**Contrasting Neurofunctional Correlates of Face- and Visuospatial-Processing in Children and Adolescents with Williams Syndrome: Convergent Results from Four fMRI Paradigms**

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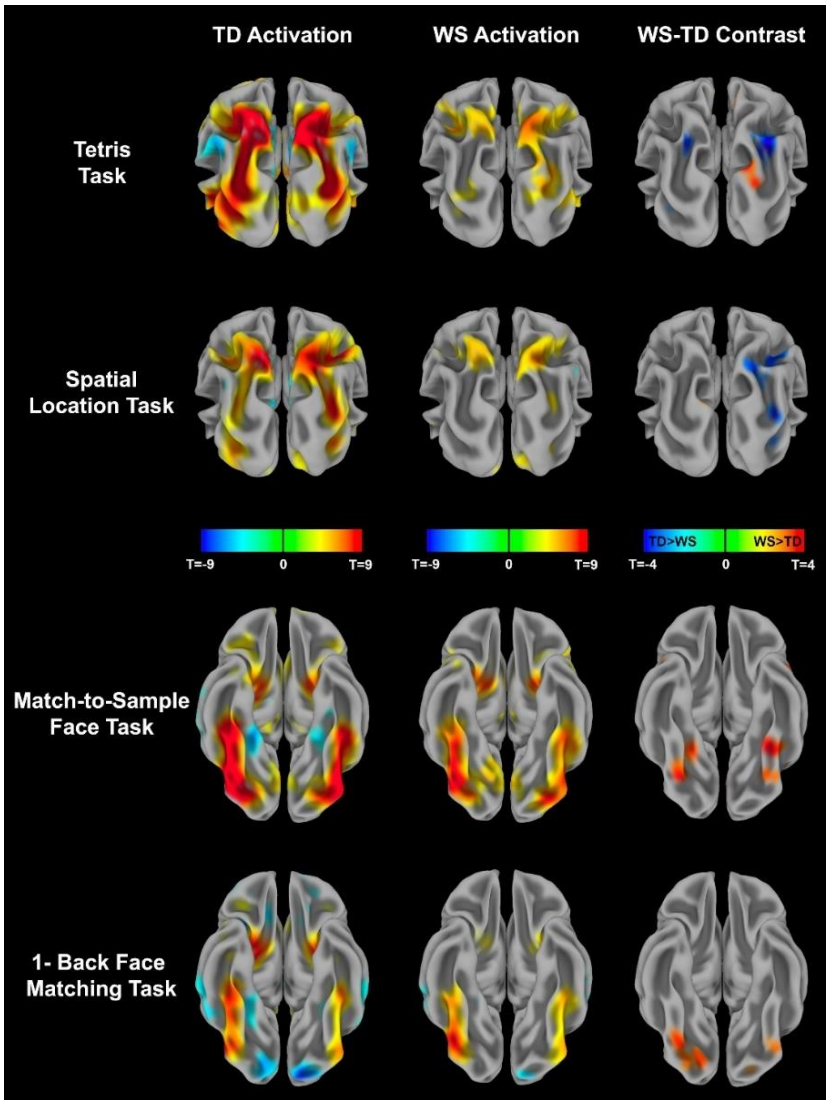
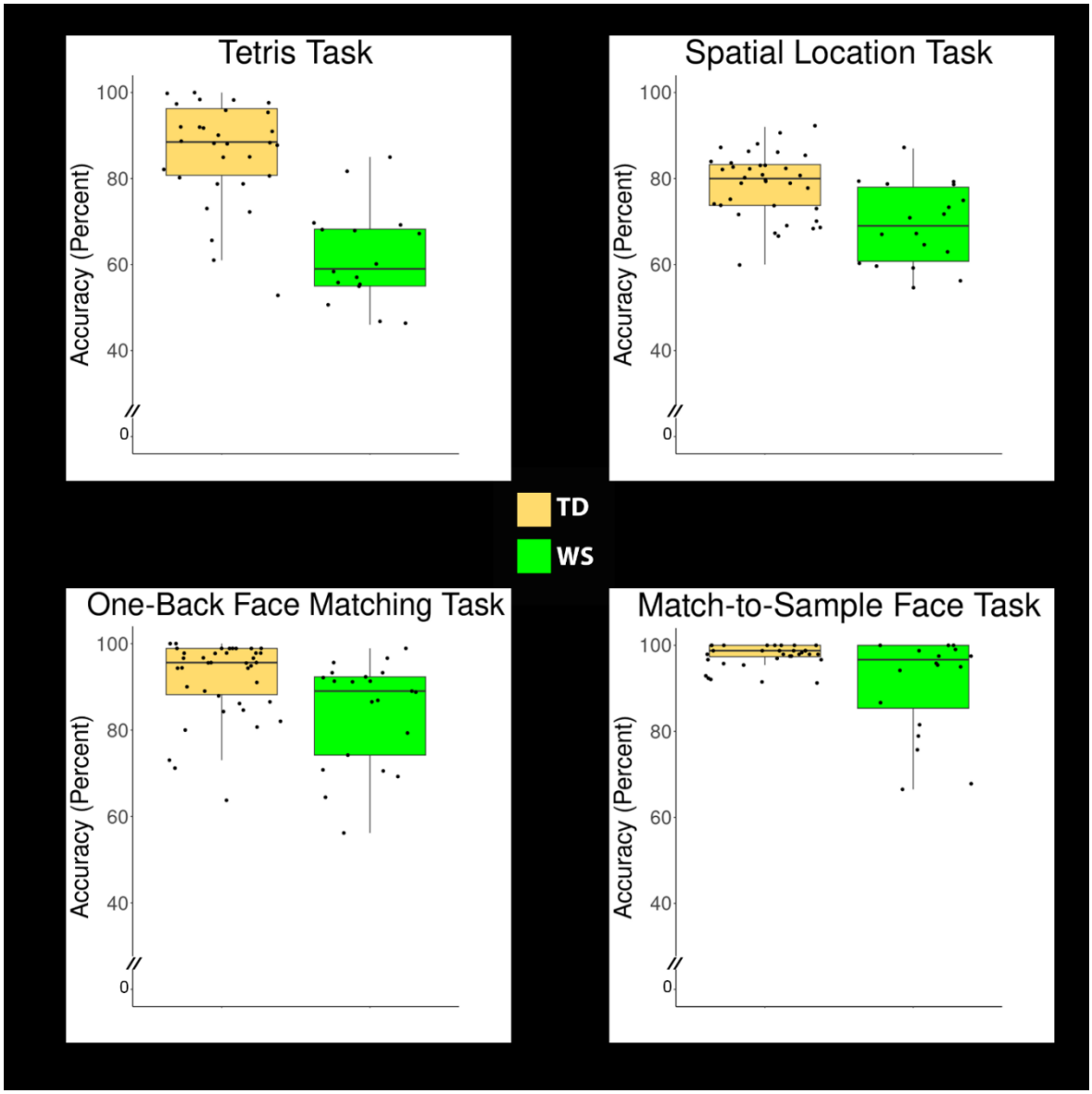
**Included Supplementary Information:**

