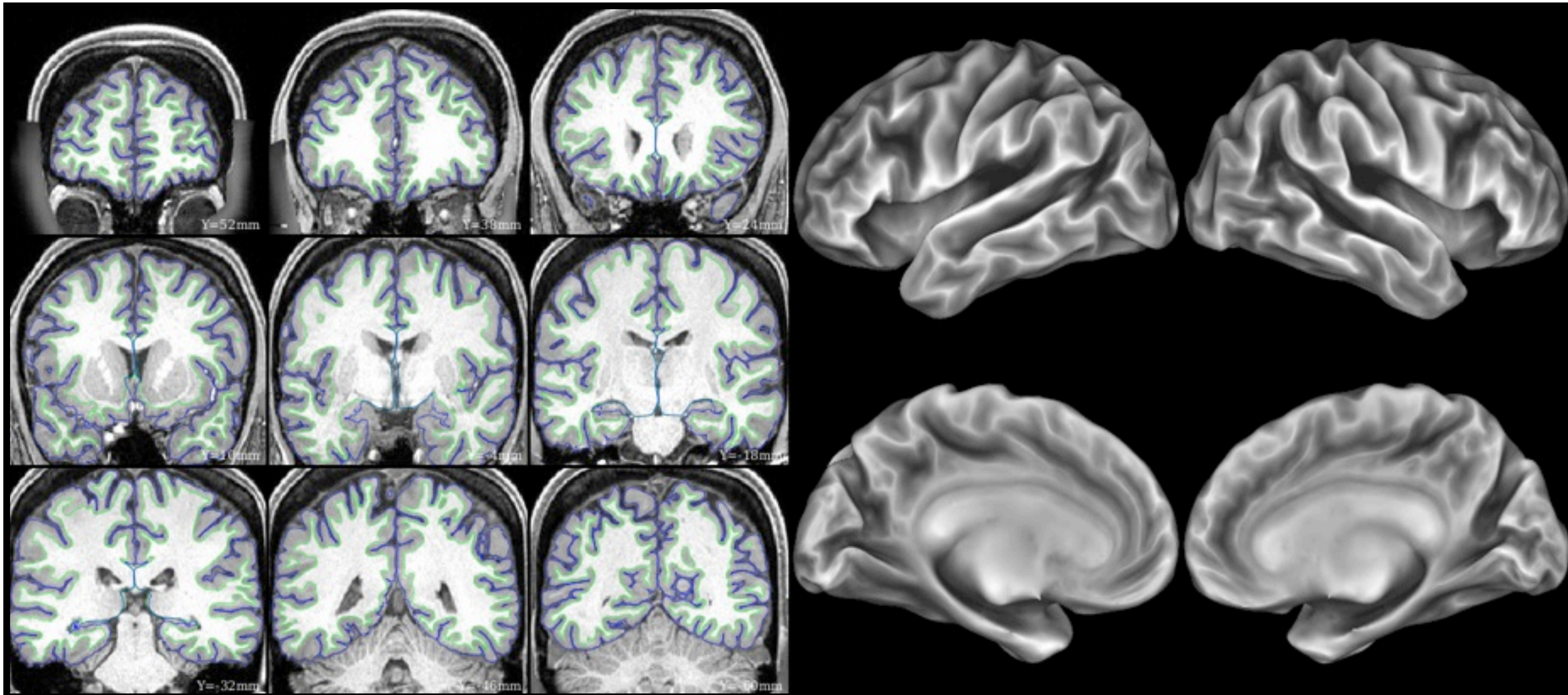
Example Surface from an 8-9 year old child



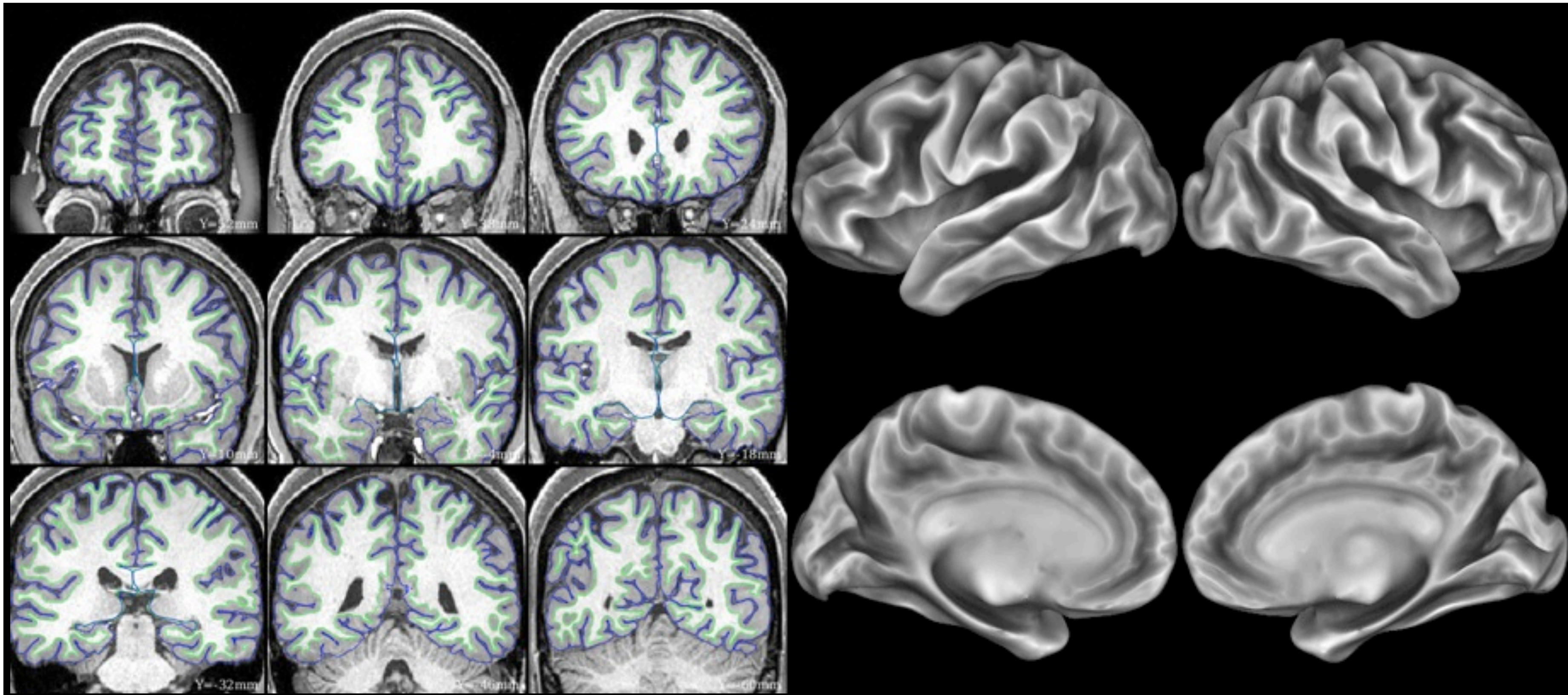
Example Surface from an 14-15 year old teen



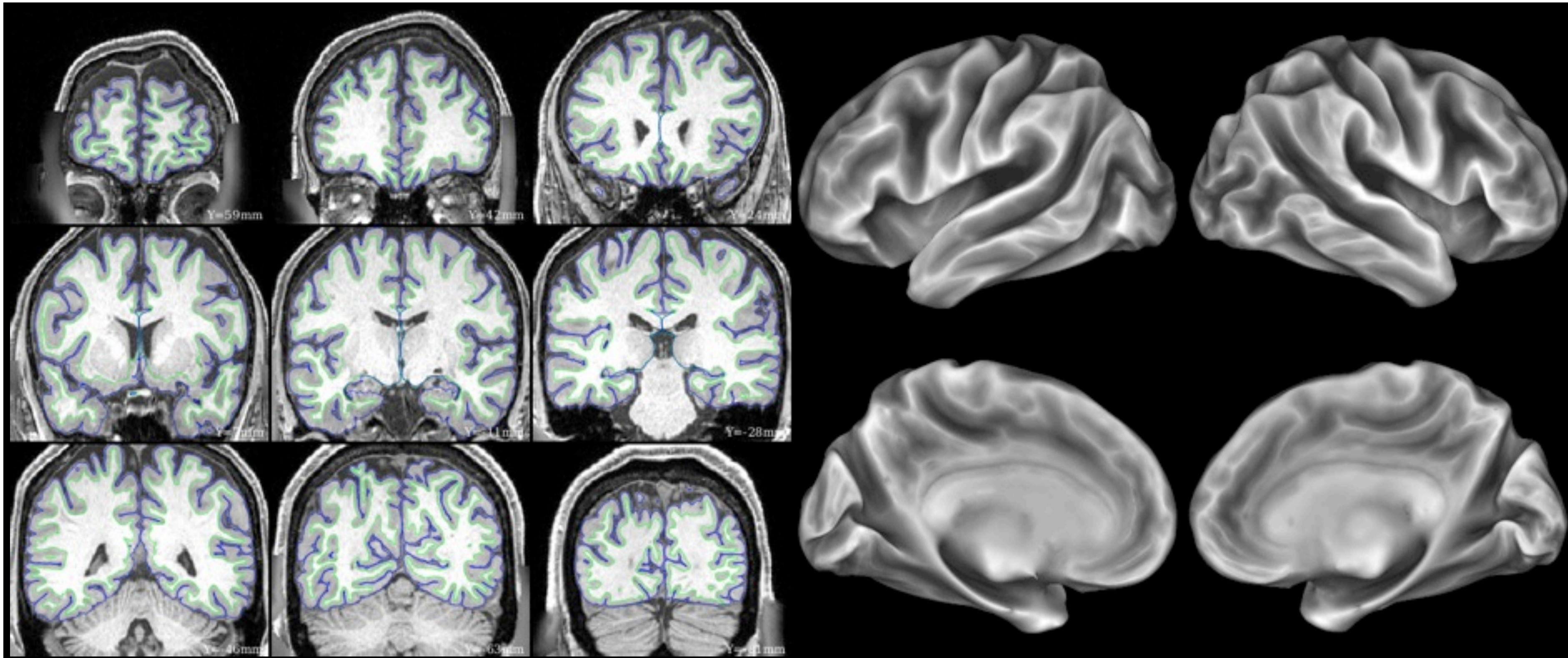
Example Surface from an 25-35 year old adult



