**Supplementary material**

**Supplementary Table 1:** Demographic variables and clinical measures of the participants**.** Table lists median and interquartilerange (IQR) of age, mRS at scan, and disease duration. Treatment, medication, and psychiatric symptoms during disease course were evaluated using a binary (present: ‘yes’ vs. absent: ‘no’) scale. Disease duration = days in hospitalization during acute phase of the disease; N = number of subjects; NMDARE = anti-NMDA receptor encephalitis.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **NMDARE Patients** | **Healthy Controls** |
| **N** |  | 57 | 61 |
| **Sex** | ♀ / ♂ | 50/7 | 54/7 |
| **Age (years)** | Median ± IQR (N) | 25.00 ± 14.50 (57) | 26.00 ± 11.00 (61) |
| **mRS at scan** | Median ± IQR (N) | 1.00 ± 1.00 (55) | .. |
| **Disease duration**  **(days in hospitalization)** | Median ± IQR (N) | 62.00 ± 59.50 (52) | ·· |
| **Years between disease onset and scan** | Median ± IQR (N) | 2.43 ± 2.95 (50) | .. |
| **First-line treatment** | yes/no | 56/1 | ·· |
| **Second-line treatment** | yes/no | 28/29 | ·· |
| **Anticonvulsant medication** | yes/no | 41/16 | ·· |
| **Antipsychotic medication** | yes/no | 41/16 | ·· |
| **Positive symptoms** | yes/no | 28/29 | ·· |
| **Negative symptoms** | yes/no | 18/39 | ·· |

**Supplementary Table 2**: Location of included independent components. Component numbers, component labels, maximum t-value, MNI-coordinates of peak voxel and number of voxels in each component counting the voxels that contain the 60% highest values.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Somatomotor network** | | | | |
| 6 | Postcentral gyrus (right) | 4.02 | [58 -18 48] | 2731 |
| 15 | Superior temporal gyrus (right) | 3.63 | [68 -32 10] | 1268 |
| 23 | Supplementary motor area (bil.) | 4.11 | [-2 -18 62] | 1930 |
| 44 | Superior temporal gyrus (bil.) | 3.67 | [48 0 -2] | 2814 |
| 78 | Precentral gyrus (bil.) | 4.14 | [-41 -20 63] | 751 |
| **Visual network** | | | | |
| 11 | Calcarine fissure (bil.) | 4.09 | [-10 -94 -4] | 4690 |
| 38 | Temporo-parietal-occipital junction (right) | 4.17 | [62 -46 10] | 2033 |
| 87 | Middle occipital gyrus (bil.) | 1.42 | [-40 -92 -2] | 2620 |
| 90 | Superior occipital gyrus (bil.) | 3.86 | [-22 90 34] | 1251 |
| **Subcortical network** | | | | |
| 5 | Putamen (bil.) | 4.70 | [-22 10 -12] | 2249 |
| 92 | Caudate (bil.) | 3.21 | [-12 -6 18] | 1001 |
| **Cerebellar network** | | | | |
| 7 | Cerebellum (right) | 2.77 | [46 -50 -30] | 3120 |
| **Default mode network** | | | | |
| 13 | Angular gyrus (bil.) | 4.46 | [44 -74 40] | 2222 |
| 14 | Parahippocampal gyrus (right) | 4.04 | [-23 -25 -21] | 154 |
| 24 | Dorsolateral superior frontal gyrus (right) | 5.28 | [14 46 50] | 1008 |
| 33 | Medial prefrontal cortex (bil.) | 4.37 | [- 2 62 18] | 2394 |
| 36 | Medial prefrontal cortex (bil.) | 6.34 | [-2 68 2] | 564 |
| 40 | Superior temporal gyrus (left) | 2.82 | [-54 20 -6] | 1800 |
| 59 | Hippocampus (bil.) | 3.54 | [20 -16 -16] | 1270 |
| 61 | Superior frontal gyrus, medial orb (bil.) | 3.91 | [-2 58 -12] | 882 |
| 84 | Parietal lobe, angular gyrus (bil.) | 2.69 | [-50 -60 52] | 1597 |
| 85 | Inferior frontal gyrus, opercular part (left) | 3.05 | [-62 14 18] | 1487 |
| **Dorsal attention network** | | | | |
| 10 | Parieto-occipital sulcus (bil.) | 9.20 | [-2 -60 64] | 411 |
| 41 | Postcentral gyrus (left) | 5.84 | [48 -34 62] | 563 |
| 43 | Interparietal sulcus (right) | 6.13 | [44 -50 62] | 494 |
| 45 | Precuneus (bil.) | 2.99 | [-36 -74 40] | 2768 |
| 58 | Superior parietal gyrus (bil.) | 4.33 | [38 -52 60] | 2017 |
| 74 | Superior parietal gyrus (bil.) | 4.95 | [30 -68 56] | 875 |
| 80 | Parieto-occipital sulcus (right) | 6.55 | [4 -56 72] | 260 |
| 82 | Postcentral gyrus (right) | 3.89 | [28 -46 72] | 584 |
| 86 | Postcentral gyrus (bil.) | 3.46 | [-58 -6 40] | 3042 |
| **Frontoparietal network** | | | | |
| 12 | Inferior temporal gyrus (bil.) | 3.24 | [-64 -44 -14] | 1544 |
| 28 | Middle frontal gyrus, orbital part (right) | 3.67 | [44 48 -6] | 985 |
| 29 | Middle frontal gyrus, orbital part (left) | 3.43 | [-46 50 -4] | 1674 |
| 51 | Dorsolateral superior frontal gyrus (right) | 4.22 | [28 66 6] | 322 |
| 54 | Middle frontal gyrus (bil.) | 4.13 | [32 50 38] | 1533 |
| 71 | Inferior frontal gyrus, triangular part (bil.) | 3.66 | [-56 20 32] | 1800 |
| 89 | Superior frontal gyrus (left) | 5.83 | [-24 66 17] | 575 |
| 91 | Superior temporal gyrus (left) | 1.81 | [-54 20 -8] | 5643 |

