Brainhack Padova 2020

Project title   **Association of Microstructural White Matter and Personality Traits based on Human Connectome Project dataset**

Group Members:

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Background and Motivation

medium to large association

Human Connectome Project Database

weak association

NeuroImage
Volume 220, 15 October 2020, 117067
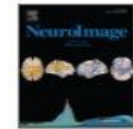
Personality and local brain structure: Their shared genetic basis and reproducibility

Sofie L. Valk [a, b, c], Felix Hoffstaedter [a, b], Julia A. Camilleri [a, b], Peter Kochunov [d], B.T. Thomas Yeo [e, f, g], Simon B. Eickhoff [a, b]

NeuroImage
Volume 220, 15 October 2020, 117092

Little evidence for associations between the Big Five personality traits and variability in brain gray or white matter

Reut Avinun [a, b], Salomon Israel [b], Annchen R. Knodt [a], Ahmad R. Hariri [a]

What We Did in BrainHack

Projection · Association · Commissural
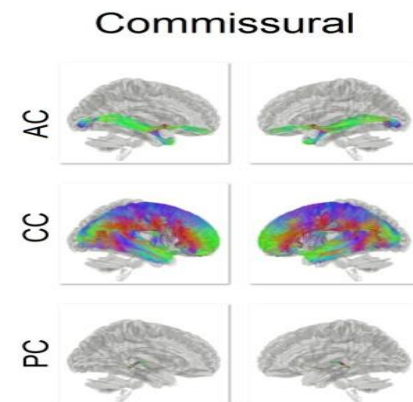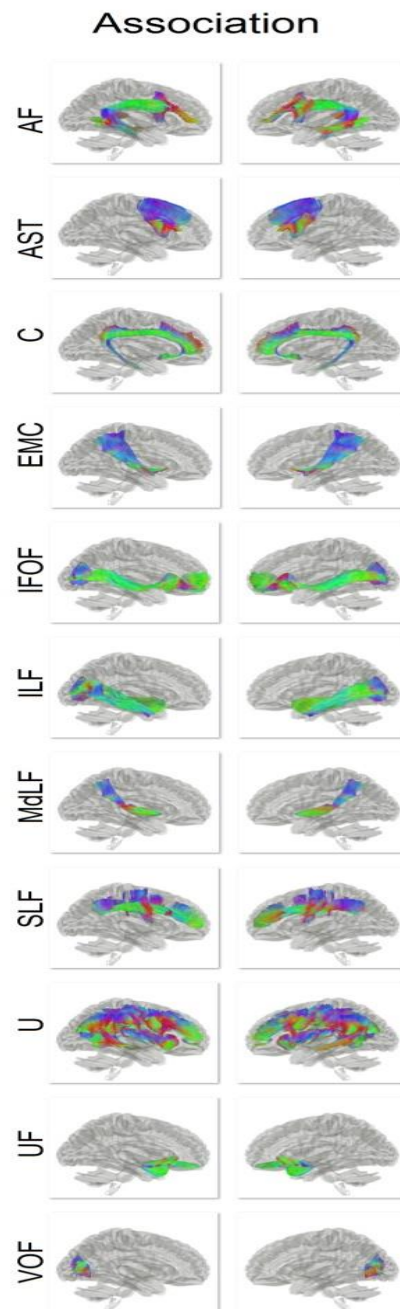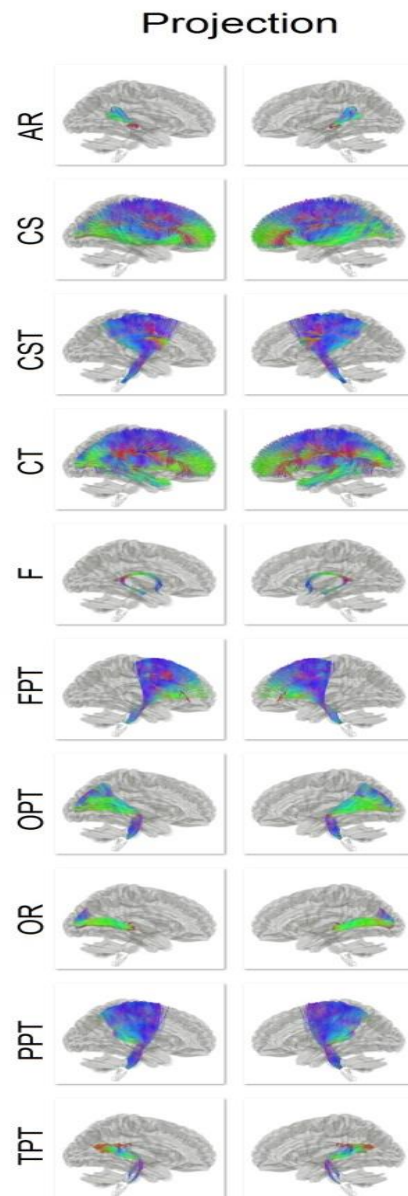
Diffusion Measures of Tractography of 68 fibers

- Quantitative Anisotropy (QA)
- Normalized QA
- Fractional Anisotropy (FA)
- Mean Diffusivity
- Axial Diffusivity
- Radial Diffusivity
- Generalized FA

First Step Analysis

- Linear Regression Analysis (Pvalue <0.0007)