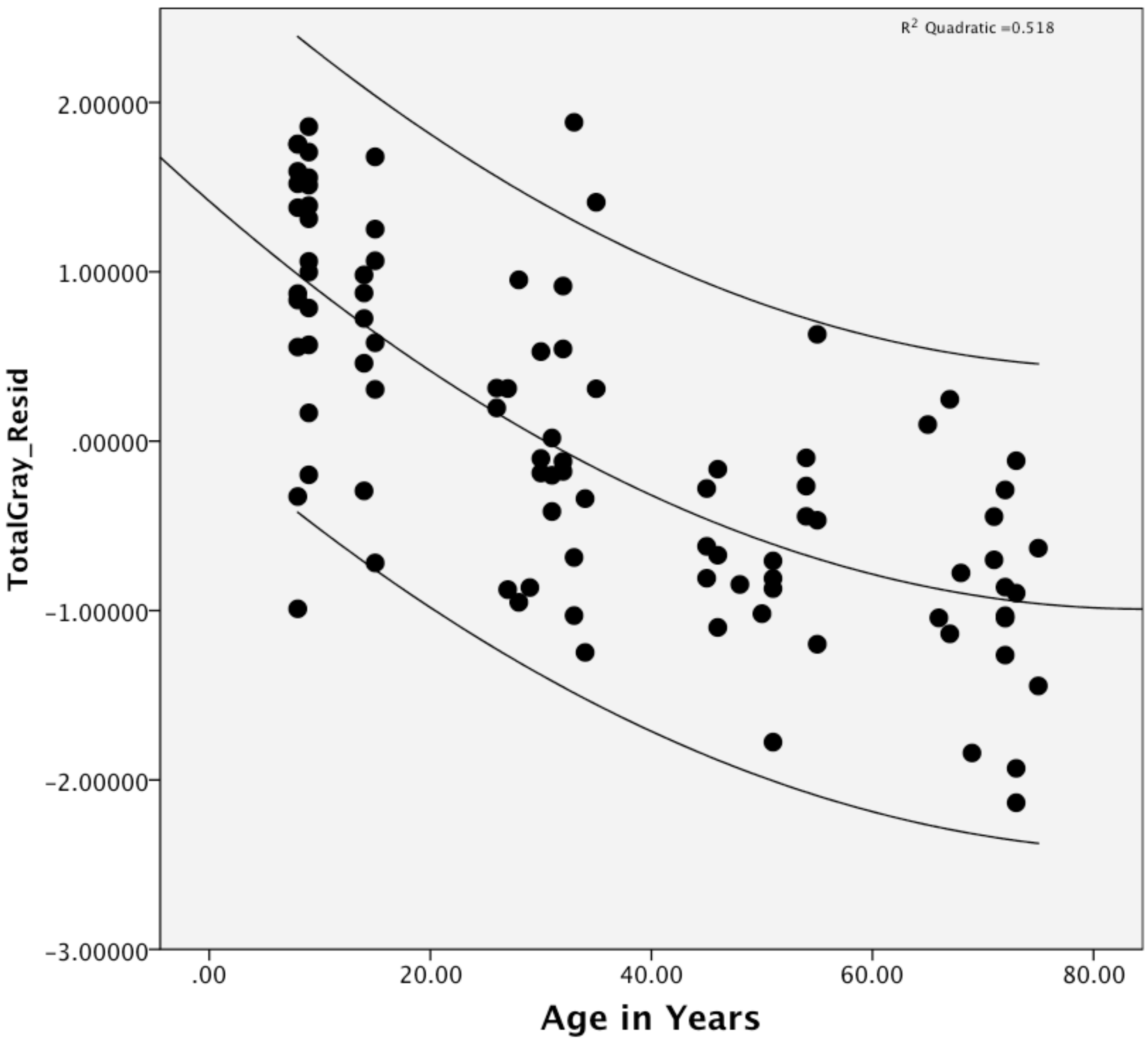
Example Surface from an 45-55 year old adult

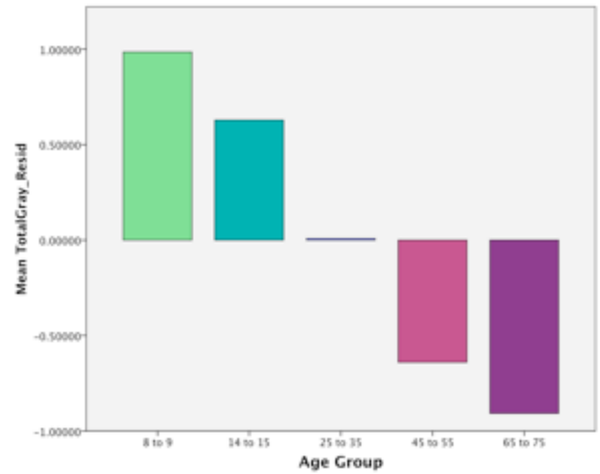


Example Surface from an 65 to 75 year old adult



Analysis of Structural Data as "Positive Control"

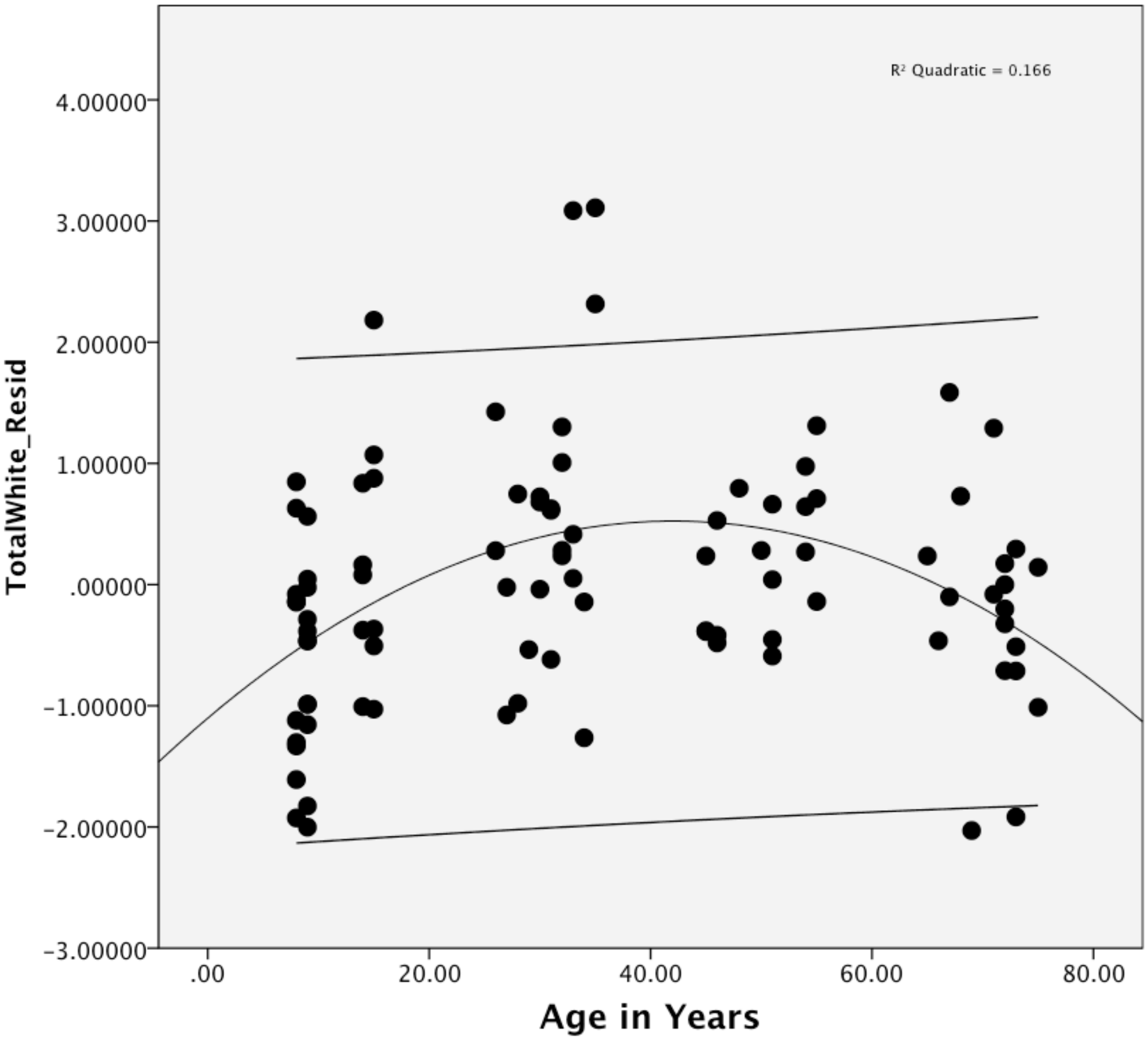


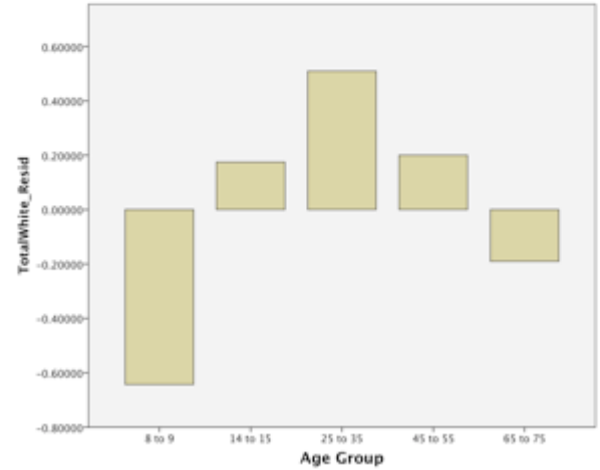


We find the expected effects of Gray Matter volume as a function of age. Data are residuals after accounting for gender effects.