**Supplementary Figure 1. Functional activation by task in typically developing individuals and people with WS. Top two rows:** activation patterns shown separately for each of two visuospatial tasks within TD individuals (left column) and within people with WS (middle column), as well as between-group activation difference maps for each task (right column). For each visuospatial processing task, TD individuals and people with WS activated the dorsal stream and, in particular, the bilateral intraparietal sulci, with more robust engagement seen in TD individuals (blue voxels in the between-groups analysis). **Bottom two rows:** activation patterns shown separately for each of two face processing tasks within TD individuals (left column) and within people with WS (middle column), as well as between-group activation difference maps for each task (right column). For each face processing task, both groups (TD individuals and people with WS) activated the ventral stream and, in particular, the bilateral fusiform gyri, with more robust engagement in particular fusiform areas in children and adolescents with WS (red voxels in the between-groups analysis). Activation maps are shown thresholded at $p < 0.05$, family-wise error corrected.



**Supplementary Figure 2: Performance accuracy for all participants during each of the four fMRI tasks.** Dots represent accuracy for each individual, boxes represent the range of the central 50% of data, and whiskers represent the spread of the maximum and minimum values for each group within 1.5x the interquartile range. TD=typically developing individuals, WS=individuals with Williams syndrome.



**Supplementary Table 1. Clusters showing significant activation in each group and between-group differences for the Match-to-Sample Face Task (BA = Brodmann Area)**

**TD participants**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Right Fusiform Gyrus | 37 | 42.5 | -51.8 | -24.5 | 22.6 | 6750 |
| Right Amygdala | N/A | 20.0 | -6.8 | -14.5 | 9.9 | 2170 |
| Right Premotor Cortex | 6 | 47.5 | 3.2 | 55.5 | 6.8 | 869 |
| Left Precentral Gyrus | 4 | -47.5 | -24.2 | 65.5 | 6.3 | 208 |
| Right Orbitofrontal Cortex | 11 | 2.5 | 53.2 | -24.5 | 6.1 | 246 |
| Left Inferior Frontal Gyrus | 47 | -40.0 | 25.8 | -19.5 | 5.6 | 107 |
| Right Superior Temporal Gyrus | 22 | 45.0 | -41.8 | 15.5 | 5.2 | 112 |
| Right Fusiform Gyrus | 37 | 25.0 | -51.8 | -12 | -6.9 | 209 |
| Left Fusiform Gyrus | 37 | -27.5 | -54.2 | -12.0 | -6.4 | 140 |
| Right Superior Temporal Gyrus | 22 | 67.5 | -19.2 | 0.5 | -5.1 | 346 |

**WS participants**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Right Fusiform Gyrus | 37 | 40.0 | -81.8 | -12.0 | 15.4 | 6031 |
| Right Amygdala | N/A | 17.5 | -6.8 | -14.5 | 9.2 | 576 |
| Left Amygdala | N/A | -30.0 | -1.8 | -24.5 | 9.2 | 412 |
| Left Frontal Eye Fields | 8 | -42.5 | 15.8 | 25.5 | 7.5 | 178 |
| Left Thalamus | N/A | -20.0 | -29.2 | -2.0 | 7.1 | 230 |
| Right Temporal Pole | 38 | 47.5 | 15.8 | -34.5 | 6.8 | 204 |
| Right Frontal Eye Fields | 44 | 45.0 | 18.2 | 25.5 | 6.4 | 163 |
| Left Orbitofrontal Cortex | 11 | -5.0 | 53.2 | -22.0 | 6.3 | 138 |
| Left Pars Orbitalis | 47 | -45.0 | 28.2 | -9.5 | 5.6 | 154 |
| Left Motor Cortex | 4 | -37.5 | -16.8 | 70.5 | 5.5 | 188 |
| Left Medial Temporal Gyrus | 21 | -50.0 | -41.8 | 5.5 | 5.2 | 153 |

**Between-Group TD – WS**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Left Visual Association Area | 18 | -15.0 | -96.8 | 3.0 | -5.7 | 168 |
| Right Posterior Cingulate Cortex | 18 | 25.0 | -64.2 | 18.0 | -5.2 | 406 |
| Left Fusiform Gyrus | 37 | -32.5 | -56.8 | -19.5 | -4.8 | 194 |
| Right Fusiform Gyrus | 44 | 35.0 | -76.8 | -12.0 | -4.4 | 251 |
| Left Superior Temporal Gyrus | 37 | -55.0 | -39.2 | 8.0 | -4.3 | 326 |
| Left Temporal Pole | 38 | -52.5 | 0.8 | -27.0 | -4.2 | 156 |
| Right Middle Occipital Gyrus | 19 | 40.0 | -79.2 | 13.0 | -4.0 | 123 |
| Right Superior Parietal Lobule | 7 | 27.5 | -49.2 | 63.0 | -3.9 | 186 |