Right Cingulum Parahippocampal

Right Uncinate Fasciculus
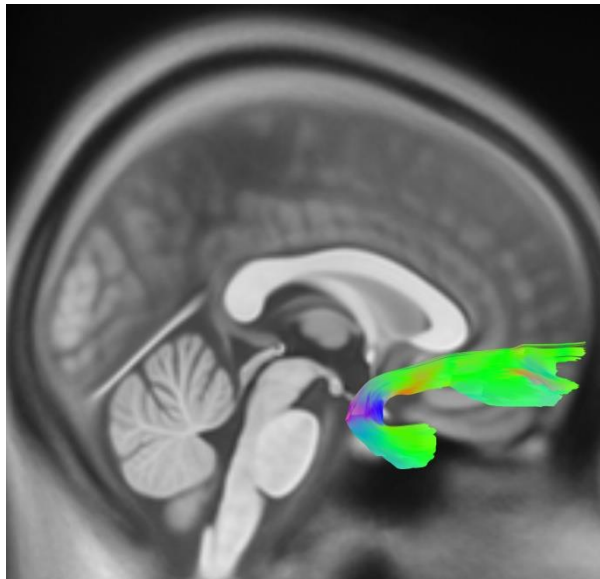
Right & Left
Inferior Cerebellar Peduncle

Neuroticism

Agreeableness

First Step Analysis

- Linear Regression Analysis (Pvalue <0.0007)

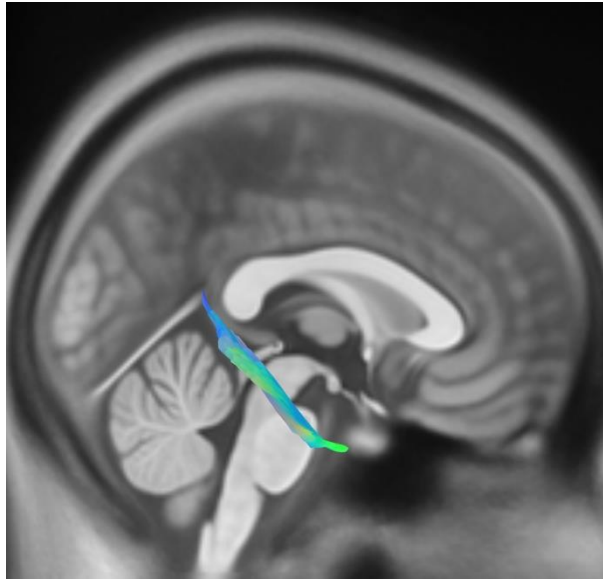|	Slope coefficient	P-value	R2
Tract: Cingulum_Parahippocampal_R, Variables: Agreeableness vs md	0.16 +- 0.05	0.0006	2.69 %
Tract: Cingulum_Parahippocampal_R, Variables: Agreeableness vs ad	0.17 +- 0.05	0.0004	2.82 %
Tract: Inferior_Cerebellar_Peduncle_L, Variables: Neuroticism vs nqa	0.17 +- 0.05	0.0005	2.80 %
Tract: Inferior_Cerebellar_Peduncle_R, Variables: Neuroticism vs nqa	0.17 +- 0.05	0.0006	2.73 %
Tract: Uncinate_Fasciculus_R, Variables: Neuroticism vs nqa	0.16 +- 0.05	0.0006	2.71 %

First Step Analysis

- Linear Regression Analysis (Pvalue <0.0007)

	Slope coefficient	P-value	R2
Tract: Cingulum_Parahippocampal_R, Variables: Agreeableness vs md	0.16 +- 0.05	0.0006	2.69 %
Tract: Cingulum_Parahippocampal_R, Variables: Agreeableness vs ad	0.17 +- 0.05	0.0004	2.82 %
Tract: Inferior_Cerebellar_Peduncle_L, Variables: Neuroticism vs nqa	0.17 +- 0.05	0.0005	2.80 %
Tract: Inferior_Cerebellar_Peduncle_R, Variables: Neuroticism vs nqa	0.17 +- 0.05	0.0006	2.73 %
Tract: Uncinate_Fasciculus_R, Variables: Neuroticism vs nqa	0.16 +- 0.05	0.0006	2.71 %

Second Step Analysis

- Sex Differences Analysis (Female) (Pvalue < 0.007)

Openness to experience (Right)

