**Supplementary File 1a. Neuropsychological test battery performance.**

|  |  |  |
| --- | --- | --- |
| Measure | Mean (SD) | Range |
| WTAR | 42.53 (4.31) | 29 – 50 |
| WASI Vocabulary | 72.01 (4.39) | 51 – 78 |
| WASI Similarities | 39.68 (3.22) | 28 – 46 |
| WASI Matrix Reasoning | 26.31 (3.09) | 17 – 31 |
| WASI Block Design | 43.35 (11.90) | 16 – 68 |
| Boston Naming Test | 28.95 (1.35) | 24 – 30 |
| Category Fluency (animals) | 25.83 (5.56) | 12 – 42 |
| Digit Span Forward | 10.70 (2.23) | 6 – 16 |
| Digit Span Backward | 7.92 (2.51) | 3 – 14 |
| Trails A (s) | 32.13 (10.69) | 15 – 65 |
| Trails B (s) | 66.05 (21.12) | 33 – 150 |
| HVLT Immediate Recall a | 28.74 (4.03) | 14 – 35 |
| HVLT Delayed Recall | 10.49 (1.68) | 5 – 12 |
| HVLT Recognition | 11.01 (1.07) | 8 – 12 |
| BVMT Immediate Recall a | 24.42 (6.50) | 8 – 36 |
| BVMT Delayed Recall | 9.80 (2.16) | 5 – 12 |
| BVMT Recognition | 5.84 (0.44) | 4 – 6 |
| Logical Memory Immediate Recall | 50.02 (7.59) | 30 – 64 |
| Logical Memory Delayed Recall | 32.04 (6.16) | 18 – 44 |
| Logical Memory Recognition | 27.28 (2.04) | 21 – 30 |

a Sum over three learning trials. WTAR = Wechsler Test of Adult Reading; WASI = Wechsler Abbreviated Scale of Intelligence; BVMT-R = Brief Visuospatial Memory Test-Revised; HVLT-R = Hopkins Verbal Learning Test-Revised.

**Supplementary File 1b. Reaction time (ms) and trial counts as a function of trial type.**

|  |  |  |
| --- | --- | --- |
| **Trial Type** | **Median RT (SD)** | **Mean # Trials (SD)** |
| Associative Hita  Associative Missa  Item Only Hita  Item Missa  Correct Rejectiona  Associative Hitb Face  Associative Hitb Place | 2382 (421)  2939 (553)  3198 (600)  2689 (568)  2095 (491)  2271 (497)  2548 (413) | 70.15 (19.32)  15.13 (10.35)  13.74 (13.22)  13.65 (9.35)  23.08 (5.31)  39.06 (10.19)  31.09 (10.46) |

a RT varied as a function of response type, such that associative hits were faster than associative misses (*t*(99)=12.09, *p* < 10-16), item only hits (*t*(99)=13.80, *p* < 10-16), item misses (*t*(99)=4.99, *p* < 10-6), and were slower than correct rejections (*t*(99)=2.81, *p* < .01). bAssociative hit RT was significantly faster for face trials than place trials (*t*(99)=8.40, *p* < 1013).

**Supplementary File 1c. Summary of model parameters for mixed effects models.**

|  |  |  |
| --- | --- | --- |
| **IV interest** | **IV nuisance** | **DV** |
| Hippocampal Activity | Age, Category | Associative Hit  Exemplar Specific Hit  RT |
| Category-Level Reinstatement Strength (logits) | Age, Category, Encoding Strength (logits), ROI Univariate Activitya | Associative Hit  Exemplar Specific Hit  RT |
| Category-Level Reinstatement Strength (ERS) | Age, Category, Encoding Strength (logits), ROI Univariate Activityb | Associative Hit  Exemplar Specific Hit  RT |
| Event-Level Reinstatement Strength (ERS) | Age, Category, ROI Univariate Activityb, Category Reinstatement (ERS) | Associative Hit  Exemplar Specific Hit  RT |
| Hippocampal Activity | Age, Category, Encoding Strength (logits) | Category Reinstatement Strength (logits) |
| Hippocampal Activity | Age, Category, Encoding Strength (logits) | Category Reinstatement Strength (ERS) |
| Hippocampal Activity | Age, Category, Category Reinstatement Strength (ERS) | Event-Level Reinstatement Strength (ERS) |

*Note:*All models include a random intercept for subject and a random slope for the IV of interest. a =Univariate activity in top 500 category-selective voxels in VTC or ANG over which classification analyses were conducted; b = Univariate activity in whole ROI (VTC or ANG) over which pattern similarity analyses were conducted; ERS = Encoding Retrieval Similarity; ROI = Region of Interest.