**Supplementary Table 2. Clusters showing significant activation in each group and between-group differences in the One-Back Face Matching Task (BA=Brodmann Area)**

**TD Participants**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Right Amygdala | NA | 25.0 | -1.8 | -22.0 | 10.2 | 3218 |
| Left Hippocampus | NA | -27.5 | -6.8 | -22.0 | 8.8 | 1258 |
| Left Medial Prefrontal Cortex | 10 | 2.5 | 60.8 | -14.5 | 7.5 | 362 |
| Left Angular Gyrus | 39 | -60.0 | -69.2 | 15.5 | 5.8 | 382 |
| Right Inferior Frontal Gyrus | 45 | 57.5 | 33.2 | 5.5 | 5.4 | 136 |
| Right Posterior Cingulate Cortex | 23 | 5.0 | -56.8 | 25.5 | 5.2 | 302 |
| Right Primary Auditory Cortex | 41 | 42.5 | -16.8 | 8.0 | 4.4 | 115 |
| Left Superior Parietal Lobule | 7 | -25.0 | -64.2 | 55.5 | -10.6 | 2545 |
| Left Brodmann Area 18 | 18 | -10.0 | -101.8 | -17.0 | -10.0 | 211 |
| Right Superior Parietal Lobule | 7 | 27.5 | -69.2 | 53.0 | -9.9 | 2632 |
| Right Premotor Cortex | 6 | 27.5 | 3.2 | 50.5 | -9.2 | 2201 |
| Right Insula | 13 | 32.5 | 20.8 | 3.0 | -8.4 | 372 |
| Left Orbitofrontal Cortex | 11 | -22.5 | 53.2 | -17.0 | -7.9 | 212 |
| Left Insula | 13 | -32.5 | 23.2 | -4.5 | -7.5 | 301 |
| Right Visual Association Area | 18 | 20.0 | -101.8 | -12.0 | -6.6 | 351 |
| Right Fusiform Gyrus | 37 | 57.5 | -54.2 | -14.5 | -6.5 | 446 |
| Right Fusiform Gyrus | 37 | 27.5 | -56.8 | -12.0 | -5.9 | 161 |
| Right Premotor Cortex | 6 | 47.5 | 3.2 | 25.5 | -5.9 | 145 |
| Left Cingulate Gyrus | 23 | -7.5 | -29.2 | 25.5 | -5.7 | 185 |
| Right Prefrontal Cortex | 10 | 42.5 | 53.2 | 5.5 | -5.6 | 563 |
| Left Prefrontal Cortex | 10 | -37.5 | 58.2 | 13.0 | -5.6 | 240 |
| Left Fusiform Gyrus | 37 | -62.5 | -44.2 | -22.0 | -5.5 | 234 |
| Left DLPFC | 9 | -42.5 | 25.8 | 35.5 | -5.1 | 130 |
| Right Orbitofrontal Cortex | 11 | 17.5 | 68.2 | -19.5 | -5.0 | 182 |

**WS Participants**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Right Fusiform Gyrus | 37 | 40.0 | -81.8 | -14.5 | 10.2 | 831 |
| Left Fusiform Gyrus | 37 | -42.5 | -91.8 | -4.5 | 8.3 | 843 |
| Left Amygdala | NA | -27.5 | -1.8 | -19.5 | 6.0 | 128 |
| Left Angular Gyrus | 39 | -45.0 | -54.2 | 48.0 | -6.6 | 773 |
| Right Superior Parietal Lobule | 7 | 20.0 | -81.8 | 53.0 | -6.3 | 121 |

**Between-Group TD – WS**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Right Middle Occipital Gyrus | 19 | 40.0 | -86.8 | 10.5 | -5.6 | 1478 |
| Right Premotor Area | 6 | 27.5 | 0.8 | 48.0 | -5.2 | 311 |
| Left Superior Parietal Lobule | 7 | -25.0 | -64.2 | 55.5 | -5.1 | 841 |
| Left Premotor Area | 6 | -25.0 | -6.8 | 50.5 | -5.0 | 322 |
| Left Fusiform Gyrus | 37 | -40.0 | -84.2 | -17.0 | -3.6 | 102 |
| Right Visual Association Area | 19 | 57.5 | -64.2 | 20.5 | 4.1 | 107 |