Linear Effect of Age = $p<.001$; Quadratic Effect of Age = $p = .05$

Analysis of Structural Data as "Positive Control"



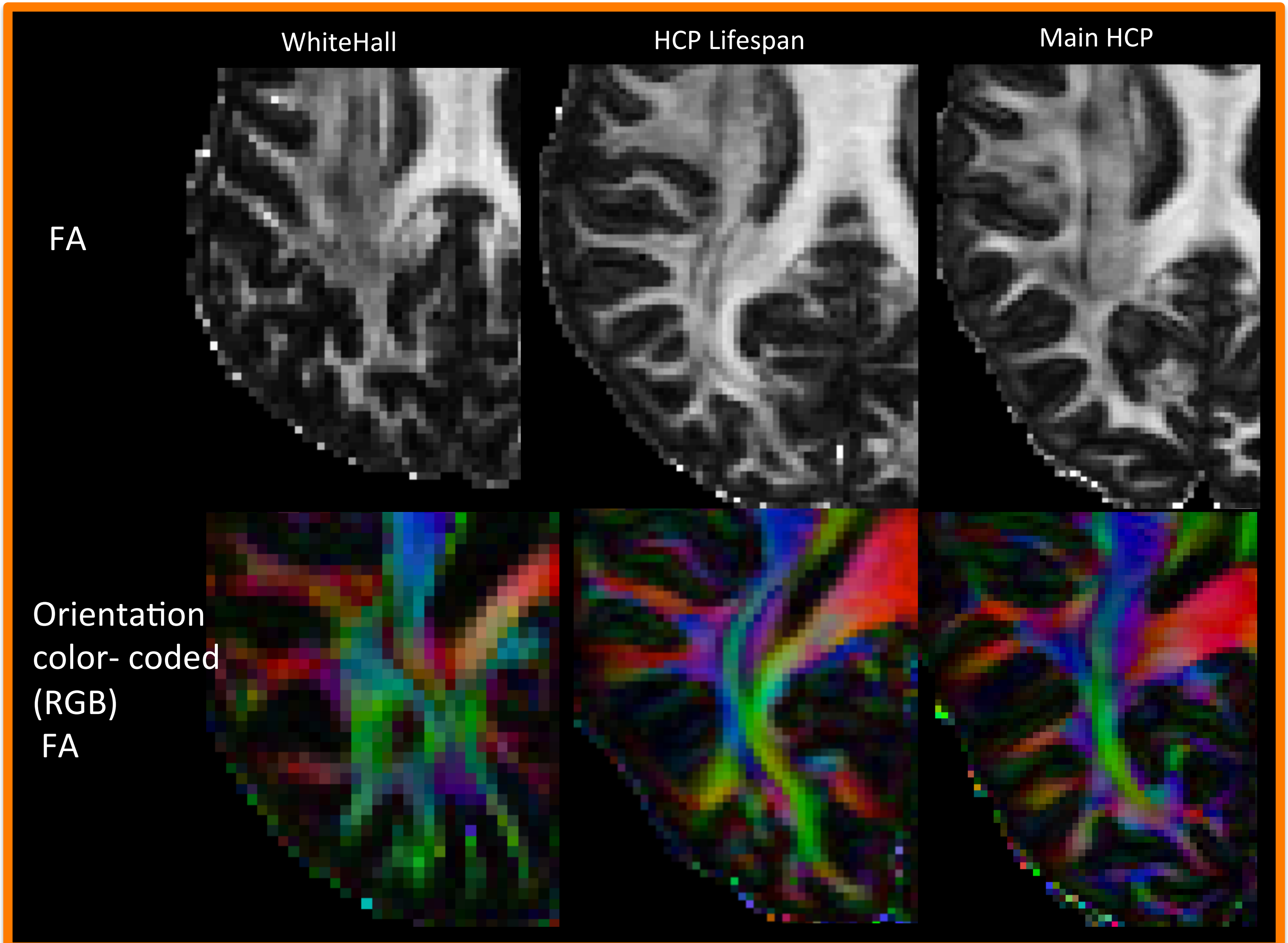


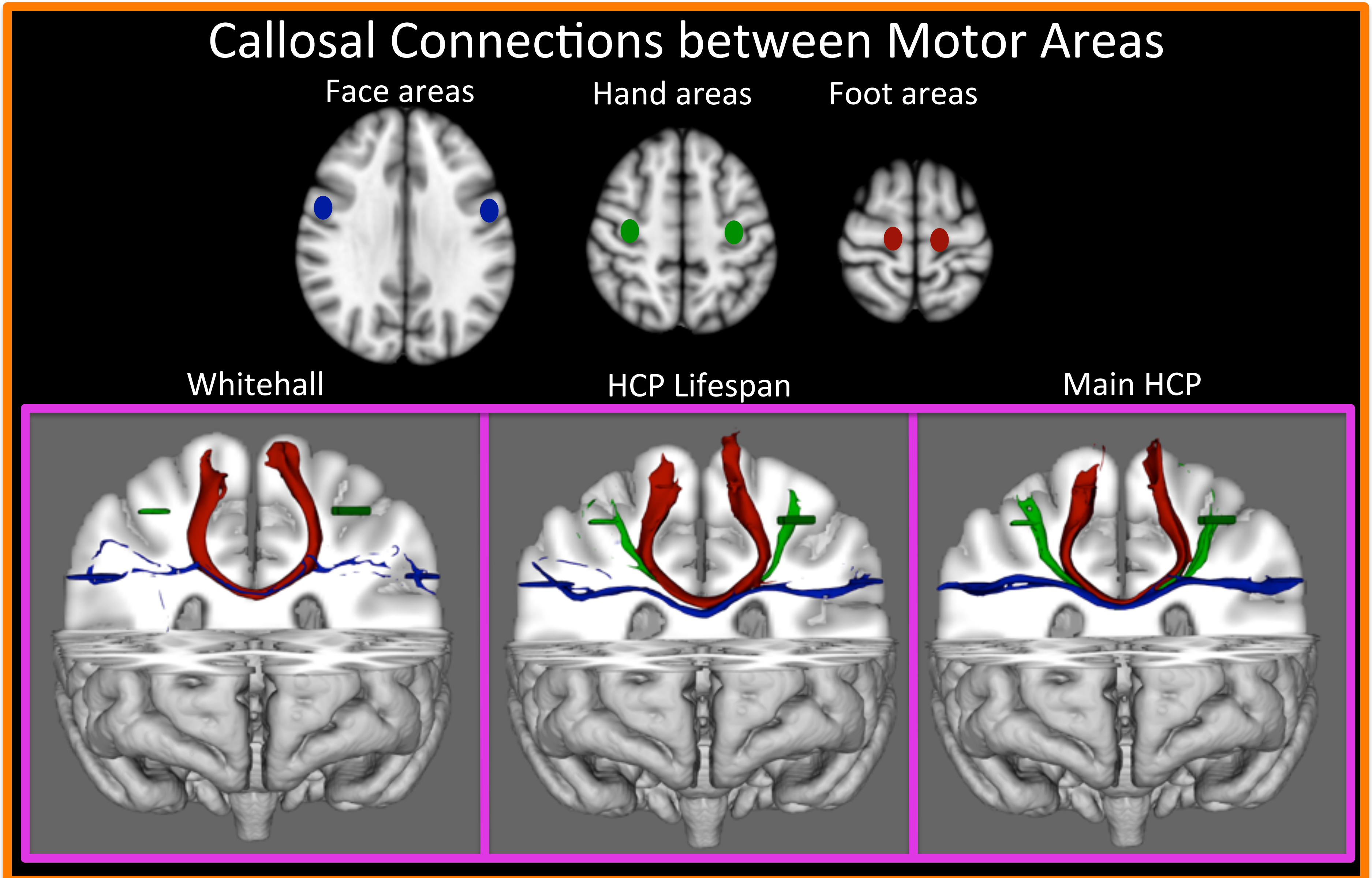
We find the expected changes in white matter volume as a function of age. Data are residuals after accounting for gender effects.