**Supplementary File 1d. Summary of linear and logistic mixed effects model results when item miss trials are excluded.**

|  |  |  |  |
| --- | --- | --- | --- |
| **IV** | **DV** | **χ2** | **P** |
| Category-Level Reinstatement VTC | Associative Hit | 90.25 | 2.1\* 10-21 |
| Category-Level Reinstatement \* Age  Category-Level Reinstatement ANG  Category-Level Reinstatement \* Age  Event-Level Reinstatement VTC  Event-Level Reinstatement \*Age  Event-Level Reinstatement ANG  Event-Level Reinstatement \*Age  Hippocampal Activity  Hippocampal Activity \* Age  Hippocampal Activity  Hippocampal Activity \* Age  Hippocampal Activity  Hippocampal Activity \* Age  Hippocampal Activity  Hippocampal Activity \* Age  Hippocampal Activity  Hippocampal Activity \* Age | Associative Hit  Associative Hit  Associative Hit  Associative Hit  Category-Level Reinstatement VTC  Category-Level Reinstatement ANG  Event-Level Reinstatement VTC  Event-Level Reinstatement ANG | 4.48  128.15  2.93  1.78  1.30  7.50  0.02  41.16  0.89  35.26  1.67  24.88  0.65  4.55  0.472  0.78  0.478 | 0.034  1.04 \* 10-29  0.087  0.183  0.254  0.006  0.900  1.40 \* 10-10  0.345  2.89\*10-9  0.197  6.10\*10-7  0.419  0.033  0.492  0.378  0.489 |

Note: Statistics reflect χ2 values (degrees of freedom = 1) and p values for model comparison with and without the primary IV of interest. Category-Level Reinstatement = classifier evidence at retrieval (logits). Event-Level Reinstatement = encoding-retrieval similarity. See Supplementary File 1c for a list of all nuisance regressors included in each model.

**Supplementary File 1e. Summary of linear and logistic mixed effects models examining effects of stimulus category (face, place) on relationships between neural variables and behavioural variables.**

|  |  |  |  |
| --- | --- | --- | --- |
| **IV** | **DV** | **χ2** | **P** |
| Category-Level Reinstatement VTC | Associative Retrieval Accuracy | 29.55 | 5.4 \* 10-8 |
|  | * Face Trials * Place Trials | 21.89  75.81 | 2.9 *\** 10-6  3.1 \* 10-18 |
| Category-Level  Reinstatement ANG  Hippocampal Activity | Decision RT associative hits   * Face Trials * Place Trials   Associative Retrieval Accuracy   * Face Trials * Place Trials   Decision RT associative hits  - Face Trials  - Place Trials  Associative Retrieval Accuracy  Decision RT associative hits | 9.39  36.40  8.46  9.63  93.73  55.84  92.29  45.51  10.43  2.86  0.01 | 0.002  1.6 \* 10-9  0.004  0.002  3.6 \* 10-22  7.9\* 10-14  7.5 \* 10-22  1.5 \* 10-11  0.001  *p =* .091  *p* = .905 |

Note: Statistics reflect χ2 values (degrees of freedom = 1) and p values for model comparison with and without the interaction term. When the interaction term was significant, follow-up regression models were conducted within each stimulus category separately. Category-Level Reinstatement = classifier evidence at retrieval (logits).

**Supplementary File 1f. Summary of linear mixed effects models examining effects of stimulus category (face, place) on relationships between hippocampal activity and cortical reinstatement.**

|  |  |  |  |
| --- | --- | --- | --- |
| **IV** | **DV** | **χ2** | **p** |
| Hippocampal Activity | Category-Level Reinstatement VTC | 235.87 | 3.1 \* 10-42 |
|  | * Face Trials * Place Trials | 11.96  82.93 | 0.0005  8.5 \* 10-20 |
| Hippocampal Activity  Hippocampal Activity  Hippocampal Activity | Category-Level Reinstatement ANG   * Face Trials * Place Trials   Event-Level Reinstatement VTC   * Face Trials * Place Trials   Event-Level Reinstatement ANG | 8.47  28.28  3.15  4.62  0.02  9.13  2.23 | 0.004  1.1 \* 10-7  0.077  0.032  0.881  0.003  0.135 |

Note: Statistics reflect χ2 values (degrees of freedom = 1) and p values for model comparison with and without the interaction term. When the interaction term was significant, follow-up regression models were conducted within each stimulus category separately. Category-Level Reinstatement = classifier evidence at retrieval (logits). Event-Level Reinstatement = encoding-retrieval similarity.