**Supplementary Table 3. Clusters showing significant activation in each group and between-group differences in the Spatial Location Task (BA = Brodmann Area)**

**TD Participants**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Left Superior Parietal Lobe | 7 | -15.0 | -66.8 | 55.5 | 11.4 | 8860 |
| Left Premotor Cortex | 6 | -30.0 | -6.8 | 55.5 | 10.6 | 445 |
| Right Premotor Area | 6 | 27.5 | 5.8 | 50.5 | 8.2 | 1583 |
| Right Premotor Area | 8 | 5.0 | 28.2 | 43.0 | 7.3 | 202 |
| Right Inferior Frontal Gyrus | 47 | 42.5 | 53.2 | -17.0 | 6.7 | 216 |
| Left Premotor Area | 6 | -2.5 | 20.8 | 48.0 | 6.4 | 104 |
| Right Anterior Insula | 13 | 30.0 | 23.2 | -2.0 | 6.1 | 225 |
| Left Premotor Area | 6 | -57.5 | 5.8 | 38.0 | 5.1 | 105 |
| Right Fusiform Gyrus | 37 | 57.5 | -56.8 | -9.5 | 4.8 | 306 |
| Left Angular Gyrus | 39 | -47.5 | -76.8 | 40.5 | -7.2 | 118 |
| Right Anterior Cingulate Cortex | 32 | 7.5 | 38.2 | -2.0 | -6.4 | 949 |
| Left Frontal Eye Fields | 8 | -22.5 | 30.8 | 43.0 | -6.4 | 356 |
| Posterior Cingulate Cortex | 23 | -2.5 | -56.8 | 15.5 | -5.7 | 469 |
| Left Medial Temporal Gyrus | 21 | -57.5 | -11.8 | -22.0 | -5.0 | 103 |

**WS Participants**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Right Superior Parietal Lobe | 7 | 20.0 | -66.8 | 55.5 | 7.7 | 776 |
| Right Premotor Area | 6 | 22.5 | -1.8 | 55.5 | 7.7 | 309 |
| Right Middle Occipital Gyrus | 18 | 25.0 | -91.8 | 5.5 | 6.6 | 940 |
| Left Superior Parietal Lobe | 7 | -20.0 | -61.8 | 50.5 | 6.6 | 598 |
| Left Fusiform Gyrus | 37 | -22.5 | -94.2 | -17.0 | 5.7 | 194 |
| Right Medial Prefrontal Cortex | 10 | 2.5 | 55.8 | 0.5 | -5.4 | 138 |

**Between-Group TD – WS**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Right Middle Occipital Gyrus | 19 | 37.5 | -81.8 | 20.5 | 4.3 | 186 |
| Right Intraparietal Sulcus | 7 | 20.0 | -71.8 | 55.5 | 4.1 | 184 |
| Right Superior Parietal Lobule | 7 | 37.5 | -41.8 | 43.0 | 3.8 | 163 |

**Supplementary Table 4. Clusters showing significant activation in each group and between-group differences in the Tetris Task (BA = Brodmann Area)**