Linear Effect of Age = p=.29 ;   Quadratic Effect of Age = p <.001

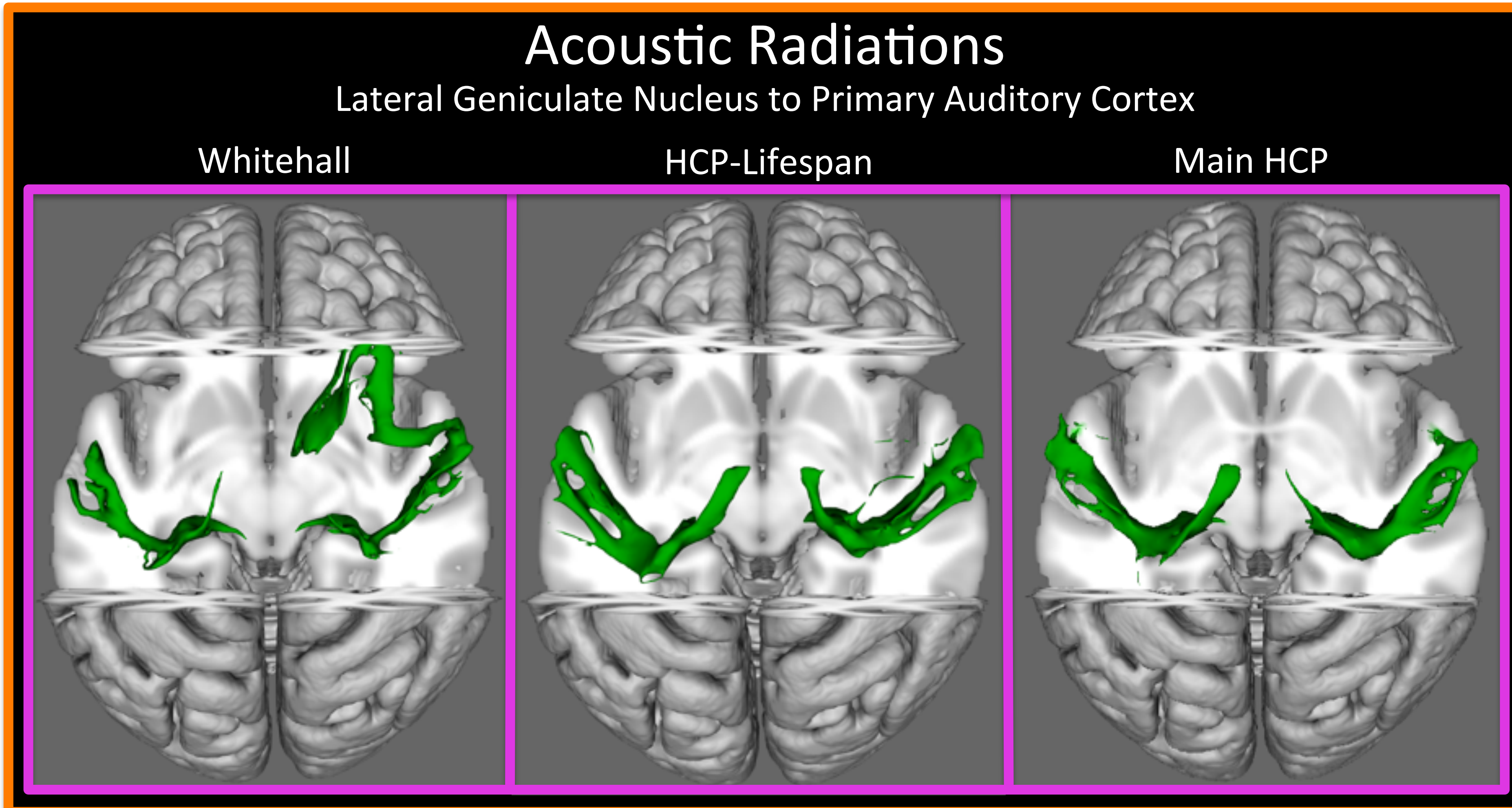
Diffusion Imaging

Comparison of the Spatial Resoluation Across Diffusion Acquisitions





These images show the outcome of placing seeds in the face (blue), hand (green) or foot (red) motor areas on one hemisphere and tracking the fibers through the callosal connections necessary to link them with their homologous regions in the opposite hemisphere. These tracts go through both the right and left centrum semiovales, and thus have to go through many complex fibre crossings. Conventional data such as the WhiteHall acquisition tend to easily resolve the medial projections, but struggle with the lateral ones. Both the main HCP and the HCP-Lifespan do a good job of resolving all three tracts, both the medial and the lateral projections .

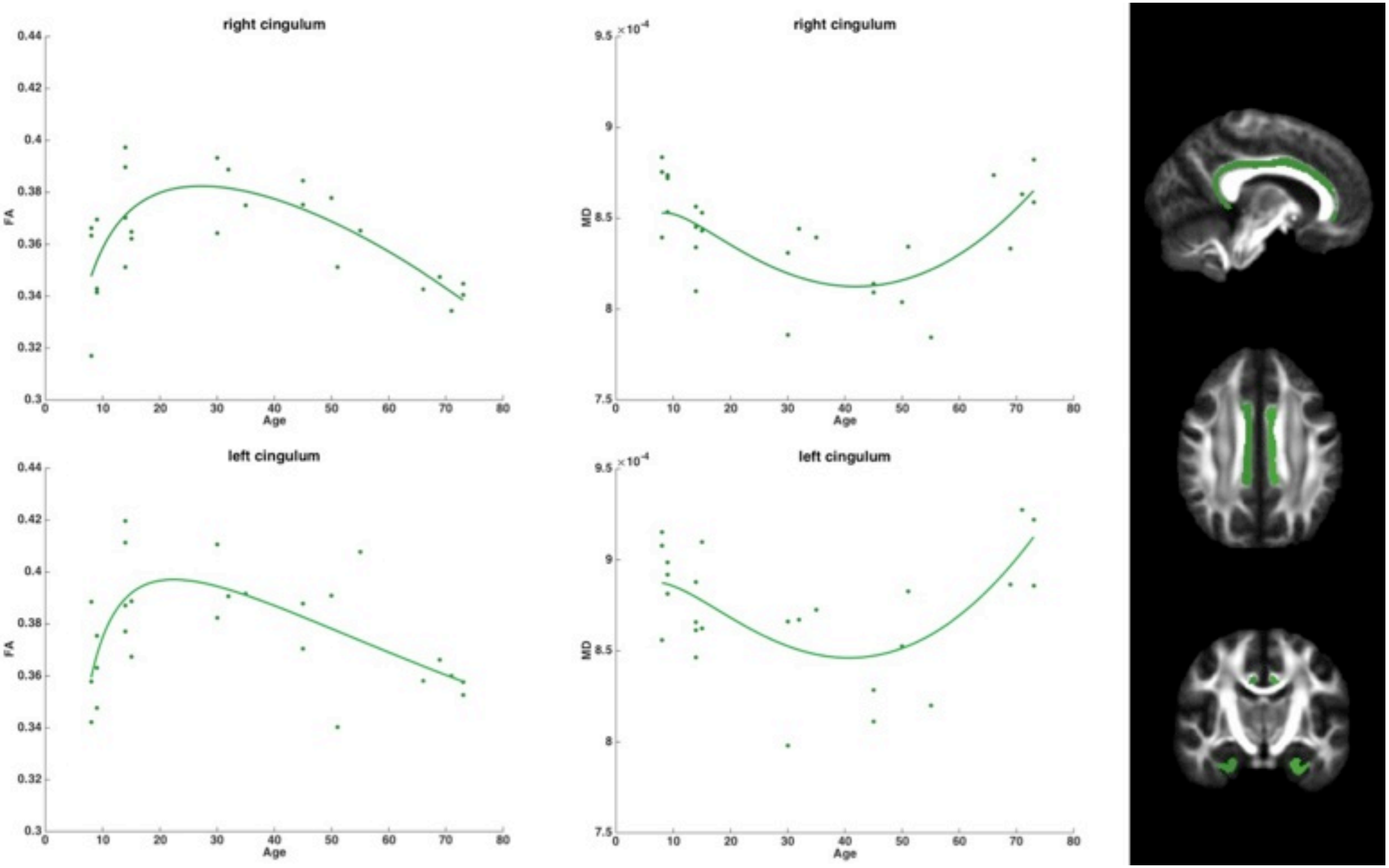


These images shows data for the acoustic radiations. The main HCP and the HCP-Lifespan diffusion acquisitions accurately detect the radiations going from the lateral geniculate nucleus to the primary auditory cortex. However, the WhiteHall acquisition shows a strong false positive.

