Supplementary Materials1 for

**Microstructural asymmetries of the planum temporale predict functional lateralization of auditory-language processing**

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**This file includes:**

supplementary file 1a-1j

Supplementary file 1a. Group-level hemispheric asymmetry of PT functional and structural measures

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **L1/R1** | | | **L1/R2** | | | | **L2/R1** | | | **L2/R2** | | | |
| *T* | *PFWE* | *Cohen’s d* | | *T* | *PFWE* | *Cohen’s d* | *T* | *PFWE* | *Cohen’s d* | | *T* | *PFWE* | *Cohen’s d* |
| **Speech perception** | **6.82** | **<.001\*** | **0.35** | | **5.55** | **<.001\*** | **0.52** | -1.29 | >.99 | -0.10 | | 1.40 | >.99 | 0.26 |
| **Speech comprehension** | **6.54** | **<.001\*** | **0.36** | | **6.12** | **<.001\*** | **0.57** | -0.08 | >.99 | -0.12 | | 2.94 | >.99 | 0.12 |
| **Surface area** | **6.83** | **<.001\*** | **0.42** | | **14.4** | **<.001\*** | **1.48** | -2.06 | >.99 | **-**0.25 | | **4.88** | **<.001\*** | **0.73** |
| **Thickness** | **-10.0** | **<.001\*** | **-0.53** | | -3.08 | 0.06 | -0.30 | **-4.39** | **<.001\*** | **-0.44** | | -3.58 | 0.01 | -0.49 |
| **Myelin content** | -0.99 | >.99 | -0.05 | | **5.97** | **<.001\*** | **0.58** | **-6.50** | **<.001\*** | **-0.68** | | 2.67 | 0.23 | 0.36 |
| **NDI** | **-4.43** | **<.001\*** | **-0.21** | | **4.26** | **<.001\*** | **0.40** | **-4.83** | **<.001\*** | **-0.48** | | 2.59 | 0.29 | 0.30 |
| **ODI** | **26.7** | **<.001\*** | **1.65** | | **15.8** | **<.001\*** | **1.71** | **8.69** | **<.001\*** | **1.03** | | **9.17** | **<.001\*** | **1.49** |

*PFWE*, corrected *P* value after Bonferroni correction; \*, significant hemispheric asymmetry between the left and right PTs; L1/R1, single HG on the left and single HG on the right; L1/R2, single HG on the left and duplicated HG on the right; L2/R1, duplicated HG on the left and single HG on the right; L2/R2, duplicated HG on the left and duplicated HG on the right; NDI, neurite density index; ODI, orientation dispersion index.

Supplementary file 1b. The interaction effect of “PT structural AI × HG gyrification pattern” on PT nonspeech-related functional AIs (the first specificity analysis)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Working memory** | | **Incentive processing** | | **Emotion processing** | | **Social cognition** | | **Motor** | | **Relational processing** | |
|  | *F* | *PFWE* | *F* | *PFWE* | *F* | *PFWE* | *F* | *PFWE* | *F* | *PFWE* | *F* | *PFWE* |
| **Surface area** | 6.54 | 0.32 | 0.68 | >.99 | 3.94 | >.99 | 0.13 | >.99 | 0.20 | >.99 | 0.04 | >.99 |
| **Thickness** | 2.06 | >.99 | 0.00 | >.99 | 0.45 | >.99 | 1.06 | >.99 | 0.80 | >.99 | 0.20 | >.99 |
| **Myelin content** | 0.03 | >.99 | 2.86 | >.99 | 0.69 | >.99 | 0.01 | >.99 | 0.19 | >.99 | 0.53 | >.99 |
| **NDI** | 1.33 | >.99 | 0.84 | >.99 | 0.01 | >.99 | 0.28 | >.99 | 0.03 | >.99 | 0.19 | >.99 |
| **ODI** | 0.32 | >.99 | 0.05 | >.99 | 0.02 | >.99 | 2.24 | >.99 | 0.35 | >.99 | 3.71 | >.99 |

PT, planum temporale; HG, Heschl's gyrus; AI, Asymmetry index; *PFWE*, corrected *P* value after Bonferroni correction; NDI, neurite density index; ODI, orientation dispersion index.