**Supplementary Table 3:** Two-way ANOVA for overall connectivity. \* indicates significant effect.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Sum of squares** | **Df** | **F** | **p** |
| Main effect: group | 0.002 | 1 | 2.52 | 0.11 |
| Main effect: state | 0.188 | 3 | 67.62 | <0.0001 \* |
| Interaction effect | 0.004 | 3 | 1.58 | 0.19 |
| Residuals | 0.268 | 290 |  |  |

**Supplementary Table 4**: Average windows-wise overall connectivity (± SD) across all subjects.

|  |  |
| --- | --- |
|  | **Mean (**± SD**)** |
| State 1 | 0.23 (± 0.02) |
| State 2 | 0.27 (± 0.03) |
| State 3 | 0.30 (± 0.04) |
| State 4 | 0.24 (± 0.03) |

**Supplementary Table 5**: Post-hoc Kruskal-Wallis test to examine state-wise differences in overall connectivity (Chi2=124.37, p < 0.0001, df =3). The table contains the Bonferroni-corrected p-values for pairwise state comparison.

|  |  |
| --- | --- |
| **State** | ***p*** |
| State 1 - State 2 | < 0.0001 |
| State 1 - State 3 | < 0.0001 |
| State 1 - State 4 | 0.19 |
| State 2 - State 3 | 0.11 |
| State 2 - State 4 | < 0.0001 |
| State 3 - State 4 | < 0.0001 |

**Supplementary Table 6**: Two-way ANOVA for modularity. \* indicates significant effect.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Sum of squares** | **Df** | **F** | **p** |
| Main effect: group | 0.012 | 1 | 3.16 | 0.076 |
| Main effect: state | 1.113 | 3 | 98.11 | <0.0001 \* |
| Interaction effect | 0.002 | 3 | 0.14 | 0.94 |
| Residuals | 1.098 | 290 |  |  |

**Supplementary Table 7**: Average window-wise modularity (± SD) across all subjects.

|  |  |
| --- | --- |
|  | **Mean (**± SD**)** |
| State 1 | 0.37 (± 0.06) |
| State 2 | 0.42 (± 0.07) |
| State 3 | 0.25 (± 0.05) |
| State 4 | 0.41 (± 0.07) |

**Supplementary Table 8**: Post-hoc Kruskal-Wallis test to examine state-wise differences in modularity (Chi2=136.08, p < 0.0001, df =3). The table contains the Bonferroni-corrected p-values for pairwise state comparison.

|  |  |
| --- | --- |
| **State** | ***p*** |
| State 1 - State 2 | < 0.0001 |
| State 1 - State 3 | < 0.0001 |
| State 1 - State 4 | 0.0070 |
| State 2 - State 3 | < 0.0001 |
| State 2 - State 4 | 1 |
| State 3 - State 4 | < 0.0001 |

**Supplementary Table 9:** Group differences in occurrences of states**.** Group differences were calculated using the z-test for population proportions. \* p < 0.05 (uncorrected). NMDARE = anti-NMDA receptor encephalitis.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **State** | **NMDARE Patients**  (N, %) | **Healthy Controls**  (N, %) | **z** | ***puncorr*** |
| **Occurrence** | 1 | N=49, 85.96% | N=55, 90.16% | 0.70 | 0.48 |
| 2 | N=42, 73.68% | N=31, 50.82% | 2.34 | 0.019\* |
| 3 | N=28, 49.12% | N=28, 45.90% | -0.35 | 0.73 |
| 4 | N=34, 59.65% | N=31, 50.82% | -0.96 | 0.34 |

**Supplementary Table 10**: Two-way ANOVA for dwell time. \* indicates significant effect.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Sum of squares** | **Df** | **F** | **p** |
| Main effect: group | 23068.00 | 1 | 6.79 | 0.0096 \* |
| Main effect: state | 68622.00 | 3 | 6.73 | 0.00021 \* |
| Interaction effect | 20411.00 | 3 | 2.00 | 0.11 |
| Residuals | 985147.00 | 290 |  |  |

**Supplementary Table 11**: Two-way ANOVA for transition frequencies. \* indicates significant effect.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Sum of squares** | **Df** | **F** | **p** |
| Main effect: group | 7.25 | 1 | 4.07 | 0.044 \* |
| Main effect: state | 46.87 | 5 | 5.26 | <0.0001 \* |
| Interaction effect | 9.20 | 5 | 1.03 | 0.40 |
| Residuals | 1239.96 | 696 |  |  |

