**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 typedf: (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 typedf: (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 typedf: (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 typedf: (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 typedf: (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 typedf: (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 typedf: (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 typedf: (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 typedf: (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 |