**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 HitaAssociative MissaItem Only HitaItem MissaCorrect RejectionaAssociative Hitb FaceAssociative 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 HitRT |
| Category-Level Reinstatement Strength (logits) | Age, Category, Encoding Strength (logits), ROI Univariate Activitya  | Associative Hit Exemplar Specific HitRT |
| Category-Level Reinstatement Strength (ERS) | Age, Category, Encoding Strength (logits), ROI Univariate Activityb  | Associative Hit Exemplar Specific HitRT |
| Event-Level Reinstatement Strength (ERS) | Age, Category, ROI Univariate Activityb, Category Reinstatement (ERS) | Associative Hit Exemplar Specific HitRT |
| 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 ANGCategory-Level Reinstatement \* AgeEvent-Level Reinstatement VTCEvent-Level Reinstatement \*AgeEvent-Level Reinstatement ANGEvent-Level Reinstatement \*AgeHippocampal Activity Hippocampal Activity \* AgeHippocampal Activity Hippocampal Activity \* AgeHippocampal Activity Hippocampal Activity \* AgeHippocampal Activity Hippocampal Activity \* AgeHippocampal Activity Hippocampal Activity \* Age | Associative HitAssociative HitAssociative HitAssociative HitCategory-Level Reinstatement VTCCategory-Level Reinstatement ANGEvent-Level Reinstatement VTCEvent-Level Reinstatement ANG | 4.48128.152.931.781.307.500.0241.160.8935.261.6724.880.654.550.4720.780.478 | 0.0341.04 \* 10-290.0870.1830.2540.0060.9001.40 \* 10-100.3452.89\*10-90.1976.10\*10-70.4190.0330.4920.3780.489 |

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
 | 21.8975.81 | 2.9 *\** 10-63.1 \* 10-18 |
| Category-LevelReinstatement ANGHippocampal Activity  | Decision RT associative hits* Face Trials
* Place Trials

Associative Retrieval Accuracy* Face Trials
* Place Trials

Decision RT associative hits- Face Trials- Place TrialsAssociative Retrieval AccuracyDecision RT associative hits | 9.3936.408.469.6393.7355.8492.2945.5110.432.860.01 | 0.0021.6 \* 10-90.0040.0023.6 \* 10-227.9\* 10-147.5 \* 10-221.5 \* 10-110.001*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
 | 11.9682.93 | 0.00058.5 \* 10-20 |
| Hippocampal ActivityHippocampal ActivityHippocampal Activity | Category-Level Reinstatement ANG* Face Trials
* Place Trials

Event-Level Reinstatement VTC* Face Trials
* Place Trials

Event-Level Reinstatement ANG | 8.4728.283.154.620.029.132.23 | 0.0041.1 \* 10-70.0770.0320.8810.0030.135 |

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** |
| AgeSexEducation | Head Motion study | 0.19-0.300.03 | 0.0530.1530.762 |
|  |  |  |  |
| AgeSexEducation | Head Motion test | 0.15-0.290.05 | 0.1390.1590.611 |
|  |  |  |  |
| Head Motion studyHead Motion study | Encoding Strength VTC Encoding Strength ANG  | -0.48-0.34 | 4.2\*10-70.001 |
|  |  |  |  |
| Head Motion testHead Motion testHead Motion meanHead Motion mean Head Motion test | Category-Level Reinstatement VTCCategory-Level Reinstatement ANGEvent-Level Reinstatement VTCEvent-Level Reinstatement ANGHippocampal Activity | -0.06-0.19-0.08-0.04-0.16 | 0.5210.0560.4170.6520.105 |

*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 | 0.2840.368 | 0.0880.100 | 0.002\*\*0.001\*\*\* |  |
|  |  |  |  |  |  |
| Step 3b | Age  | -0.245 | 0.089 | 0.007\*\* | 0.249 |
|  | Hippocampal Activitya ANG Reinstatementab | 0.2820.303 | 0.0930.117 | 0.003\*\*0.011\* |  |
|  |  |  |  |  |  |
| Step 4 | Age  | -0.179 | 0.090 | 0.064~ | 0.297 |
| Step 5 | Hippocampal Activitya VTC ReinstatementabANG ReinstatementabAgeHippocampal Activitya | 0.2620.3100.146-0.1190.228 | 0.0890.1130.1270.0900.088 | 0.004\*\*\*0.007\*\*\*0.2540.1900.012\* | 0.336 |
|  | VTC ReinstatementabDelayed Recall | 0.3120.328 | 0.1000.124 | 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/CA3aCAaSubaHeadaTaila | Associative *d’*bAssociative *d’*bAssociative *d’*bAssociative *d’*bAssociative *d’*b | 0.250.190.190.300.26 | 0.0070.0450.0440.0010.005 |
| DG/CA3aCAaSubaHeadaTaila | Exemplar-Specific RecallbExemplar-Specific RecallbExemplar-Specific RecallbExemplar-Specific RecallbExemplar-Specific Recallb | 0.300.270.270.410.26 | 0.0020.0040.0067.5 \* 10-60.007 |

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