**Supplementary File 1**

**Supplementary File 1a.**

Decoding accuracy for the stimulus-presenting epoch in the perceptual control task

| One-sample t-test against chance (1/3) based on non-parametric permutation test | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | V1 | V2 | V3 | V3AB | IPS0/1 | IPS2/3 | sPCS | iPCS |
| Within radial | ***t* = 10.433**  ***p* < .001** | ***t* = 15.598**  ***p* < .001** | ***t* = 9.802**  ***p* < .001** | ***t* = 3.848**  ***p* < .001** | ***t* = 2.049**  ***p* = 0.033** | *t* = 0.606  *p* = 0.245 | *t* = 0.712  *p* = 0.259 | *t* = 0.039  *p* = 0.510 |
| Within angular | ***t* = 8.885**  ***p* < .001** | ***t* = 6.339**  ***p* < .001** | ***t* = 7.416**  ***p* < .001** | ***t* = 3.879**  ***p* < .001** | *t* = 1.532  *p* = 0.067 | ***t* = 4.691**  ***p* < .001** | *t* = -0.218  *p* = 0.594 | *t* = 0.914  *p* = 0.172 |
| Cross radial to angular | *t* = -5.255  *p* = 1.000 | *t* = -2.993  *p* = 0.994 | *t* = -0.406  *p* = 0.621 | *t* = 1.669  *p* = 0.056 | *t* = 1.029  *p* = 0.153 | ***t* = 1.702**  ***p* = 0.049** | *t* = 1.535  *p* = 0.074 | *t* = -1.155  *p* = 0.873 |
| Cross angular to radial | *t* = -5.660  *p* = 1.000 | *t* = -3.342  *p* = 0.998 | *t* = -0.598  *p* = 0.692 | ***t* = 2.912**  ***p* = 0.008** | ***t* = 1.880**  ***p* = 0.040** | ***t* = 2.483**  ***p* = 0.009** | *t* = 0.470  *p* = 0.340 | *t* = -0.751  *p* = 0.787 |
| Permutation-based 2-way ANOVA. Decoding type Modulator type | | | | | | | | |
|  | V1 | V2 | V3 | V3AB | IPS0/1 | IPS2/3 | sPCS | iPCS |
| Decoding type  df: (1, 15) | ***F* = 233.710**  ***p* < .001** | ***F* = 170.450**  ***p* < .001** | ***F* = 68.036**  ***p* < .001** | ***F* = 7.515**  ***p* = 0.007** | *F* = 1.145  *p* = 0.290 | *F* = 1.875  *p* = 0.179 | *F* = 0.447  *p* = 0.520 | *F* = 1.659  *p* = 0.202 |
| Modulator type  df: (1, 15) | ***F* = 6.676**  ***p* = 0.018** | ***F* = 12.017**  ***p* = 0 .001** | ***F* = 4.624**  ***p* = 0.037** | *F* < .001  *p* = 0.993 | *F* = 0.324  *p* = 0.576 | ***F* = 7.597**  ***p* = 0.005** | *F* = 0.778  *p* = 0.375 | *F* = 0.428  *p* = 0.510 |
| Decoding type  Modulator type  df: (1, 15) | *F* = 1.251  *p* = 0.274 | ***F* = 7.585**  ***p* = 0.009** | *F* = 3.887  *p* = 0.051 | *F* = 0.632  *p* = 0.435 | *F* = 0.243  *p* = 0.621 | *F* = 2.940  *p* = 0.094 | *F* = 0.003  *p* = 0.959 | *F* = 0.035  *p* = 0.855 |