Diffusion Analysis

FA

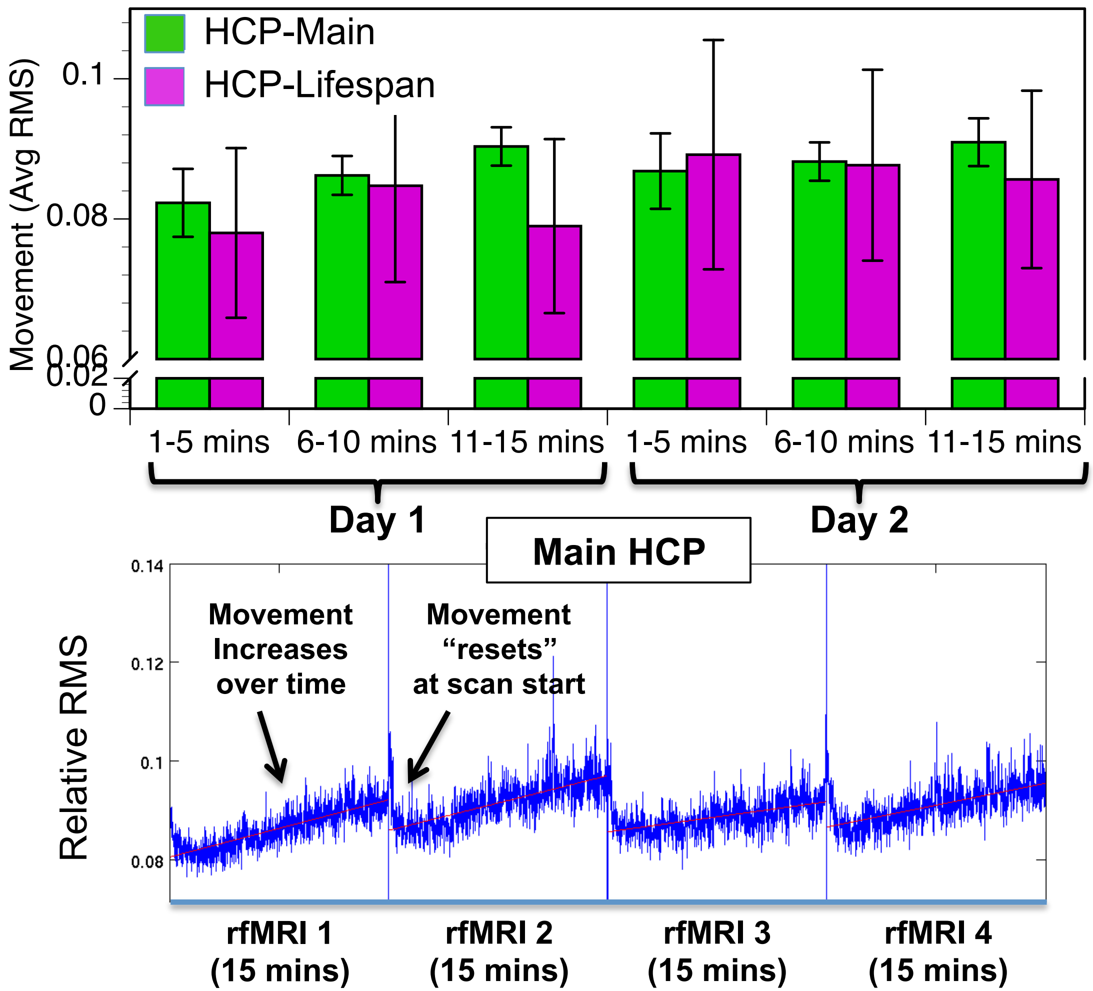
MD



Note: Average fractional anisotropy (FA) and mean diffusivity (MD) projected onto the whole TBSS skeleton showed a highly non-linear age dependence, following an inverted U-pattern for FA, and a U-pattern for MD (Figure 1). The model qualitatively describing best the trajectories in the skeleton was a rational polynomial fit with a cubic numerator, and a linear denominator. Our bespoke registration strategy improved the alignment of all FA and MD images, particularly in subcortical regions, frontal white matter and cerebellum (data not shown).

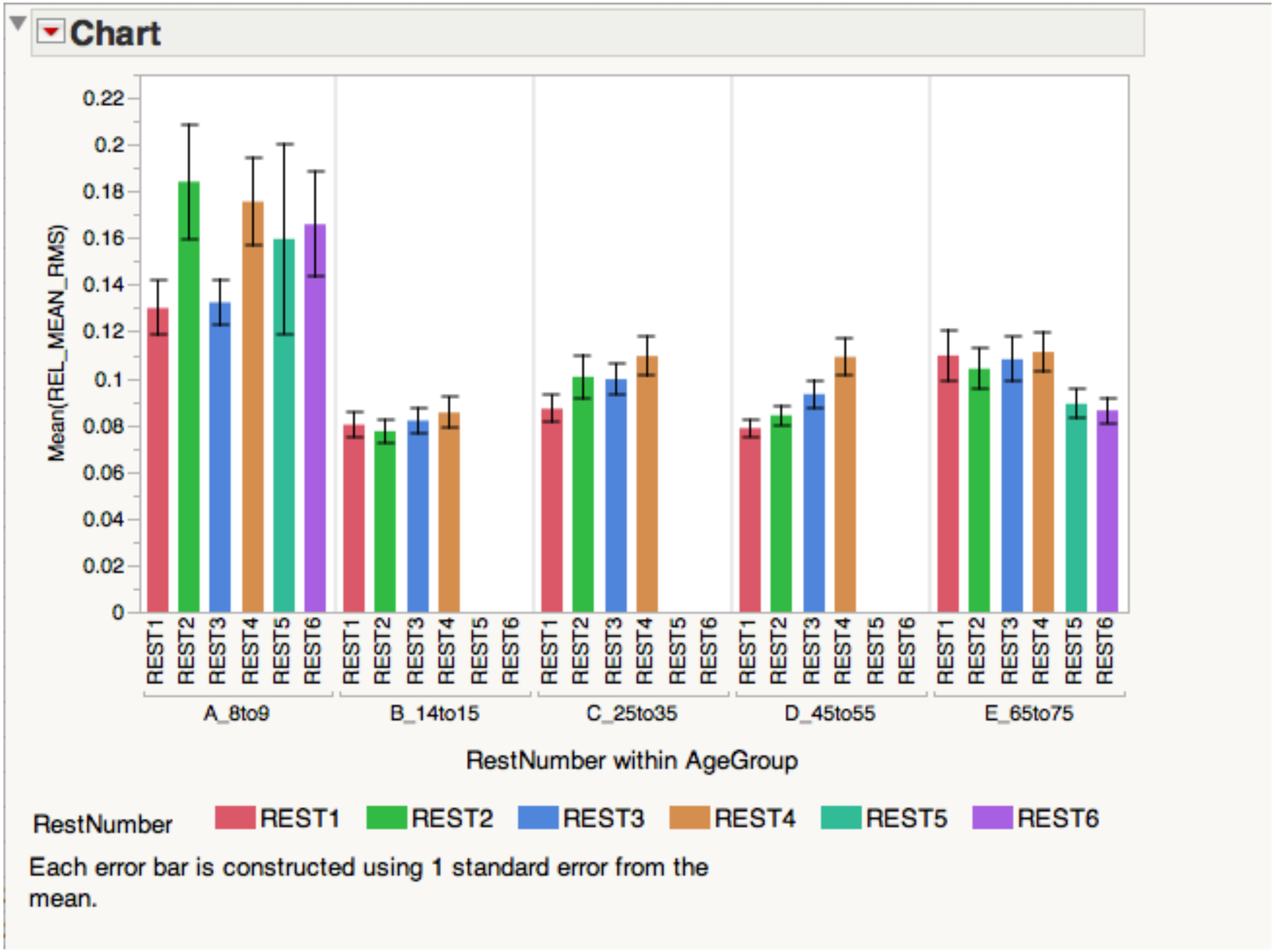
Resting State fMRI

Movement in 15 min vs 5 min Resting State Acquisitions



This figure plots the amount of movement across the first 15 minutes of resting state scanning on each day for the main HCP protocol (i.e., dividing the first 15-minute acquisition into 5 minute chunks) and the HCP-Lifespan (i.e., the first three five minute acquisitions on each day). The movement increases at a steeper slope across time during the continuous 15-minute acquisition for main HCP as compared to the separate 5-minute acquisitions for the HCP-Lifespan supporting the use of shorter acquisitions for this purpose.

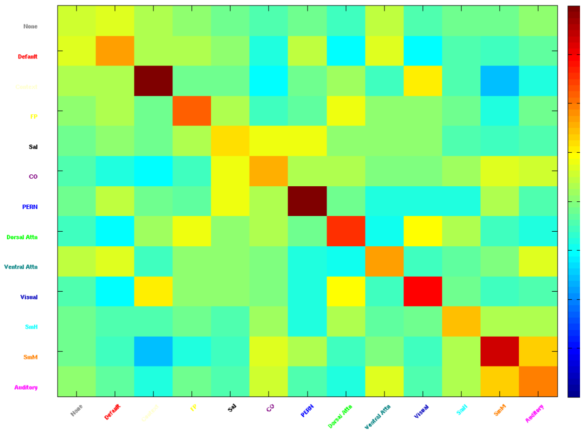
Movement in Resting State Data



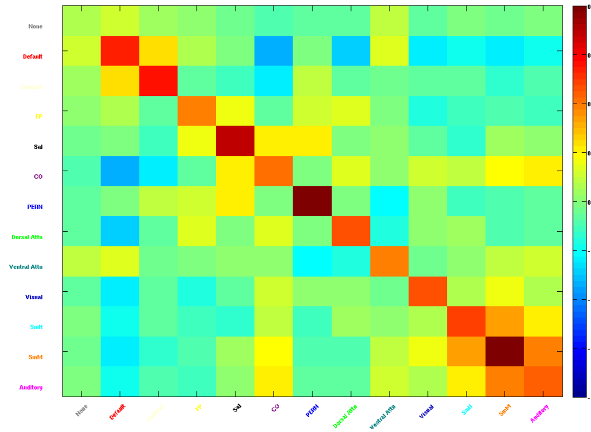
Main Effect of AGE = *p<.0001 = Due to the 8-9 year olds*