- Cingulum

  Parahippocampal

- Corticostriatal Tract

  Posterior

- Vertical Occipital
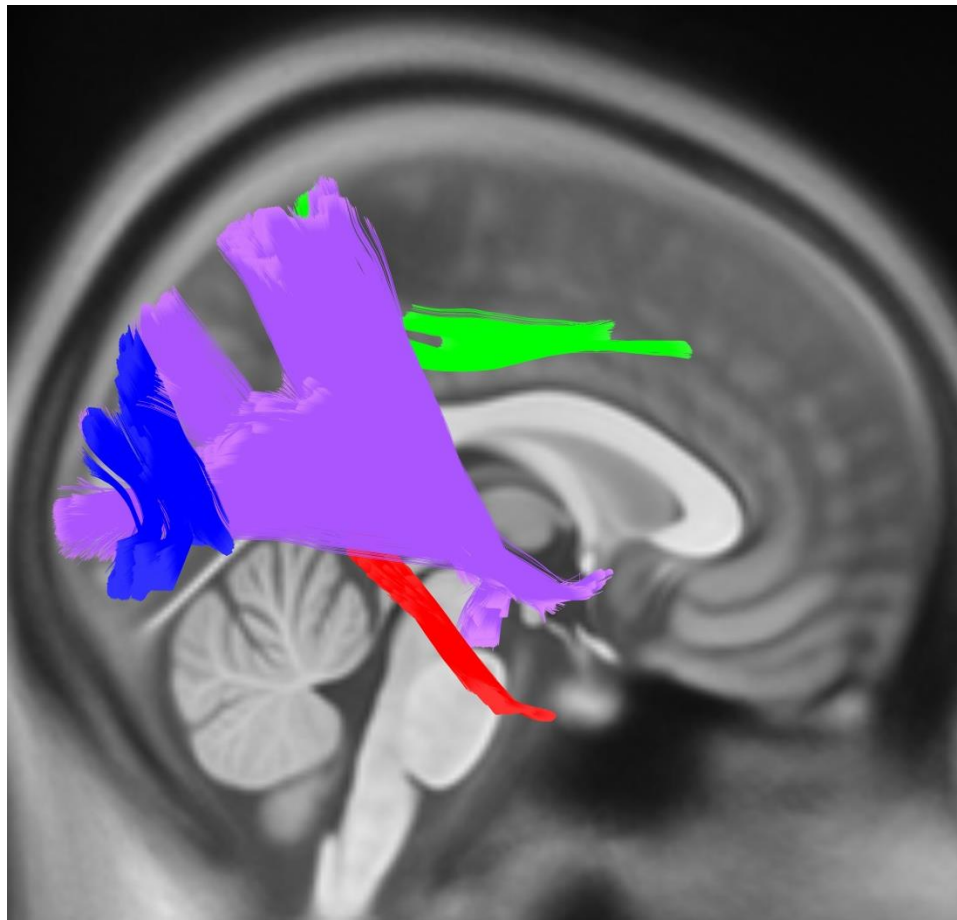
  Fasciculus

- Superior Longitudinal

  Fasciculus1

Second Step Analysis

- Sex Differences Analysis (Female) (Pvalue < 0.007)

Openness to experience (Left)

- Corticopontine Tract
  (Occipital)

- Corticopontine Tract
  (Parietal)

- Inferior Fronto -
  Occipital Fasciculus

- Superior Longitudinal
  Fasciculus1
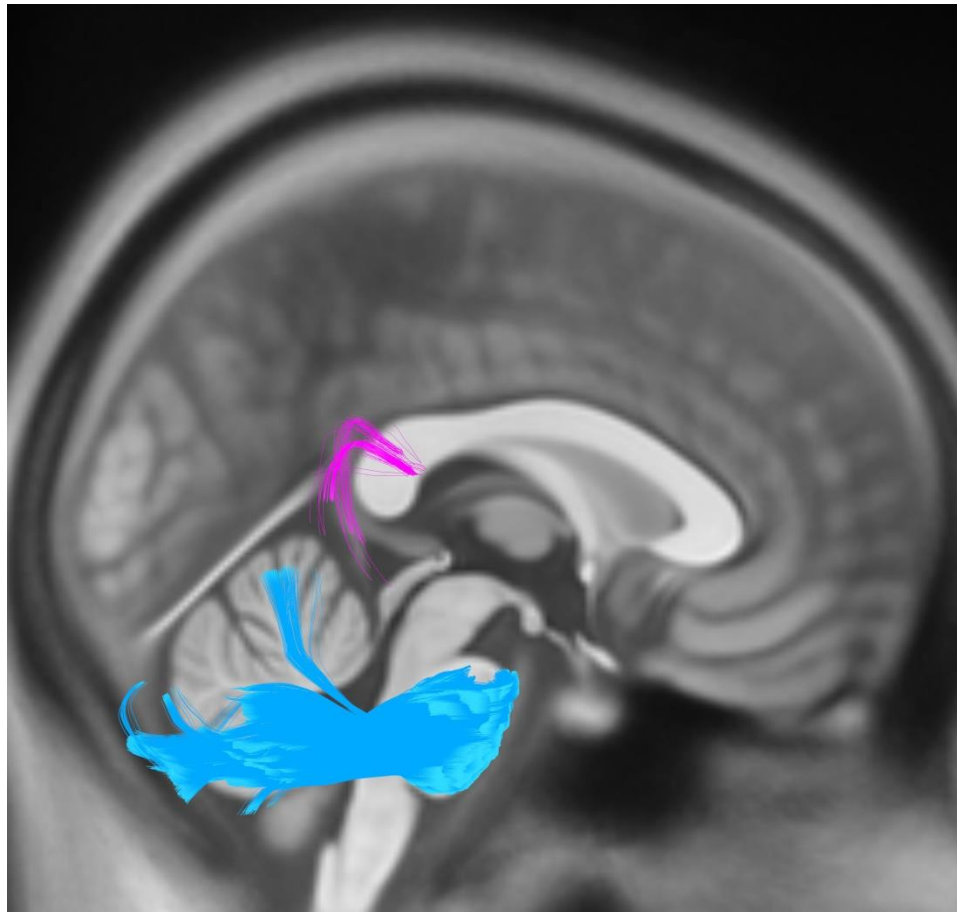
- Superior Longitudinal
  Fasciculus3
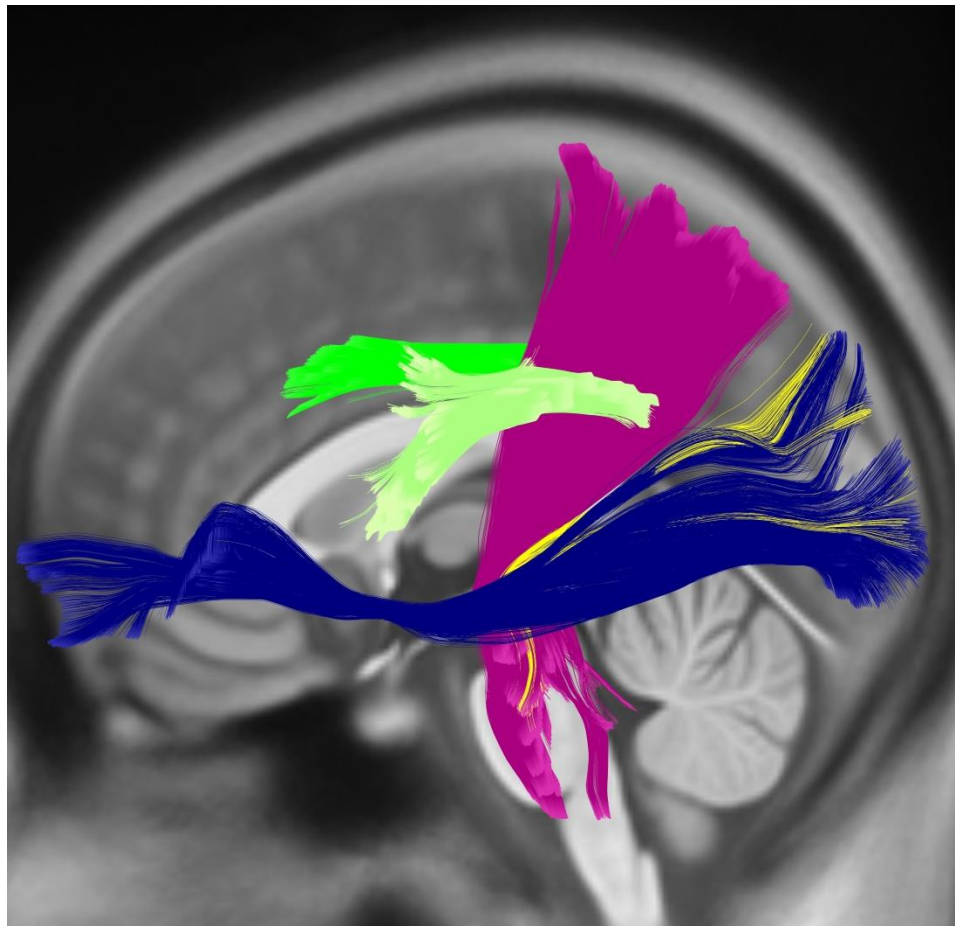
Second Step Analysis