**Supplementary File 1b.**

Decoding accuracy for the late delay epoch in the WM task

| One-sample t-test against chance (1/3) based on non-parametric permutation test | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | V1 | V2 | V3 | V3AB | IPS0/1 | IPS2/3 | sPCS | iPCS |
| Within radial | ***t* = 5.302**  ***p* < .001** | ***t* = 4.520**  ***p* < .001** | ***t* = 4.337**  ***p* < .001** | ***t* = 5.891**  ***p* < .001** | ***t* = 4.910**  ***p* < .001** | ***t* = 5.141**  ***p* < .001** | ***t* = 2.706**  ***p* = 0.007** | ***t* = 2.164**  ***p* = 0.025** |
| Within angular | ***t* = 5.279**  ***p* < .001** | ***t* = 6.040**  ***p* < .001** | ***t* = 4.737**  ***p* < .001** | ***t* = 6.260**  ***p* < .001** | ***t* = 5.225**  ***p* < .001** | ***t* = 3.460**  ***p* < .001** | ***t* = 2.936**  ***p* = 0.008** | *t* = 1.718  *p* = 0.058 |
| Cross radial to angular | ***t* = 4.513**  ***p* < .001** | ***t* = 4.400**  ***p* < .001** | ***t* = 4.015**  ***p* < .001** | ***t* = 4.953**  ***p* < .001** | ***t* = 4.102**  ***p* < .001** | ***t* = 3.755**  ***p* < .001** | ***t* = 1.835**  ***p* = 0.049** | *t* = 0.476  *p* = 0.354 |
| Cross angular to radial | ***t* = 4.695**  ***p* < .001** | ***t* = 4.361**  ***p* < .001** | ***t* = 3.993**  ***p* < .001** | ***t* = 5.239**  ***p* < .001** | ***t* = 4.764**  ***p* < .001** | ***t* = 3.873**  ***p* < .001** | ***t* = 4.636**  ***p* < .001** | ***t* = 2.588**  ***p* = 0.009** |
| Permutation-based 2-way ANOVA. Decoding type Modulator type | | | | | | | | |
|  | V1 | V2 | V3 | V3AB | IPS0/1 | IPS2/3 | sPCS | iPCS |
| Decoding type  df: (1, 15) | *F* = 2.553  *p* = 0.119 | *F* = 0.931  *p* = 0.339 | *F* = 0.232  *p* = 0.646 | *F* = 0.426  *p* = 0.527 | *F* = 0.138  *p* = 0.721 | *F* = 0.012  *p* = 0.912 | *F* = 1.172  *p* = 0.290 | *F* = 0.652  *p* = 0.415 |
| Modulator type  df: (1, 15) | *F* = 0.777  *p* = 0.378 | *F* = 0.153  *p* = 0.699 | *F* = 0.205  *p* = 0.655 | *F* = 0.008  *p* = 0.926 | *F* = 0.017  *p* = 0.900 | *F* = 0.003  *p* = 0.956 | *F* = 0.624  *p* = 0.433 | *F* = 1.017  *p* = 0.325 |
| Decoding type  Modulator type  df: (1, 15) | *F* = 1.173  *p* = 0.283 | *F* = 0.448  *p* = 0.509 | *F* = 0.161  *p* = 0.684 | *F* = 0.024  *p* = 0.876 | *F* = 0.240  *p* = 0.624 | *F* = 0.207  *p* = 0.656 | *F* = 0.092  *p* = 0.771 | *F* = 0.255  *p* = 0.613 |

**Supplementary File 1c.**

Decoding accuracy for the cross-task decoding by training the classifier in the perceptual control task and testing it in the WM task