Network-Wise Connectivity Matrices with Age

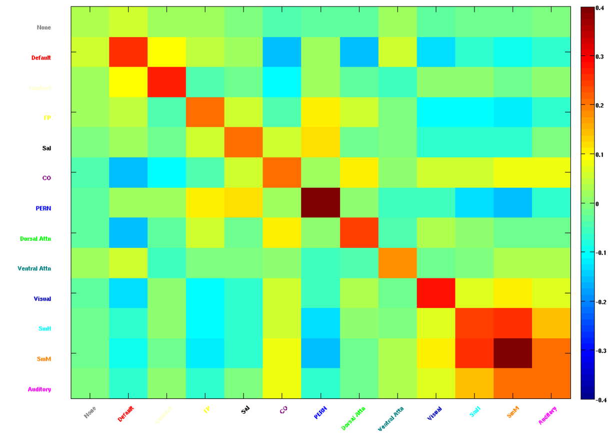
8-9 Year olds



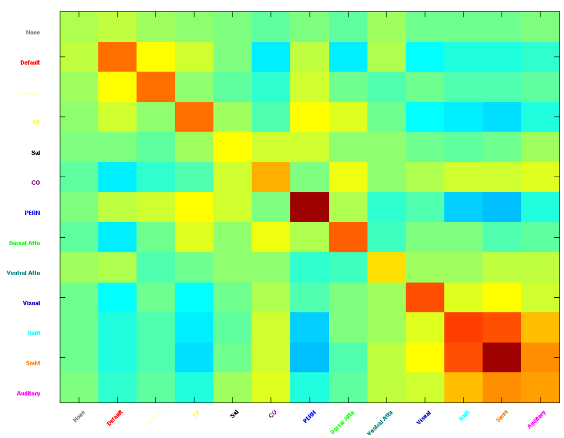
14-15 Year olds



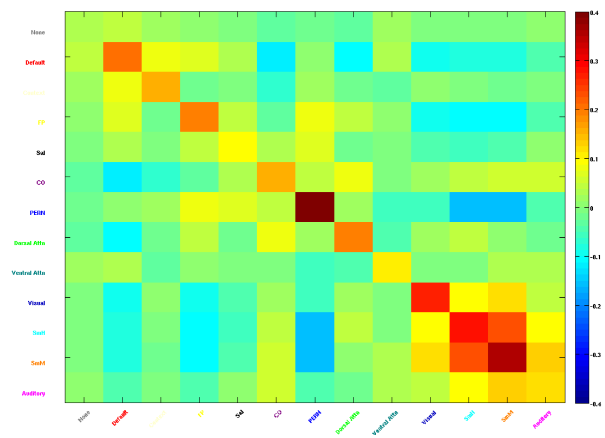
25-35 Year olds



45-55 Year olds

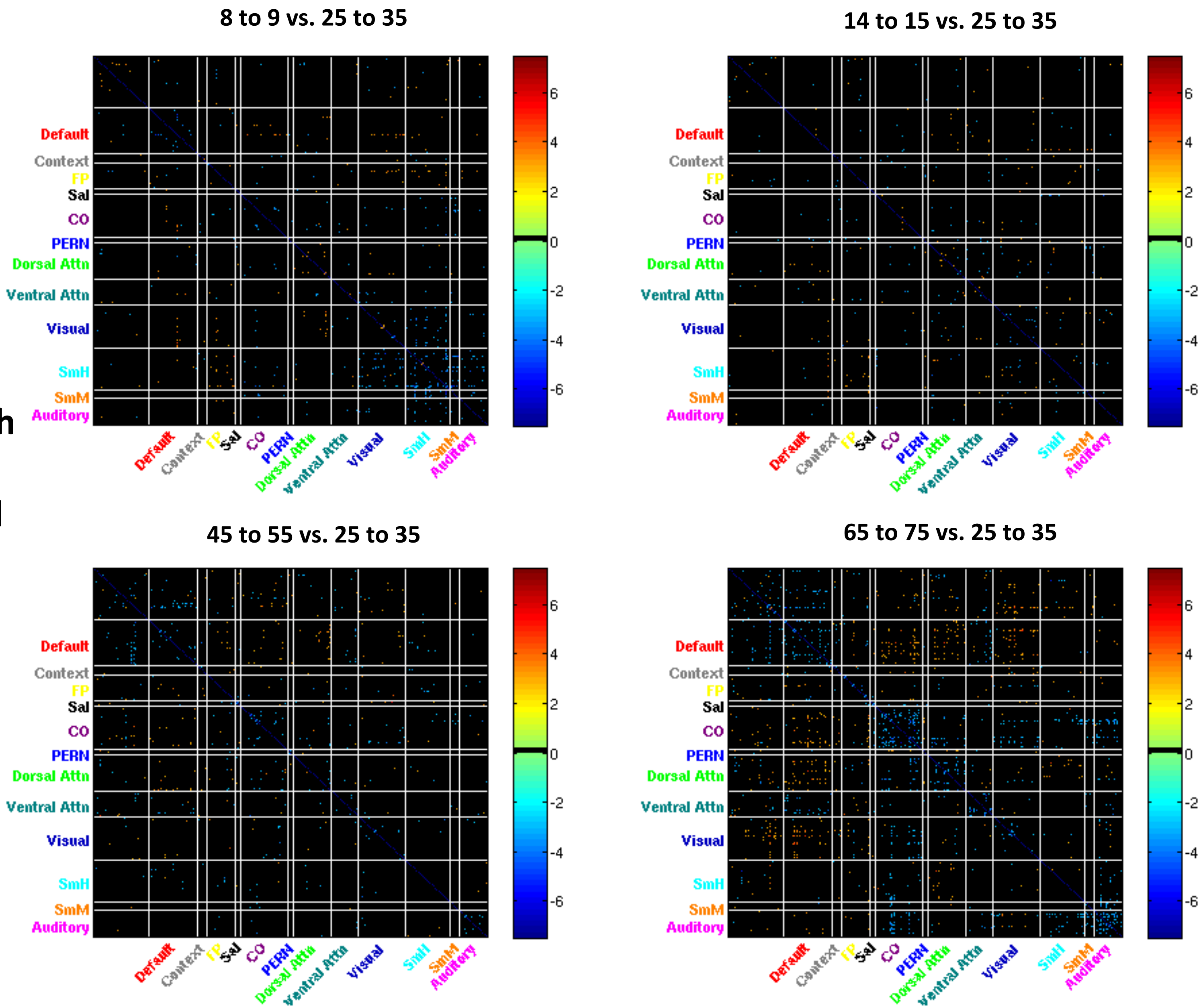


65-75 Year olds



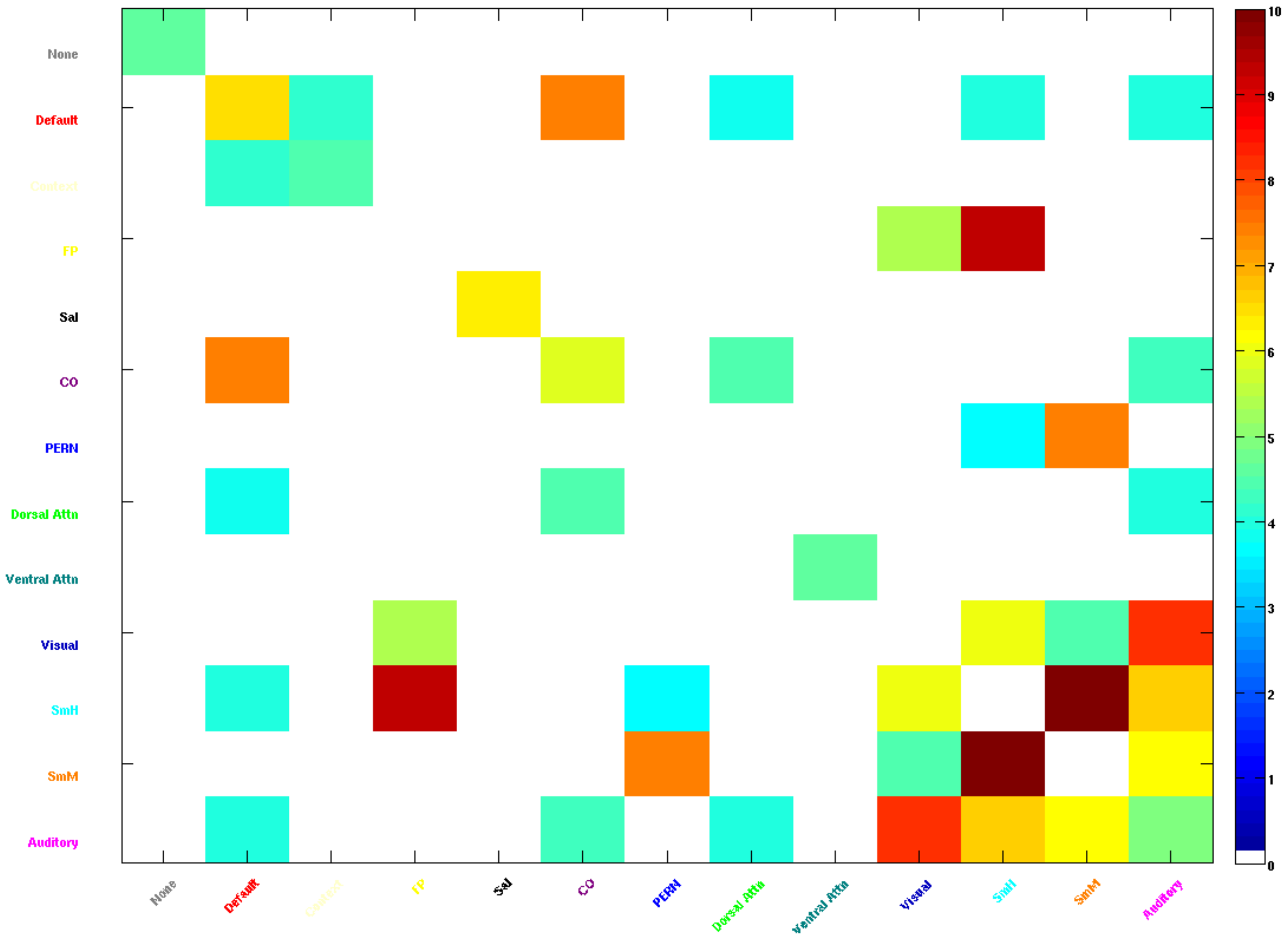
Parcel-wise Age Effects

T-tests comparing ages on each parcel, thresholded at p<.01



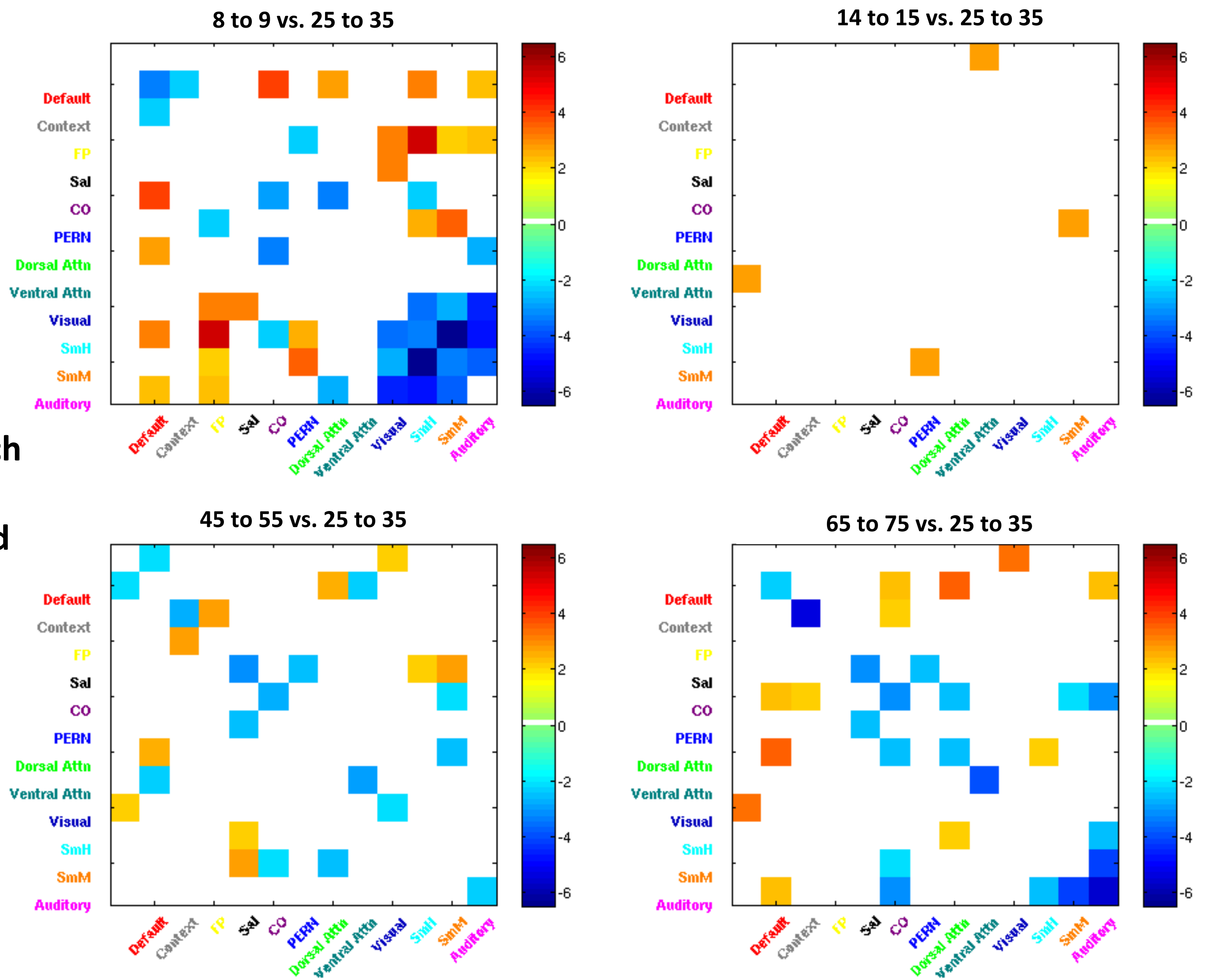
Network Based Analyses

ANOVAs by Network Connection – Age as the between subject factor: Colors are based on scale of F-statistics, threshholded at *p*<.01