- Sex Differences Analysis (Female) (Pvalue < 0.007)

Openness to experience (interhemispheric)

- Middle Cerebral
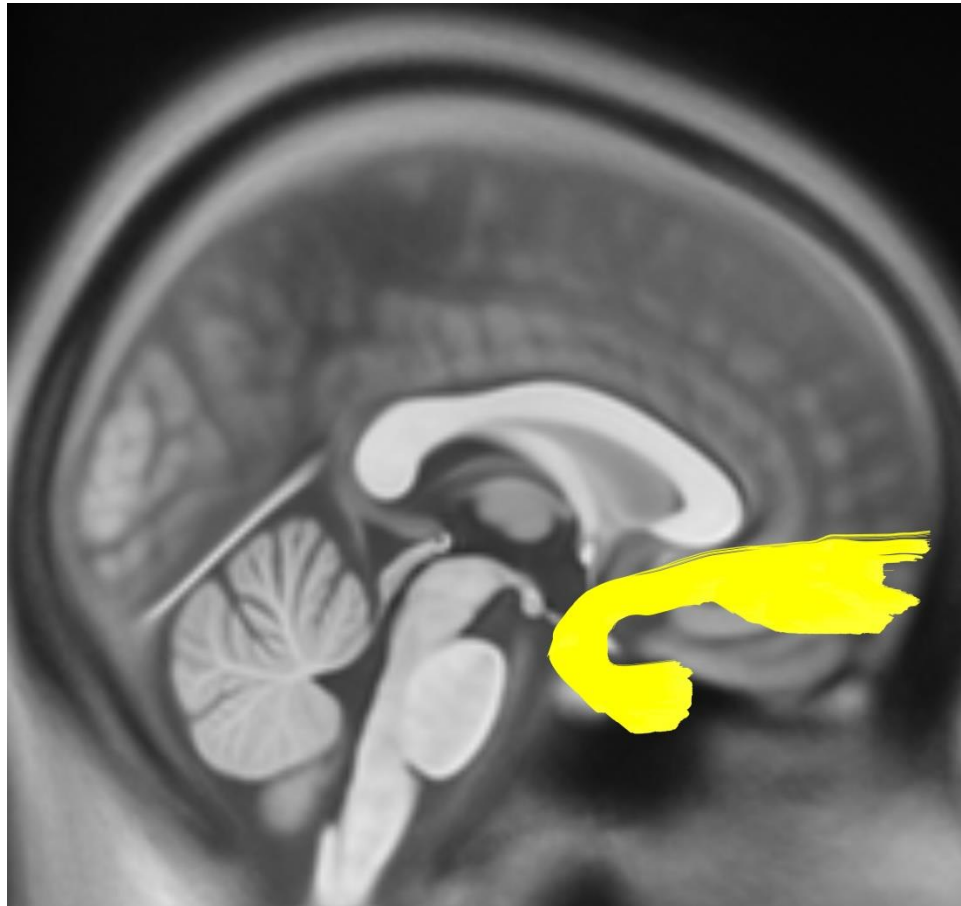 Peduncle

- Corpus Callosum
  (Tapetum)