**Supplementary File 1g. Analysis of head motion and its effects on key dependent variables of interest.**

|  |  |  |  |
| --- | --- | --- | --- |
| **IV** | **DV** | **β** | **p** |
| Age  Sex  Education | Head Motion study | 0.19  -0.30  0.03 | 0.053  0.153  0.762 |
|  |  |  |  |
| Age  Sex  Education | Head Motion test | 0.15  -0.29  0.05 | 0.139  0.159  0.611 |
|  |  |  |  |
| Head Motion study  Head Motion study | Encoding Strength VTC  Encoding Strength ANG | -0.48  -0.34 | 4.2\*10-7  0.001 |
|  |  |  |  |
| Head Motion test  Head Motion test  Head Motion mean  Head Motion mean  Head Motion test | Category-Level Reinstatement VTC  Category-Level Reinstatement ANG  Event-Level  Reinstatement VTC  Event-Level  Reinstatement ANG  Hippocampal Activity | -0.06  -0.19  -0.08  -0.04  -0.16 | 0.521  0.056  0.417  0.652  0.105 |

*Note*. Head motion is computed as mean framewise displacement, separately for study and test runs. Encoding Strength = classifier evidence at encoding (logits); Category-Level Reinstatement = classifier evidence at retrieval (logits); Event-Level Reinstatement = encoding-retrieval similarity. SE = standard error; VTC = ventral temporal cortex; ANG = angular gyrus.

**Supplementary File 1h. Summary of hierarchical regression analysis predicting associative *d’*.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Variable** | | **β** | **SE** | **p** | **Adjusted R2** |
| Step 1 | Age | | -0.324 | 0.096 | 0.001\*\*\* | 0.096 |
|  |  | |  |  |  |  |
| Step 2 | Age | | -0.283 | 0.090 | 0.001\*\*\* | 0.205 |
|  | Hippocampal Activitya | | 0.349 | 0.091 | 0.001\*\*\* |  |
|  |  | |  |  |  |  |
| Step 3a | Age | | -0.169 | 0.090 | 0.063~ | 0.295 |
|  | Hippocampal Activitya  VTC Reinstatementab | | 0.284  0.368 | 0.088  0.100 | 0.002\*\*  0.001\*\*\* |  |
|  |  | |  |  |  |  |
| Step 3b | Age | | -0.245 | 0.089 | 0.007\*\* | 0.249 |
|  | Hippocampal Activitya  ANG Reinstatementab | | 0.282  0.303 | 0.093  0.117 | 0.003\*\*  0.011\* |  |
|  |  | |  |  |  |  |
| Step 4 | Age | | -0.179 | 0.090 | 0.064~ | 0.297 |
| Step 5 | Hippocampal Activitya  VTC Reinstatementab  ANG Reinstatementab  Age  Hippocampal Activitya | | 0.262  0.310  0.146  -0.119  0.228 | 0.089  0.113  0.127  0.090  0.088 | 0.004\*\*\*  0.007\*\*\*  0.254  0.190  0.012\* | 0.336 |
|  | VTC Reinstatementab  Delayed Recall | | 0.312  0.328 | 0.100  0.124 | 0.002\*\*  0.009\*\* |  |
|  |  |  | |  |  |  |

*Note*. a = adjusted by head motion; b = adjusted by encoding strength (mean logits across leave-one-run-out-n-fold cross validation); Reinstatement = category-level reinstatement (mean logits across associative hits); SE= standard error; VTC = ventral temporal cortex; ANG = angular gyrus; ~ p < 0.1, \* p < 0.05, \*\* p < .01, \*\*\* p < .001 \*\*\*\* p < 10-5

**Supplementary File 1i. Summary of regression analyses examining the relationship between hippocampal subfield activity during associative retrieval (associative hit - CR) and associative memory.**

|  |  |  |  |
| --- | --- | --- | --- |
| **IV** | **DV** | **β** | **p** |
| DG/CA3a  CAa  Suba  Heada  Taila | Associative *d’*b  Associative *d’*b  Associative *d’*b  Associative *d’*b  Associative *d’*b | 0.25  0.19  0.19  0.30  0.26 | 0.007  0.045  0.044  0.001  0.005 |
| DG/CA3a  CAa  Suba  Heada  Taila | Exemplar-Specific Recallb  Exemplar-Specific Recallb  Exemplar-Specific Recallb  Exemplar-Specific Recallb  Exemplar-Specific Recallb | 0.30  0.27  0.27  0.41  0.26 | 0.002  0.004  0.006  7.5 \* 10-6  0.007 |

*Note*. a = adjusted by head motion. b = adjusted by age. DG = dentate gyrus; Sub = Subiculum.