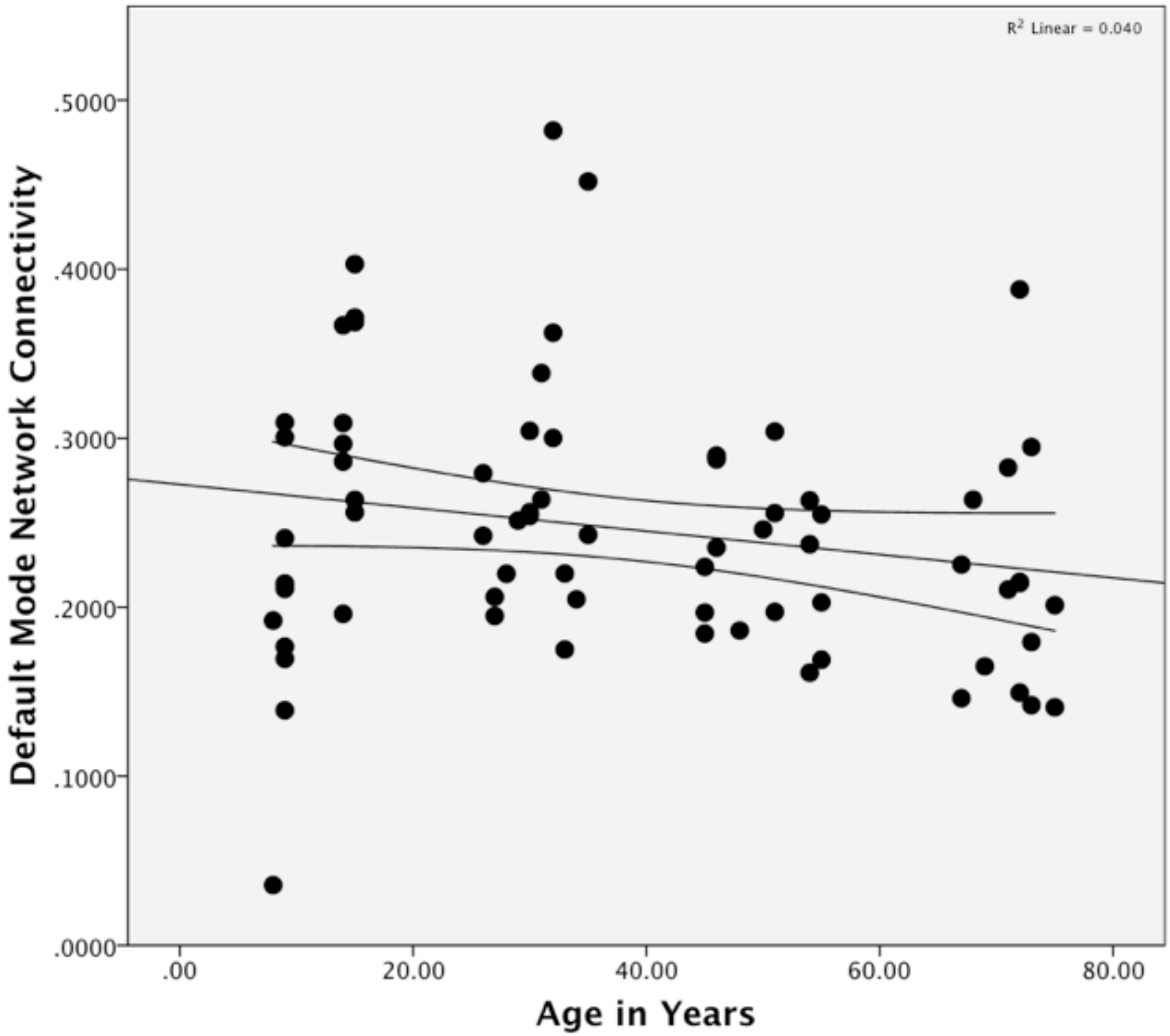


Network Based Analyses

T-tests comparing ages on each network, thresholded at $p < .01$



Within Default Mode Network Connectivity

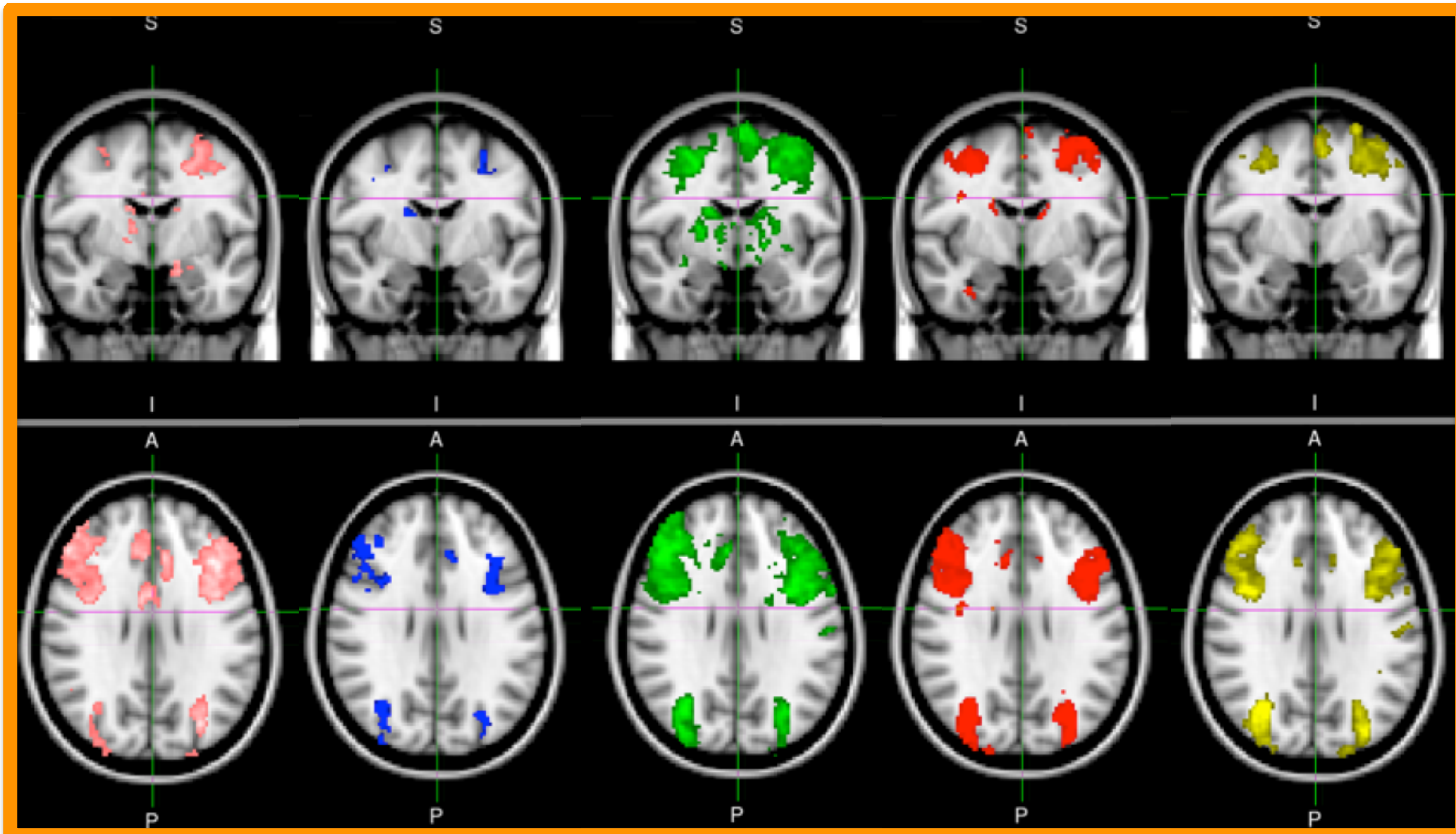


Task fMRI

Whole Brain Voxel-Wise – N Back

Whole brain cluster corrected to *p*<.05, voxel-wise Z = 2.5

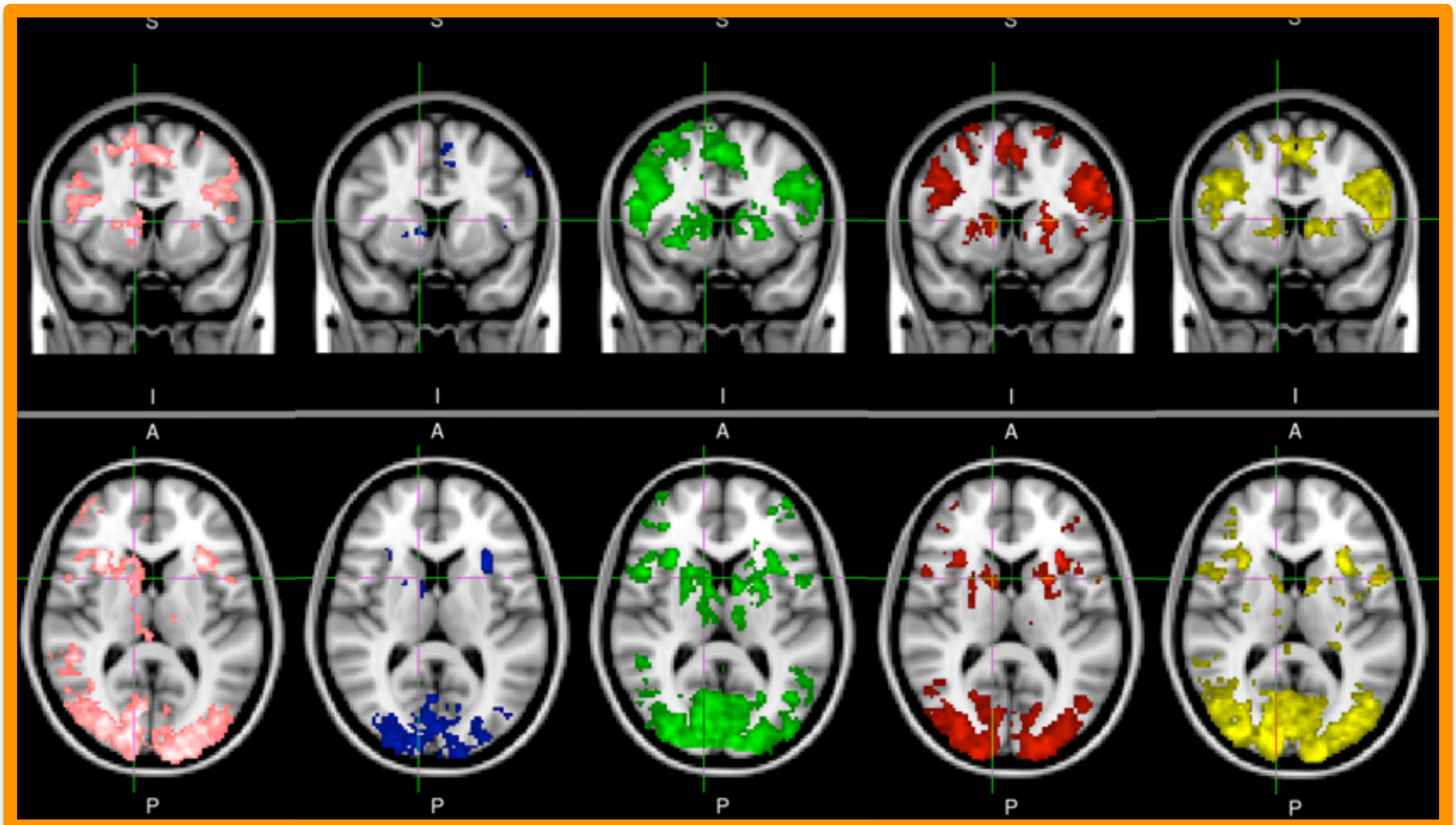
8 to 9	14 to 15	25 to 35	45-55	65 to 75