**Supplementary Table 12**: Two-way ANOVA for fraction time. \* indicates significant effect.

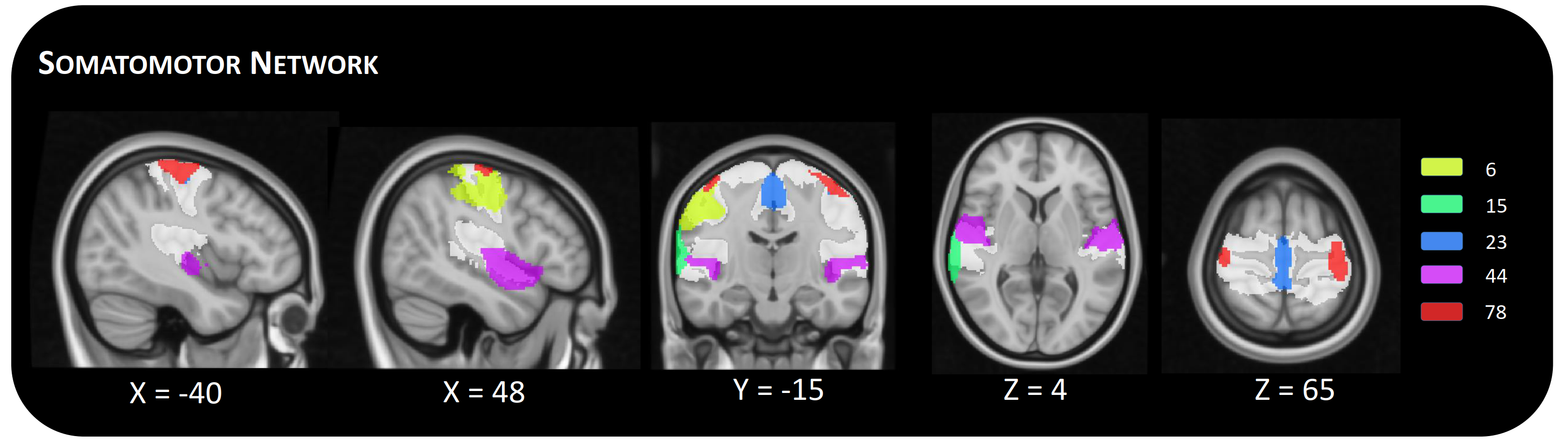
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Sum of squares** | **Df** | **F** | **p** |
| Main effect: group | 0.036 | 1 | 0.35 | 0.56 |
| Main effect: state | 1.515 | 3 | 4.94 | 0.0023 \* |
| Interaction effect | 0.037 | 3 | 0.12 | 0.95 |
| Residuals | 29.63 | 290 |  |  |

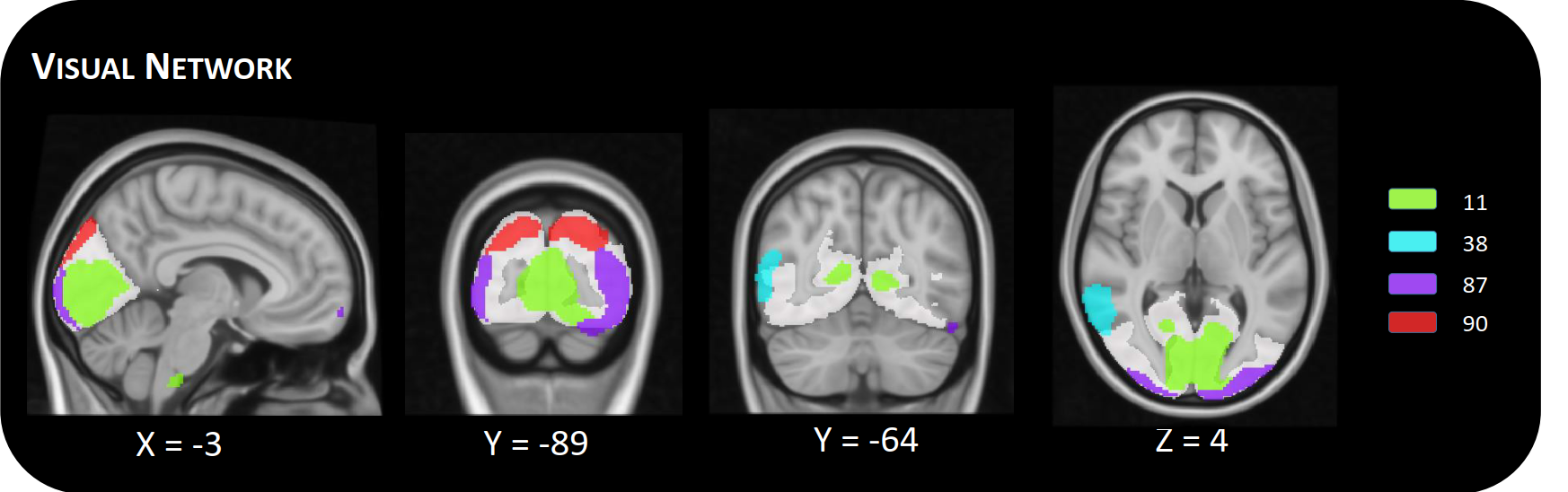
**Supplementary Table 13:** Differences between states in dwell time (windows), transition frequencies between states (absolute numbers), and fraction time (percentage). Differences between states were calculated using a Tukey’s test. T-values and p-values are shown. \* p < 0.05 (FDR-corrected), \*\* p < 0.01 (FDR-corrected).