**TD Participants**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Left Superior Parietal Lobe | 7 | -20.0 | -69.2 | 55.5 | 17.8 | 17222 |
| Right Premotor Cortex | 6 | 25.0 | 0.8 | 60.5 | 13.9 | 1994 |
| Right Thalamus | NA | 15.0 | -26.8 | 13.0 | 8.5 | 1505 |
| Left Insula | 13 | -32.5 | 23.2 | -4.5 | 8.0 | 296 |
| Right DLPFC | 9 | 42.5 | 35.8 | 20.5 | 7.7 | 536 |
| Right Premotor Area | 8 | 5.0 | 18.2 | 45.5 | 7.7 | 438 |
| Right Orbitofrontal Cortex | 11 | 20.0 | 53.2 | -19.5 | 6.7 | 164 |
| Right Anterior Cingulate Cortex | 24 | 5.0 | 5.8 | 28.0 | 6.3 | 101 |
| Left Premotor Cortex | 6 | -2.5 | 13.2 | 48.0 | 6.1 | 120 |
| Left DLPFC | 9 | -50.0 | 30.8 | 33.0 | 5.3 | 122 |
| Left Angular Gyrus | 39 | -52.5 | -71.8 | 40.5 | -9.6 | 697 |
| Right Angular Gyrus | 39 | 57.5 | -64.2 | 35.5 | -9.3 | 395 |
| Right Posterior Cingulate Cortex | 23 | 7.5 | -51.8 | 28.0 | -7.4 | 808 |
| Left Anterior Cingulate Cortex | 32 | -2.5 | 33.2 | 3.0 | -6.6 | 1718 |
| Right Superior Temporal Gyrus | 41 | 62.5 | -11.8 | -12.0 | -5.5 | 151 |
| Right Frontal Eye Fields | 8 | 20.0 | 38.2 | 43.0 | -5.4 | 197 |
| Left Medial Temporal Gyrus | 21 | -50.0 | -9.2 | -19.5 | -5.4 | 120 |

**WS Participants**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Right Premotor Area | 6 | 27.5 | -6.8 | 50.5 | 9.7 | 524 |
| Right Visual Association Area | 19 | 40.0 | -86.8 | 10.5 | 9.3 | 3820 |
| Right Thalamus | NA | 5.0 | -14.2 | -2.0 | 7.4 | 230 |
| Left Premotor Area | 6 | -47.5 | 0.8 | 33.0 | 6.5 | 179 |
| Right Premotor Area | 6 | 50.0 | 8.2 | 28.0 | 6.4 | 142 |

**Between-Group TD – WS**

| Location of Peak T Statistic in Cluster | Peak BA | $X_{MNI}$ | $Y_{MNI}$ | $Z_{MNI}$ | Max T | # Voxels |
|---|---|---|---|---|---|---|
| Right Intraparietal Sulcus | 7 | 27.5 | -71.8 | 48.0 | 4.8 | 377 |
| Left Visual Association Area | 18 | -22.5 | -79.2 | 3.0 | 4.8 | 336 |
| Right Retrosplenial Cortex | 30 | 32.5 | -51.8 | 5.5 | 4.8 | 161 |
| Left Intraparietal Sulcus | 7 | -22.5 | -71.8 | 48.0 | 4.3 | 119 |
| Left Prefrontal Cortex | 10 | -25.0 | 68.2 | 8.0 | -4.6 | 101 |
| Right Parieto-Occipital Junction | 19 | 15.0 | -84.2 | 38.0 | -4.4 | 116 |

**Supplementary Table 5. Partial correlation coefficients between age, IQ, sex and performance separated by task.** * represents partial correlation coefficients with a corresponding p value of < 0.05, uncorrected, ** represents partial correlation coefficients with a corresponding p value of < 0.05, corrected for multiple comparisons (for three measures per task).

**Effects of Age, IQ, and Sex on Performance in Typically Developing Cohort**

| | Spatial Location Task | Tetris Task | Match-to-Sample Face Task | 1-Back Face Matching Task |
|---|---|---|---|---|
| **Age** | 0.42* | 0.57** | 0.17 | 0.49** |
| **IQ** | 0.35 | 0.3 | 0.2 | 0.29 |
| **Sex** | 0.22 | 0.1 | 0.08 | -0.15 |

**Effects of Age, IQ, and Sex on Performance in Williams Syndrome Cohort**

| | Spatial Location Task | Tetris Task | Match-to-Sample Face Task | 1-Back Face Matching Task |
|---|---|---|---|---|
| **Age** | 0.2 | 0.14 | 0.55* | 0.63** |
| **IQ** | -0.15 | 0.12 | 0.35 | -0.14 |
| **Sex** | 0.36 | 0.29 | -0.25 | -0.35 |