Supplementary file 1c. The correlations of PT structural AIs with PT nonspeech-related functional activation AIs after controlling for the HG gyrification pattern (the first specificity analysis)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Working memory** | | **Incentive processing** | | **Emotion processing** | | **Social cognition** | | **Motor** | | **Relational processing** | |
|  | *R* | *PFWE* | *R* | *PFWE* | *R* | *PFWE* | *R* | *PFWE* | *R* | *PFWE* | *R* | *PFWE* |
| **Surface area** | **0.18** | **<.001\*** | 0.09 | 0.25 | **0.21** | **<.001\*** | 0.05 | >.99 | **0.18** | **<.001\*** | **0.14** | **<.01\*** |
| **Thickness** | 0.03 | >.99 | 0.04 | >.99 | 0.09 | 0.17 | -0.01 | >.99 | -0.08 | 0.55 | -0.01 | >.99 |
| **Myelin content** | 0.01 | >.99 | 0.02 | >.99 | 0.06 | >.99 | 0.04 | >.99 | **-0.11** | **0.04\*** | -0.06 | >.99 |
| **NDI** | 0.08 | 0.64 | -0.02 | >.99 | 0.09 | 0.26 | 0.01 | >.99 | -0.08 | 0.79 | -0.06 | >.99 |
| **ODI** | -0.03 | >.99 | 0.02 | >.99 | -0.02 | >.99 | 0.08 | 0.71 | -0.08 | 0.66 | 0.00 | >.99 |

PT, planum temporale; HG, Heschl's gyrus; AI, Asymmetry index; *PFWE*, corrected *P* value after Bonferroni correction; NDI, neurite density index; ODI, orientation dispersion index. \*, significant correlation between PT functional and structural AIs

Supplementary file 1d. The interaction effect of “PT structural measure × HG gyrification pattern” on PT nonspeech-related functional activation for each hemisphere (the first specificity analysis)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Working memory** | | **Incentive processing** | | **Emotion processing** | | **Social cognition** | | **Motor** | | **Relational processing** | |
|  |  | *F* | *PFWE* | *F* | *PFWE* | *F* | *PFWE* | *F* | *PFWE* | *F* | *PFWE* | *F* | *PFWE* |
| **Left** | **Surface area** | 0.31 | >.99 | 0.81 | >.99 | 4.96 | >.99 | 1.93 | >.99 | 6.30 | 0.74 | 0.00 | >.99 |
| **Thickness** | 0.17 | >.99 | 0.93 | >.99 | 0.20 | >.99 | 0.56 | >.99 | 4.59 | >.99 | 1.04 | >.99 |
| **Myelin content** | 2.03 | >.99 | 2.24 | >.99 | 0.00 | >.99 | 7.06 | 0.48 | 4.23 | >.99 | 0.34 | >.99 |
| **NDI** | 0.79 | >.99 | 0.59 | >.99 | 0.11 | >.99 | 6.02 | 0.86 | 0.02 | >.99 | 0.18 | >.99 |
| **ODI** | 1.27 | >.99 | 0.01 | >.99 | 0.00 | >.99 | 0.15 | >.99 | 4.06 | >.99 | 0.31 | >.99 |
| **Right** | **Surface area** | 0.03 | >.99 | 0.03 | >.99 | 0.31 | >.99 | 0.24 | >.99 | 5.97 | 0.89 | 0.03 | >.99 |
| **Thickness** | 0.73 | >.99 | 1.13 | >.99 | 0.90 | >.99 | 0.03 | >.99 | 1.83 | >.99 | 5.24 | >.99 |
| **Myelin content** | 0.72 | >.99 | 1.14 | >.99 | 4.44 | >.99 | 1.10 | >.99 | **11.93** | **0.03\*** | 1.68 | >.99 |
| **NDI** | 0.06 | >.99 | 0.12 | >.99 | 1.37 | >.99 | 4.59 | >.99 | 2.86 | >.99 | 1.03 | >.99 |
| **ODI** | 0.02 | >.99 | 1.87 | >.99 | 2.53 | >.99 | 2.00 | >.99 | 4.21 | >.99 | 0.18 | >.99 |

PT, planum temporale; HG, Heschl's gyrus; *PFWE*, corrected *P* value after Bonferroni correction; NDI, neurite density index; ODI, orientation dispersion index. \*, the gyrification pattern of HG showed no significant effect on the correlation between functional and structural measures.