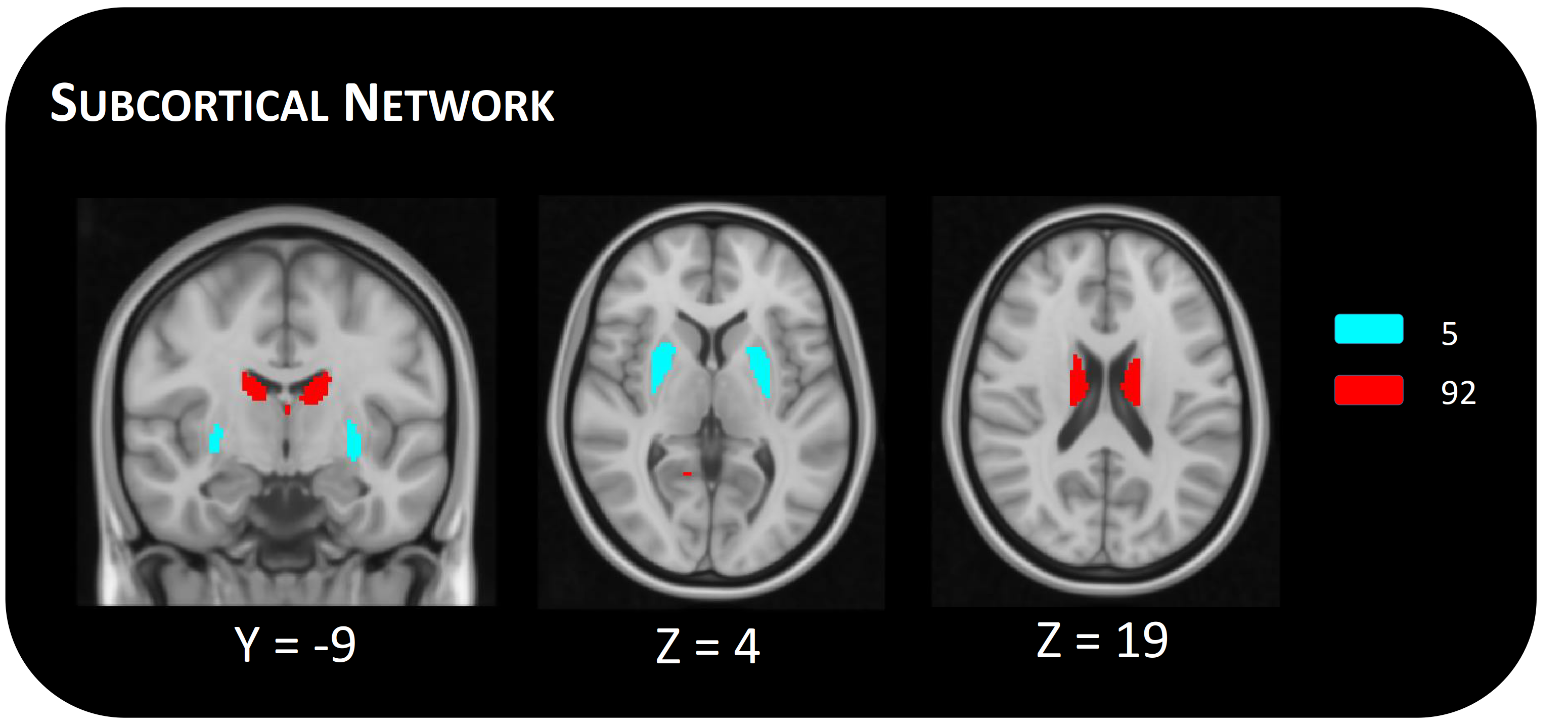
|  |  |  |  |
| --- | --- | --- | --- |
|  | **State** | ***t*** | ***pFDR*** |
| **Dwell time** | 1 - 2  1 - 3  1 - 4  2 - 3  2 - 4  3 - 4 | 3.77  3.61  1.86  -0.04  -1.69  -1.61 | 0.0011 \*\*  0.0021 \*\*  0.25  0.99  0.33  0.37 |
| **Transition frequency** | 1 - 2 vs 1 - 3  1 - 2 vs 1 - 4  1 - 2 vs 2 - 3  1 - 2 vs 2 - 4  1 - 2 vs 3 - 4  1 - 3 vs 1 - 4  1 - 3 vs 2 - 3  1 - 3 vs 2 - 4  1 - 3 vs 3 - 4  1 - 4 vs 2 - 3  1 - 4 vs 2 - 4  1 - 4 vs 3 - 4  2 - 3 vs 2 - 4  2 - 3 vs 3 - 4  2 - 4 vs 3 - 4 | 0.00  -1.22  0.54  1.97  3.32  -1.22  0.54  1.97  3.32  1.76  3.19  4.55  1.42  2.78  1.357 | 1.00  0.83  0.99  0.36  0.012 \*  0.83  0.99  0.36  0.012 \*  0.49  0.019 \*  0.00012 \*\*  0.71  0.062  0.75 |
| **Fraction time** | 1 - 2  1 - 3  1 - 4  2 - 3  2 - 4  3 - 4 | 3.226  3.017  2.170  -0.093  -0.934  -0.817 | 0.0075 \*\*  0.015 \*  0.13  0.99  0.79  0.85 |