Second Step Analysis

- Sex Differences Analysis (Female) (Pvalue < 0.007)
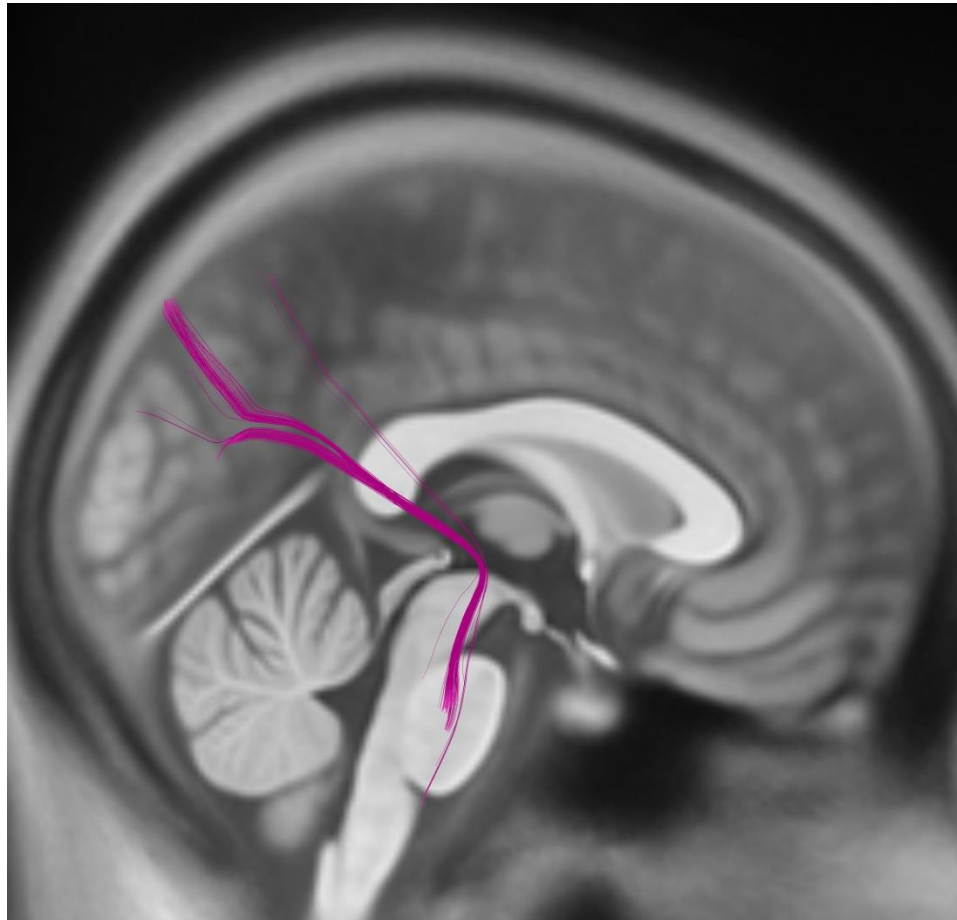
Neuroticism

Uncinate Fasciculus

Second Step Analysis

- Sex Differences Analysis (Female) (Pvalue < 0.007)

	Slope coefficient	P-value	R2
Tract: Cingulum_Parahippocampal_R, Variables: Openness to experience vs gfa	0.18 +- 0.06	0.0053	3.20 %
Tract: Corpus_Callosum_Tapetum, Variables: Openness to experience vs dti_fa	0.21 +- 0.07	0.0028	4.34 %
Tract: Corticopontine_Tract_Occipital_L, Variables: Openness to experience vs dti_fa	0.24 +- 0.07	0.0005	5.69 %
Tract: Corticopontine_Tract_Occipital_L, Variables: Openness to experience vs gfa	0.20 +- 0.07	0.0029	4.19 %
Tract: Corticopontine_Tract_Parietal_L, Variables: Openness to experience vs dti_fa	0.19 +- 0.06	0.0032	3.56 %
Tract: Corticopontine_Tract_Parietal_L, Variables: Openness to experience vs gfa	0.18 +- 0.06	0.004	3.40 %
Tract: Corticostriatal_Tract_Posterior_R, Variables: Openness to experience vs gfa	0.18 +- 0.06	0.0055	3.17 %
Tract: Inferior_Fronto_Occipital_Fasciculus_L, Variables: Openness to experience vs dti_fa	0.19 +- 0.06	0.0029	3.64 %
Tract: Middle_Cerebellar_Peduncle, Variables: Openness to experience vs dti_fa	0.18 +- 0.06	0.0053	3.20 %
Tract: Middle_Cerebellar_Peduncle, Variables: Openness to experience vs gfa	0.18 +- 0.06	0.0059	3.12 %
Tract: Superior_Longitudinal_Fasciculus1_L, Variables: Openness to experience vs ad	0.20 +- 0.06	0.0023	3.82 %
Tract: Superior_Longitudinal_Fasciculus1_R, Variables: Openness to experience vs dti_fa	0.18 +- 0.06	0.0051	3.22 %
Tract: Superior_Longitudinal_Fasciculus3_L, Variables: Openness to experience vs ad	0.19 +- 0.06	0.0036	3.47 %
Tract: Uncinate_Fasciculus_R, Variables: Neuroticism vs nqa	0.19 +- 0.06	0.003	3.61 %
Tract: Vertical_Occipital_Fasciculus_R, Variables: Openness to experience vs ad	0.19 +- 0.06	0.0032	3.56 %