Supplementary file 1e. The correlations of PT structural measures with PT nonspeech-related functional activation for each hemisphere after controlling for the HG gyrification pattern (the first specificity analysis)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Working memory** | | **Incentive processing** | | **Emotion processing** | | **Social cognition** | | **Motor** | | **Relational processing** | |
|  |  | *R* | *PFWE* | *R* | *PFWE* | *R* | *PFWE* | *R* | *PFWE* | *R* | *PFWE* | *R* | *PFWE* |
| **Left** | **Surface area** | -0.02 | >.99 | -0.09 | 0.42 | 0.00 | >.99 | 0.01 | >.99 | 0.01 | >.99 | -0.02 | >.99 |
| **Thickness** | -0.03 | >.99 | 0.04 | >.99 | 0.04 | >.99 | 0.04 | >.99 | 0.02 | >.99 | -0.06 | >.99 |
| **Myelin content** | -0.04 | >.99 | 0.02 | >.99 | -0.03 | >.99 | 0.03 | >.99 | -0.05 | >.99 | -0.04 | >.99 |
| **NDI** | 0.06 | >.99 | -0.05 | >.99 | 0.00 | >.99 | -0.03 | >.99 | -0.04 | >.99 | -0.03 | >.99 |
| **ODI** | -0.03 | >.99 | -0.05 | >.99 | -0.10 | 0.42 | 0.03 | >.99 | -0.04 | >.99 | 0.02 | >.99 |
| **Right** | **Surface area** | -0.05 | >.99 | -0.03 | >.99 | -0.05 | >.99 | **-0.12** | **0.02\*** | 0.06 | >.99 | -0.06 | >.99 |
| **Thickness** | 0.05 | >.99 | 0.01 | >.99 | 0.08 | 0.75 | -0.05 | >.99 | -0.01 | >.99 | 0.00 | >.99 |
| **Myelin content** | -0.05 | >.99 | 0.01 | >.99 | 0.02 | >.99 | -0.01 | >.99 | **-0.23** | **<.001\*** | -0.09 | 0.43 |
| **NDI** | 0.00 | >.99 | 0.01 | >.99 | -0.01 | >.99 | 0.00 | >.99 | **-0.14** | **<.01\*** | -0.11 | 0.15 |
| **ODI** | -0.02 | >.99 | 0.03 | >.99 | 0.06 | >.99 | 0.01 | >.99 | **-0.25** | **<.001\*** | 0.00 | >.99 |

PT, planum temporale; HG, Heschl's gyrus; *PFWE*, corrected *P* value after Bonferroni correction; NDI, neurite density index; ODI, orientation dispersion index. \*, significant correlation between PT functional activation and ipsilateral structural measures.

Supplementary file 1f. The interaction effect of “PT structural AI × HG gyrification pattern” on speech-related functional AIs of the entire hemisphere (the second specificity analysis)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | **Entire hemisphere** | | | |
| **Speech perception** | | **Speech comprehension** | |
| *F* | *PFWE* | *F* | *PFWE* |
| **PT** | **Surface area** | 0.10 | >.99 | 0.27 | >.99 |
| **Thickness** | 0.15 | >.99 | 0.02 | >.99 |
| **Myelin content** | 0.10 | >.99 | 2.24 | >.99 |
| **NDI** | 0.05 | >.99 | 0.59 | >.99 |
| **ODI** | 0.38 | >.99 | 1.34 | >.99 |

PT, planum temporale; HG, Heschl's gyrus; AI, Asymmetry index; *PFWE*, corrected *P* value after Bonferroni correction; NDI, neurite density index; ODI, orientation dispersion index.