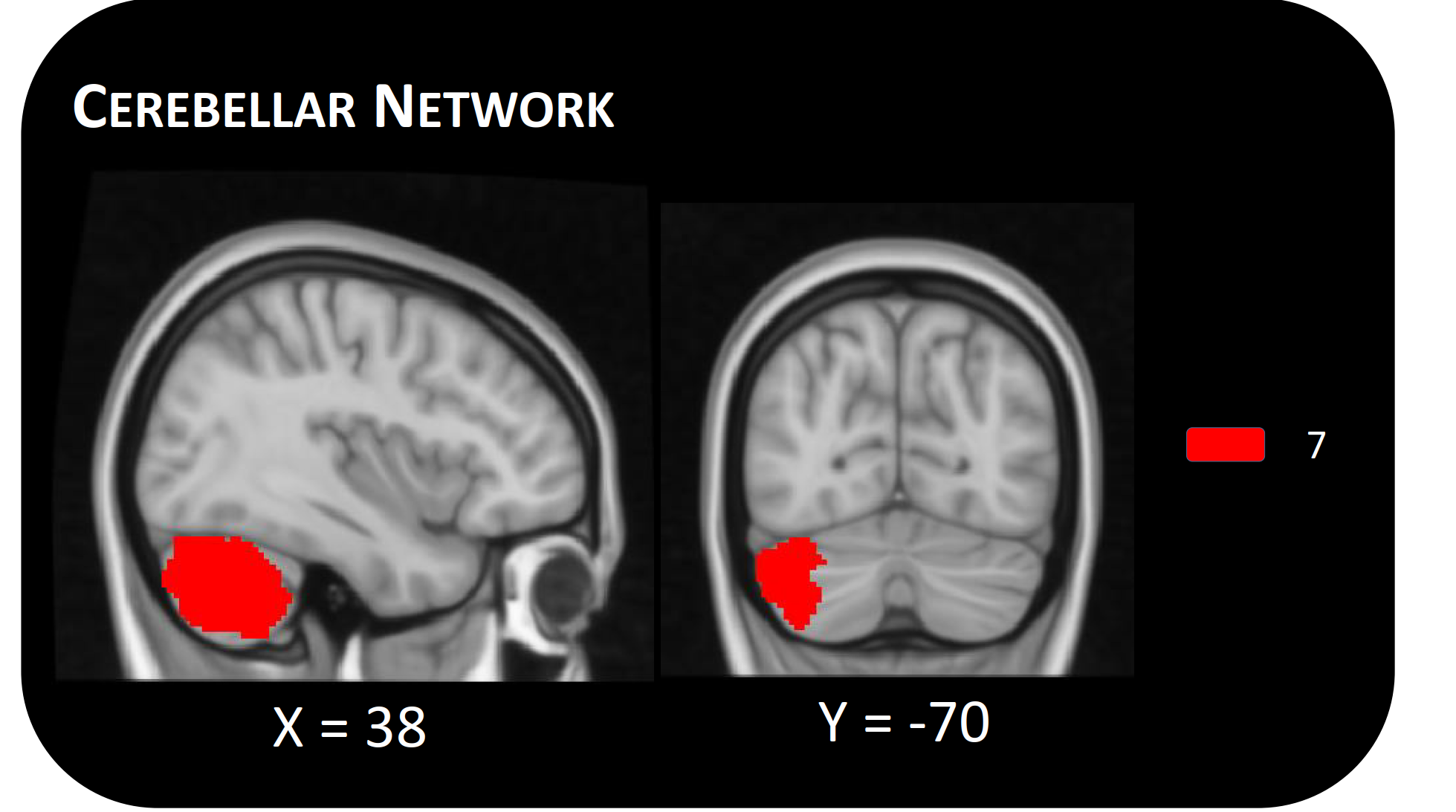
**Supplementary Table 14:** Pearson’s correlation coefficient between the participants’ average static FC and the participants’ average of each state.