| One-sample t-test against chance (1/3) based on non-parametric permutation test | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | V1 | V2 | V3 | V3AB | IPS0/1 | IPS2/3 | sPCS | iPCS |
| Within radial | ***t* = 3.961**  ***p* < .001** | ***t* = 5.596**  ***p* < .001** | ***t* = 4.430**  ***p* < .001** | ***t* = 3.373**  ***p* < .001** | ***t* = 1.927**  ***p* = 0.031** | *t* = 1.462  *p* = 0.082 | *t* = 0.080  *p* = 0.482 | ***t* = 1.913**  ***p* = 0.042** |
| Within angular | *t* = -1.907  *p* = 0.963 | *t* = -0.213  *p* = 0.598 | *t* = 1.711  *p* = 0.050 | ***t* = 4.187**  ***p* < .001** | ***t* = 3.143**  ***p* = 0.002** | ***t* = 1.923**  ***p* = 0.036** | ***t* = 2.010**  ***p* = 0.019** | *t* = -0.183  *p* = 0.574 |
| Cross radial to angular | ***t* = 4.234**  ***p* < .001** | ***t* = 5.137**  ***p* < .001** | ***t* = 5.223**  ***p* < .001** | ***t* = 3.378**  ***p* = 0.004** | *t* = 1.282  *p* = 0.106 | ***t* = 2.752**  ***p* = 0.005** | ***t* = 2.215**  ***p* = 0.014** | *t* = 1.207  *p* = 0.132 |
| Cross angular to radial | *t* = -0.395  *p* = 0.632 | *t* = 0.444  *p* = 0.336 | ***t* = 1.821**  ***p* = 0.042** | ***t* = 3.410**  ***p* = 0.003** | ***t* = 4.227**  ***p* < .001** | ***t* = 3.652**  ***p* = 0.002** | *t* = 0.798  *p* = 0.212 | ***t* = 1.717**  ***p* = 0.049** |
| Permutation-based 2-way ANOVA. Decoding type Modulator type | | | | | | | | |
|  | V1 | V2 | V3 | V3AB | IPS0/1 | IPS2/3 | sPCS | iPCS |
| Decoding type  df: (1, 15) | *F* = 0.848  *p* = 0.371 | *F* = 0.403  *p* = 0.523 | *F* = 0.105  *p* = 0.749 | *F* = 0.273  *p* = 0.598 | *F* = 0.011  *p* = 0.916 | *F* = 0.176  *p* = 0.691 | *F* = 0.410  *p* = 0.511 | *F* = 0.378  *p* = 0.539 |
| Modulator type  df: (1, 15) | ***F* = 33.587**  ***p* < .001** | ***F* = 30.100**  ***p* < .001** | ***F* = 6.287**  ***p* = 0.016** | *F* = 0.260  *p* = 0.612 | *F* = 2.488  *p* = 0.122 | *F* = 0.810  *p* = 0.380 | *F* = 0.026  *p* = 0.879 | *F* = 1.009  *p* = 0.312 |
| Decoding type  Modulator type  df: (1, 15) | *F* = 0.167  *p* = 0.690 | *F* < .001  *p* = 0.975 | *F* = 0.127  *p* = 0.728 | *F* = 0.090  *p* = 0.772 | *F* = 0.993  *p* = 0.329 | *F* = 0.198  *p* = 0.660 | *F* = 3.517  *p* = 0.063 | *F* = 0.825  *p* = 0.361 |

**Supplementary File 1d.**

Reconstruction fidelity values for the late delay epoch in the WM task

| One-sample t-test against zero based on non-parametric permutation test | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | V1 | V2 | V3 | V3AB | IPS0/1 | IPS2/3 | sPCS | iPCS |
| Radial | ***t* = 8.061**  ***p* < .001** | ***t* = 8.233**  ***p* < .001** | ***t* = 5.825**  ***p* < .001** | ***t* = 6.891**  ***p* < .001** | ***t* = 3.025**  ***p* = 0.004** | *t* = 0.672  *p* = 0.263 | *t* = 0.686  *p* = 0.240 | *t* = -0.359  *p* = 0.642 |
| Angular | ***t* = 10.875**  ***p* < .001** | ***t* = 11.998**  ***p* < .001** | ***t* = 9.070**  ***p* < .001** | ***t* = 7.559**  ***p* < .001** | ***t* = 3.132**  ***p* = 0.004** | *t* = 0.113  *p* = 0.492 | *t* = -1.247  *p* = 0.870 | *t* = 0.975  *p* = 0.149 |

**Supplementary File 1e.**

Reconstruction fidelity values for the stimulus-presenting epoch in the perceptual control task

| One-sample t-test against zero based on non-parametric permutation test | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | V1 | V2 | V3 | V3AB | IPS0/1 | IPS2/3 | sPCS | iPCS |
| Radial | ***t* = 57.306**  ***p* < .001** | ***t* = 72.482**  ***p* < .001** | ***t* = 18.235**  ***p* < .001** | ***t* = 5.002**  ***p* < .001** | *t* = -0.183  *p* = 0.562 | *t* = 0.157  *p* = 0.436 | *t* = -0.886  *p* = 0.813 | *t* = -0.781  *p* = 0.788 |
| Angular | *t* = -4.339  *p* = 1.000 | *t* = -2.451  *p* = 0.993 | *t* = 0.059  *p* = 0.467 | ***t* = 7.945**  ***p* < .001** | ***t* = 2.013**  ***p* = 0.037** | *t* = 1.351  *p* = 0.110 | *t* = -0.864  *p* = 0.818 | *t* = -0.338  *p* = 0.644 |