Supplementary file 1g. The correlations of PT structural AIs with speech-related functional AI of the entire hemisphere after controlling for the HG gyrification pattern (the second specificity analysis)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | **Entire hemisphere** | | | |
| **Speech perception** | | **Speech comprehension** | |
| *R* | *PFWE* | *R* | *PFWE* |
| **PT** | **Surface area** | -0.05 | >.99 | 0.03 | >.99 |
| **Thickness** | -0.07 | 0.47 | -0.05 | >.99 |
| **Myelin content** | -0.02 | >.99 | 0.06 | 0.89 |
| **NDI** | -0.06 | >.99 | 0.05 | >.99 |
| **ODI** | 0.02 | >.99 | 0.02 | >.99 |

PT, planum temporale; HG, Heschl's gyrus; AI, Asymmetry index; *PFWE*, corrected *P* value after Bonferroni correction; NDI, neurite density index; ODI, orientation dispersion index.

Supplementary file 1h. The interaction effect of “PT structural measure × HG gyrification pattern” on speech-related functional activation of the entire ipsilateral hemisphere (the second specificity analysis)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | **Entire ipsilateral hemisphere** | | | |
| **Speech perception** | | **Speech comprehension** | |
| *F* | *PFWE* | *F* | *PFWE* |
| **Left PT** | **Surface area** | 3.74 | >.99 | 0.63 | >.99 |
| **Thickness** | 0.11 | >.99 | 0.86 | >.99 |
| **Myelin content** | 0.31 | >.99 | 0.86 | >.99 |
| **NDI** | 0.39 | >.99 | 1.25 | >.99 |
| **ODI** | 0.15 | >.99 | 1.35 | >.99 |
| **Right PT** | **Surface area** | 0.44 | >.99 | 0.30 | >.99 |
| **Thickness** | 0.45 | >.99 | 1.35 | >.99 |
| **Myelin content** | 0.52 | >.99 | 0.10 | >.99 |
| **NDI** | 0.71 | >.99 | 0.03 | >.99 |
| **ODI** | 3.68 | >.99 | 0.00 | >.99 |

PT, planum temporale; HG, Heschl's gyrus; *PFWE*, corrected *P* value after Bonferroni correction; NDI, neurite density index; ODI, orientation dispersion index.

Supplementary file 1i. The correlations of PT structural measures with speech-related functional activation of the entire ipsilateral hemisphere after controlling for the HG gyrification pattern (the second specificity analysis)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | **Entire ipsilateral hemisphere** | | | | |
| **Speech perception** | | | **Speech comprehension** | |
| *R* | *PFWE* | *R* | | *PFWE* |
| **Left PT** | **Surface area** | 0.00 | >.99 | 0.07 | | >.99 |
| **Thickness** | -0.04 | >.99 | -0.07 | | 0.99 |
| **Myelin content** | -0.02 | >.99 | 0.03 | | >.99 |
| **NDI** | -0.08 | 0.62 | -0.05 | | >.99 |
| **ODI** | 0.02 | >.99 | 0.02 | | >.99 |
| **Right PT** | **Surface area** | 0.02 | >.99 | 0.01 | | >.99 |
| **Thickness** | 0.03 | >.99 | 0.02 | | >.99 |
| **Myelin content** | 0.02 | >.99 | -0.01 | | >.99 |
| **NDI** | 0.04 | >.99 | -0.01 | | >.99 |
| **ODI** | 0.02 | >.99 | -0.02 | | >.99 |

PT, planum temporale; HG, Heschl's gyrus; *PFWE*, corrected *P* value after Bonferroni correction; NDI, neurite density index; ODI, orientation dispersion index.

Supplementary file 1j. The difference in PT functional and structural metrices between groups with single and duplicated HG within each hemisphere (the effect size, Cohen’s D).

|  |  |  |
| --- | --- | --- |
|  | **Left hemisphere** | **Right hemisphere** |
| **Speech perception** | 0.20 | 0.04 |
| **Speech comprehension** | **0.37** | 0.12 |
| **Surface area** | **0.77** | **0.98** |
| **Thickness** | 0.02 | 0.17 |
| **Myelin content** | **0.57** | **0.65** |
| **NDI** | **0.30** | **0.67** |
| **ODI** | **0.41** | 0.14 |

NDI, neurite density index; ODI, orientation dispersion index.