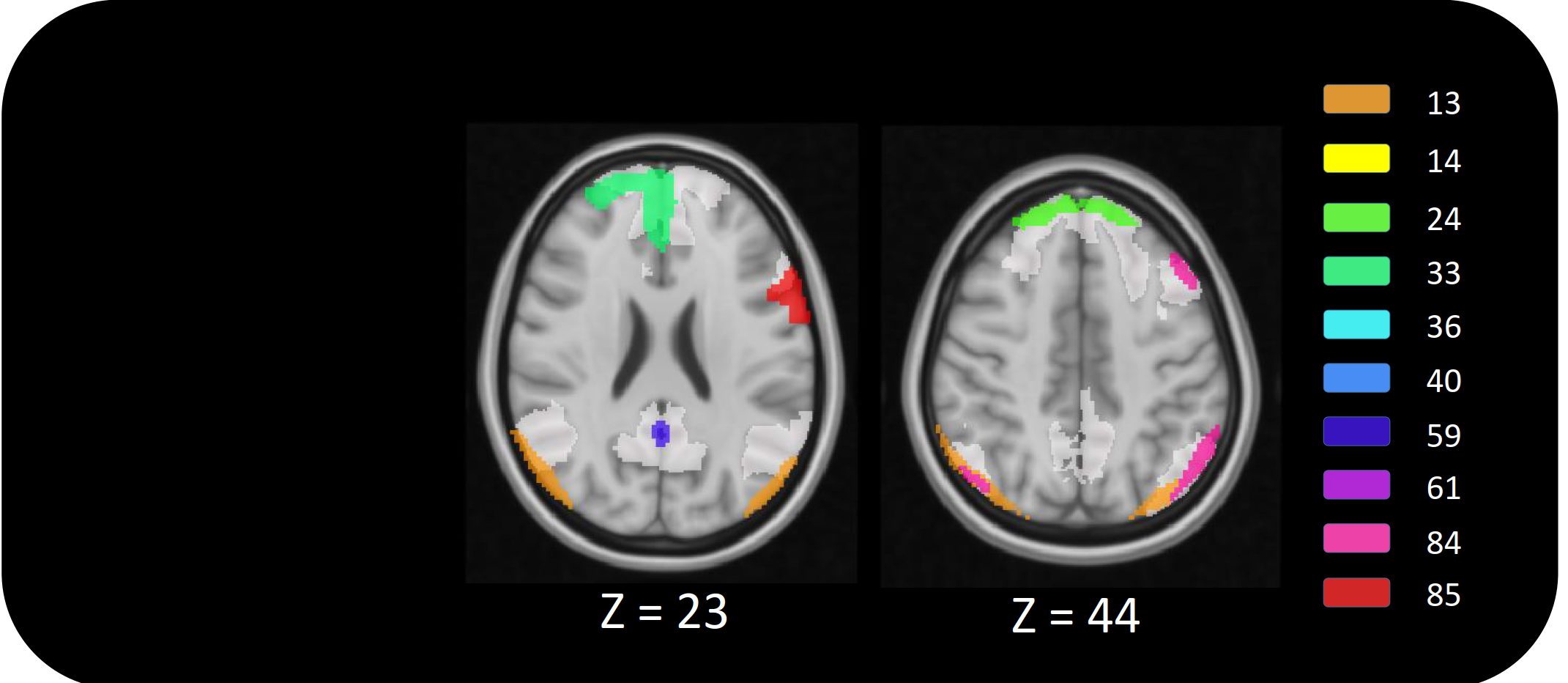
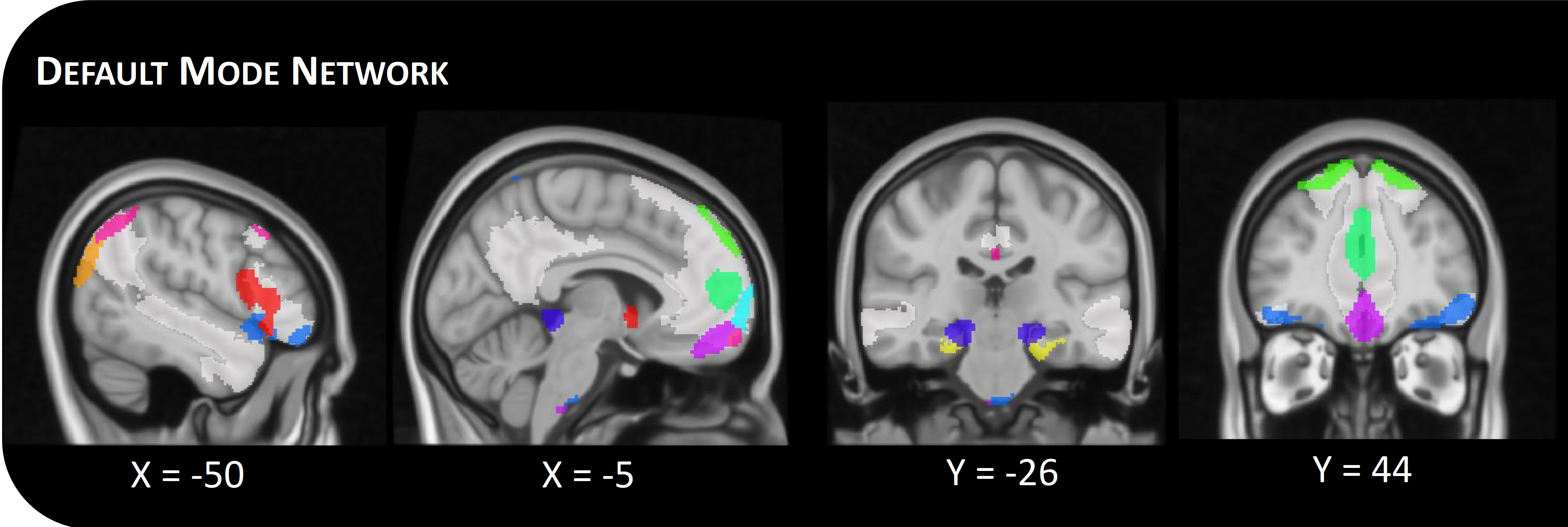
|  |  |
| --- | --- |
|  | **R** |
| Static – State 1 | 0.94 |
| Static – State 2 | 0.91 |
| Static – State 3 | 0.87 |
| Static – State 4 | 0.71 |