Second Step Analysis

- Sex Differences Analysis (Male) (Pvalue < 0.007)
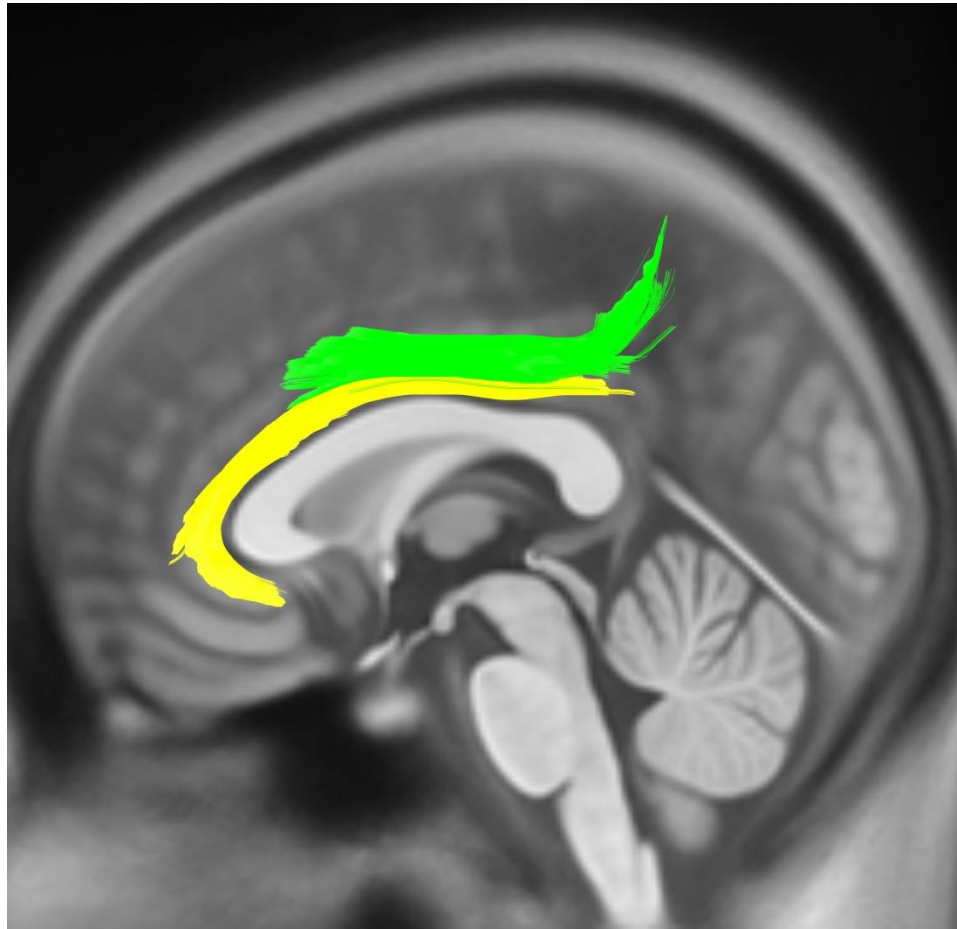
Neuroticism (Right)

Corticopontine Tract
(Occipital)

Second Step Analysis

- Sex Differences Analysis (Male) (Pvalue < 0.007)

Neuroticism (Left)

- Cingulum

  Rarolfactory

- Superior Longitudinal

  Fasciculus1

Second Step Analysis

- Sex Differences Analysis (Male) (Pvalue < 0.007)