Whole Brain Voxel-Wise – Gambling

Whole brain cluster corrected to *p*<.05, voxel-wise Z = 2.5

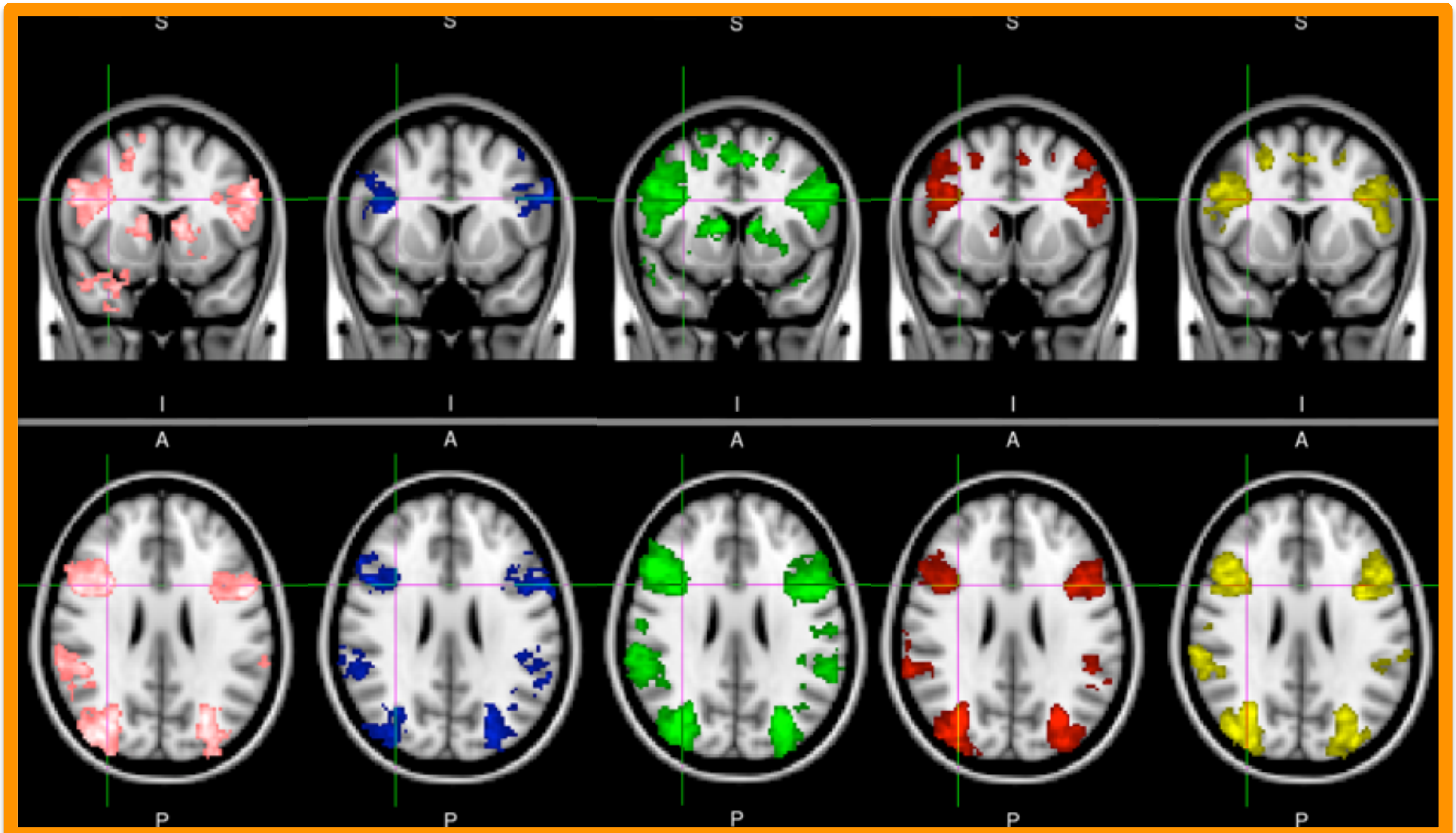
8 to 9 | 14 to 15 | 25 to 35 | 45-55 | 65 to 75



Whole Brain Voxel-Wise – Social Cognition

Whole brain cluster corrected to *p*<.05, voxel-wise Z = 2.5

8 to 9 | 14 to 15 | 25 to 35 | 45-55 | 65 to 75



Age Effects During Social Cognition