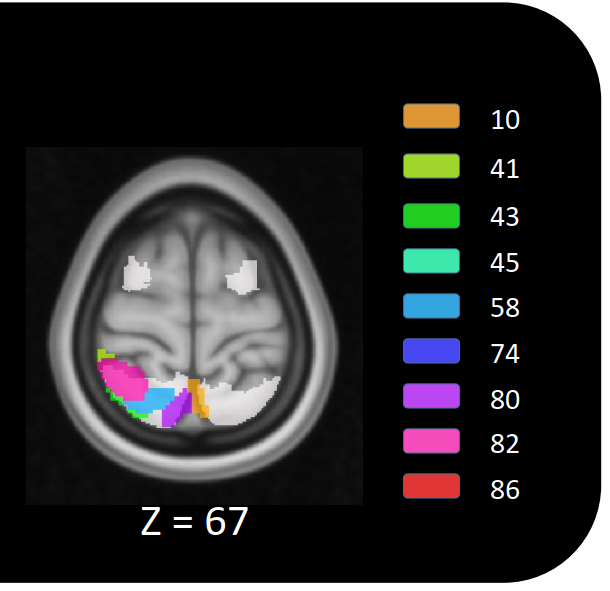
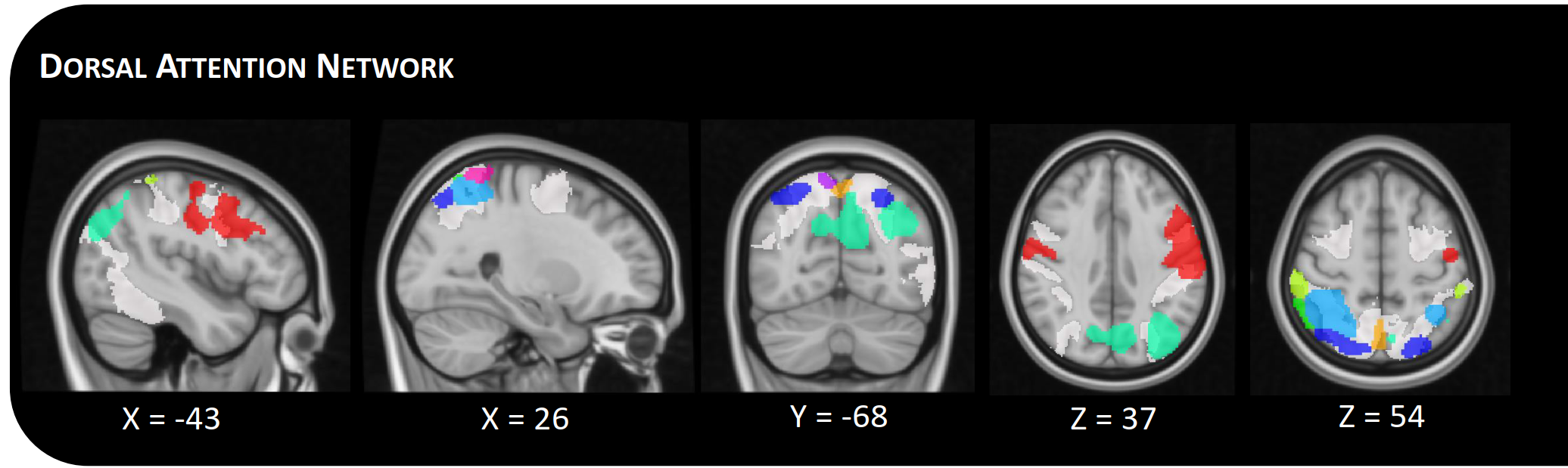