- Inferior Longitudinal Fasciculus

Conscientiousness
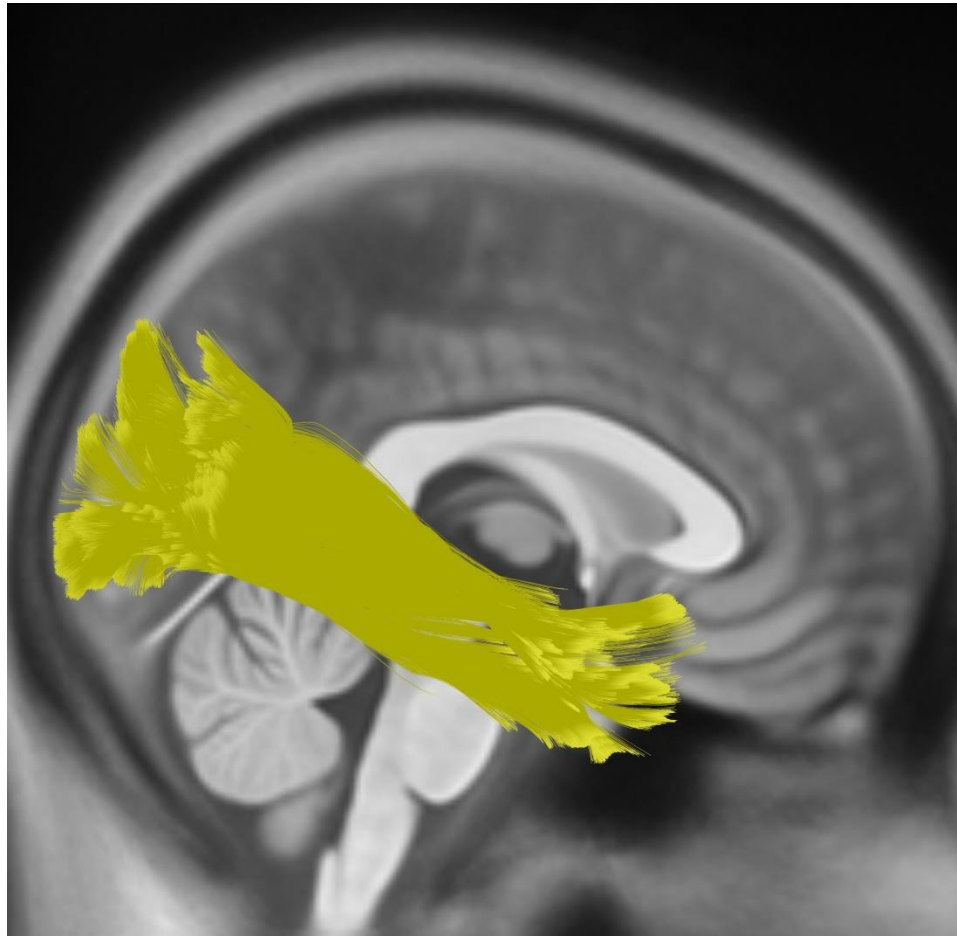
Second Step Analysis

- Sex Differences Analysis (Male) (Pvalue < 0.007)

	Slope coefficient	P-value	R2
Tract: Cingulum_Rarolfactory_L, Variables: Neuroticism vs md	-0.22 +- 0.07	0.0022	4.82 %
Tract: Cingulum_Rarolfactory_L, Variables: Neuroticism vs rd	-0.21 +- 0.07	0.0034	4.42 %
Tract: Corticopontine_Tract_Occipital_R, Variables: Neuroticism vs dti_fa	0.22 +- 0.08	0.0067	4.80 %
Tract: Inferior_Longitudinal_Fasciculus_R, Variables: Neuroticism vs rd	0.19 +- 0.07	0.0067	3.80 %
Tract: Superior_Longitudinal_Fasciculus1_L, Variables: Neuroticism vs md	-0.20 +- 0.07	0.0065	3.83 %
Tract: Superior_Longitudinal_Fasciculus1_L, Variables: Neuroticism vs rd	-0.20 +- 0.07	0.0047	4.12 %

Third Step Analysis

- **Shape Analysis**

Bundle analytics, a computational framework for investigating the shapes and profiles of brain pathways across populations

Bramsh Qamar Chandio ✉, Shannon Leigh Risacher, Franco Pestilli, Daniel Bullock, Fang-Cheng Yeh, Serge Koudoro, Ariel Rokem, Jaroslaw Harezlak & Eleftherios Garyfallidis
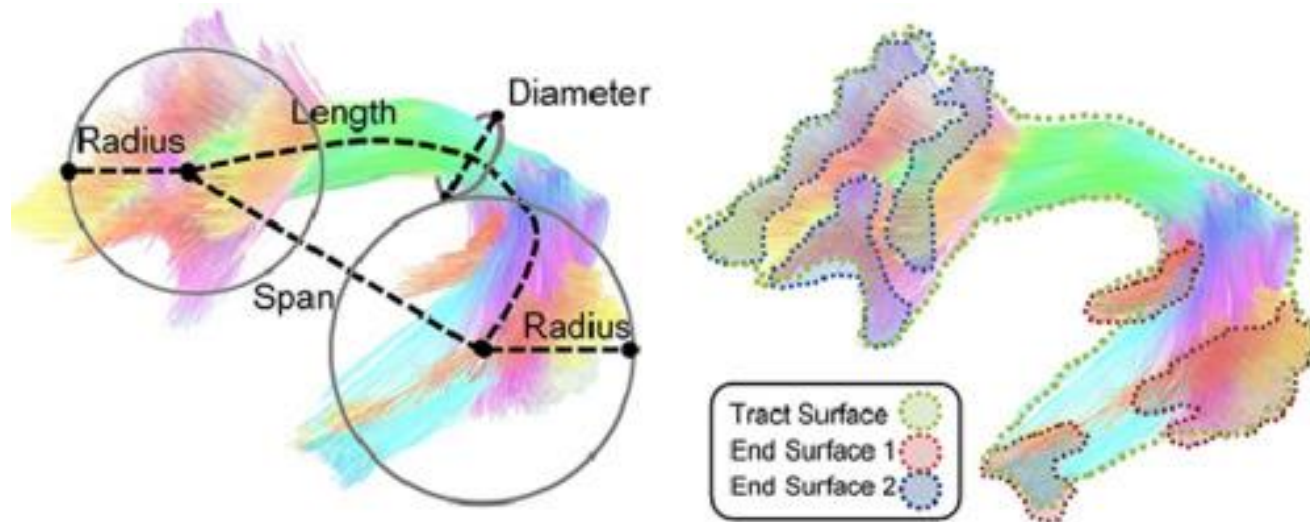
Shape analysis of the human association pathways