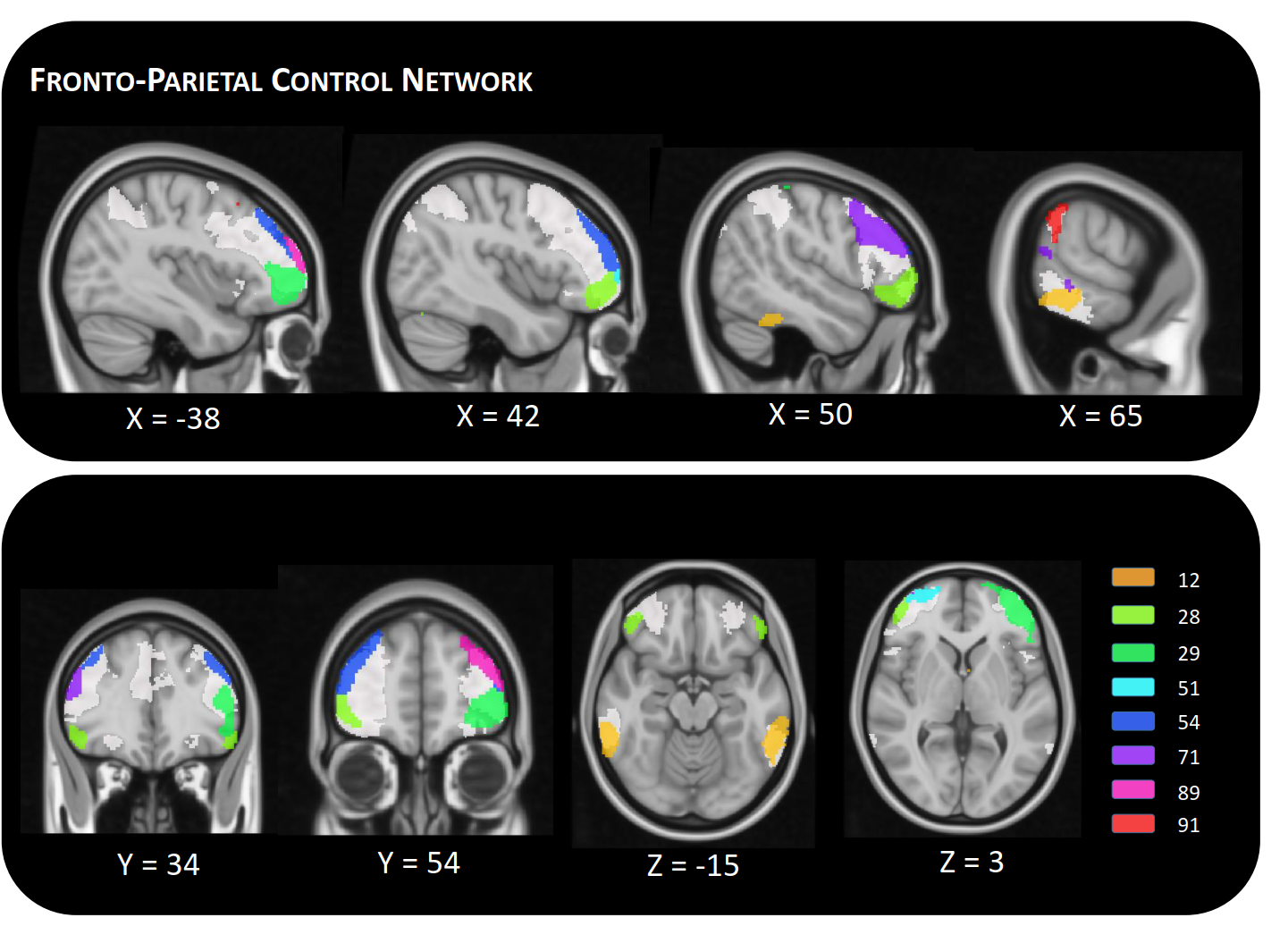








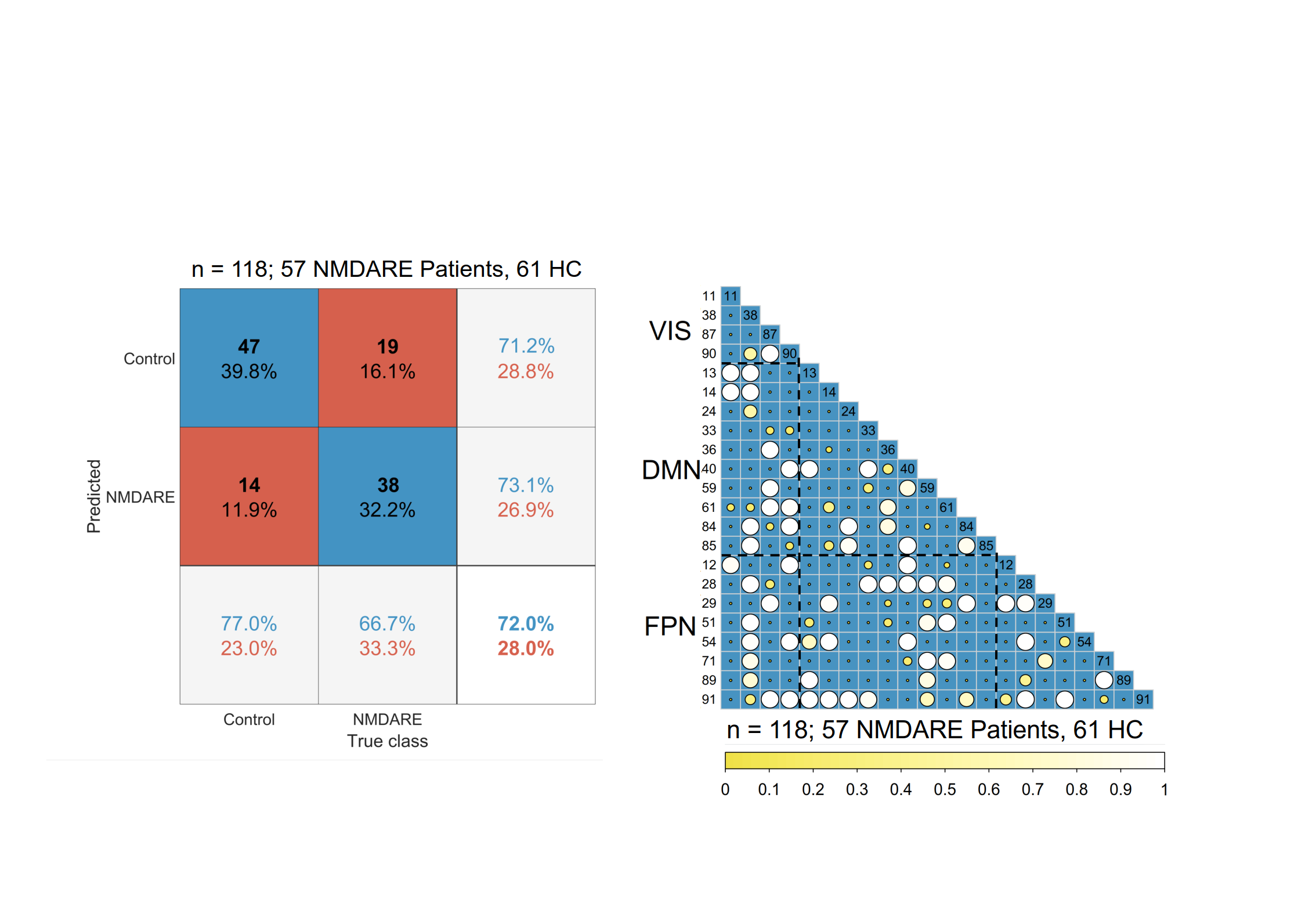




**Supplementary Fig. 1:** Included independent components in MNI space. Maps show the 39 identified signal components sorted into seven intrinsic functional connectivity networks according to 1, which are displayed transparent. Each color corresponds to a different component. For visualization purposes, maps show only the 60% highest values of components values. Component labels and peak coordinates are provided in Supplementary Table 2.

D:\dynFC_drafts\cluster_est.tif

**Supplementary Fig. 2:** Visualization of elbow criterion.



**Supplementary Fig. 3:** Confusion plot and feature selection matrix for static FC. Feature selection matrices showing all features that were selected for classification in at least 10% (threshold ≥ 0.1) of the classification after hyperparameter optimization (L1 regularization). Bigger and brighter circles indicate a higher selection rate (in percent/100) for classification. A key for the region numbers is provided in Supplementary Table 2. VIS = visual network; DMN = default mode network; FPN = fronto-parietal network; NMDARE = anti-NMDA receptor encephalitis; HC = healthy controls.



**Supplementary Fig. 4:** Standard confusion matrix for each state. Matrices indicate classification performance (i.e., true and false positive and negative rates and overall accuracy). NMDARE = NMDARE = anti-NMDA receptor encephalitis; HC = healthy controls.

**References**

1. Thomas Yeo BT, Krienen FM, Sepulcre J, et al. The organization of the human cerebral cortex estimated by intrinsic functional connectivity. *J Neurophysiol*. 2011;106(3):1125-1165. doi:10.1152/jn.00338.2011