Fang-Cheng Yeh [a, b] ✉

Third Step Analysis

- **Shape Analysis**

Third Step Analysis

	Slope coefficient	P-value	R2
Tract: Cingulum_Frontal_Parietal_R, Variables: Openness to experience vs area of end region 1(mm^2)	0.17 +- 0.05	0.0005	2.80 %
Tract: Corticobulbar_Tract_R, Variables: Agreeableness vs total area of end regions(mm^2)	-0.18 +- 0.05	0.0002	3.24 %
Tract: Corticostriatal_Tract_Anterior_L, Variables: Agreeableness vs area of end region 1(mm^2)	-0.16 +- 0.05	0.0006	2.68 %
Tract: Corticostriatal_Tract_Anterior_R, Variables: Agreeableness vs trunk volume(mm^3)	-0.18 +- 0.05	0.0001	3.32 %
Tract: Corticostriatal_Tract_Anterior_R, Variables: Agreeableness vs total area of end regions(mm^2)	-0.16 +- 0.05	0.0007	2.64 %
Tract: Corticostriatal_Tract_Posterior_R, Variables: Openness to experience vs diameter(mm)	0.16 +- 0.05	0.0006	2.68 %
Tract: Corticostriatal_Tract_Posterior_R, Variables: Openness to experience vs total surface area(mm^2)	0.17 +- 0.05	0.0003	2.93 %
Tract: Corticostriatal_Tract_Posterior_R, Variables: Openness to experience vs total area of end regions(mm^2)	0.16 +- 0.05	0.0007	2.65 %
Tract: Corticostriatal_Tract_Posterior_R, Variables: Openness to experience vs irregularity	0.16 +- 0.05	0.0006	2.67 %
Tract: Corticostriatal_Tract_Posterior_R, Variables: Openness to experience vs area of end region 1(mm^2)	0.17 +- 0.05	0.0003	3.06 %
Tract: Corticostriatal_Tract_Superior_R, Variables: Agreeableness vs area of end region 2(mm^2)	-0.17 +- 0.05	0.0004	2.89 %
Tract: Inferior_Fronto_Occipital_Fasciculus_L, Variables: Openness to experience vs diameter(mm)	0.18 +- 0.05	0.0001	3.37 %
Tract: Inferior_Fronto_Occipital_Fasciculus_L, Variables: Openness to experience vs volume(mm^3)	0.21 +- 0.05	0	4.47 %
Tract: Inferior_Fronto_Occipital_Fasciculus_L, Variables: Openness to experience vs trunk volume(mm^3)	0.17 +- 0.05	0.0003	2.94 %
Tract: Inferior_Fronto_Occipital_Fasciculus_L, Variables: Openness to experience vs total surface area(mm^2)	0.19 +- 0.05	0.0001	3.60 %
Tract: Inferior_Fronto_Occipital_Fasciculus_L, Variables: Openness to experience vs total area of end regions(mm^2)	0.21 +- 0.05	0	4.51 %
Tract: Inferior_Fronto_Occipital_Fasciculus_L, Variables: Openness to experience vs area of end region 2(mm^2)	0.19 +- 0.05	0.0001	3.66 %
Tract: Inferior_Fronto_Occipital_Fasciculus_R, Variables: Openness to experience vs total surface area(mm^2)	0.16 +- 0.05	0.0006	2.68 %
Tract: Inferior_Fronto_Occipital_Fasciculus_R, Variables: Openness to experience vs total area of end regions(mm^2)	0.19 +- 0.05	0.0001	3.60 %
Tract: Inferior_Fronto_Occipital_Fasciculus_R, Variables: Openness to experience vs area of end region 2(mm^2)	0.17 +- 0.05	0.0004	2.91 %
Tract: Inferior_Longitudinal_Fasciculus_R, Variables: Openness to experience vs radius of end region 2(mm)	0.17 +- 0.05	0.0005	2.80 %
Tract: Parietal_Aslant_Tract_L, Variables: Agreeableness vs elongation	-0.18 +- 0.05	0.0001	3.40 %
Tract: Parietal_Aslant_Tract_L, Variables: Agreeableness vs diameter(mm)	0.17 +- 0.05	0.0005	2.77 %
Tract: Superior_Longitudinal_Fasciculus1_R, Variables: Neuroticism vs total area of end regions(mm^2)	-0.16 +- 0.05	0.0006	2.67 %
Tract: Superior_Longitudinal_Fasciculus1_R, Variables: Neuroticism vs area of end region 1(mm^2)	-0.16 +- 0.05	0.0006	2.67 %
Tract: Superior_Longitudinal_Fasciculus2_L, Variables: Openness to experience vs span(mm)	0.18 +- 0.05	0.0002	3.18 %
Tract: Superior_Longitudinal_Fasciculus2_L, Variables: Openness to experience vs curl	-0.16 +- 0.05	0.0006	2.70 %
Tract: Superior_Longitudinal_Fasciculus2_L, Variables: Agreeableness vs total area of end regions(mm^2)	0.18 +- 0.05	0.0002	3.07 %
Tract: Superior_Longitudinal_Fasciculus2_L, Variables: Agreeableness vs area of end region 1(mm^2)	0.21 +- 0.05	0	4.52 %
Tract: Superior_Longitudinal_Fasciculus2_L, Variables: Openness to experience vs area of end region 1(mm^2)	0.17 +- 0.05	0.0005	2.81 %

What is next step

- Writing a Paper (re-analysis of statistical tests/ use twins/sibling data as retest)

- Create a study group to investigate other neuropsychological/behavioral tests in HCP and other databases

Thank you for your attention