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Manuscript Number:	NN-A53763	# Supplementary Figures:	11
Manuscript Type:	Article	# Supplementary Tables:	3
		# Supplementary Videos:	0

Reporting Checklist for Nature Neuroscience

This checklist is used to ensure good reporting standards and to improve the reproducibility of published results. For more information, please read Reporting Life Sciences Research.

Please note that in the event of publication, it is mandatory that authors include all relevant methodological and statistical information in the manuscript.

Statistics reporting, by figure

- Please specify the following information for each panel reporting quantitative data, and where each item is reported (section, e.g. Results, & paragraph number).
- Each figure legend should ideally contain an exact sample size (n) for each experimental group/condition, where n is an exact number and not a range, a clear definition of how n is defined (for example x cells from x slices from x animals from x litters, collected over x days), a description of the statistical test used, the results of the tests, any descriptive statistics and clearly defined error bars if applicable.
- For any experiments using custom statistics, please indicate the test used and stats obtained for each experiment.
- Each figure legend should include a statement of how many times the experiment shown was replicated in the lab; the details of sample collection should be sufficiently clear so that the replicability of the experiment is obvious to the reader.
- For experiments reported in the text but not in the figures, please use the paragraph number instead of the figure number.

Note: Mean and standard deviation are not appropriate on small samples, and plotting independent data points is usually more informative. When technical replicates are reported, error and significance measures reflect the experimental variability and not the variability of the biological process; it is misleading not to state this clearly.

		TEST USED		n			DESCRIPTIVE STATS (AVERAGE, VARIANCE)		P VALUE		DEGREES OF FREEDOM & F/t/z/R/ETC VALUE	
	FIGURE NUMBER	WHICH TEST?	SECTION & PARAGRAPH #	EXACT VALUE	DEFINED?	SECTION & PARAGRAPH #	REPORTED?	SECTION & PARAGRAPH #	EXACT VALUE	SECTION & PARAGRAPH #	VALUE	SECTION & PARAGRAPH #
example	1a	one-way ANOVA	Fig. legend	9, 9, 10, 15	mice from at least 3 litters/group	Methods para 8	error bars are mean +/- SEM	Fig. legend	p = 0.044	Fig. legend	F(3, 36) = 2.97	Fig. legend
example	results, para 6	unpaired t-test	Results para 6	15	slices from 10 mice	Results para 6	error bars are mean +/- SEM	Results para 6	p = 0.0006	Results para 6	t(28) = 2.808	Results para 6

		TEST USED		n			DESCRIPTIVE STATS (AVERAGE, VARIANCE)		P VALUE		DEGREES OF FREEDOM & F/t/z/R/ETC VALUE	
	FIGURE NUMBER	WHICH TEST?	SECTION & PARAGRAPH #	EXACT VALUE	DEFINED?	SECTION & PARAGRAPH #	REPORTED?	SECTION & PARAGRAPH #	EXACT VALUE	SECTION & PARAGRAPH #	VALUE	SECTION & PARAGRAPH #
+ -	1d	-	Fig. legend	17	Participants	Results para 2, Methods para 1	mean, s.d., max, min	Results para 2, Table S1	-	-	-	-
+ -	1d	-	Fig. legend	50	Scenes in movie	Results para 2, Methods para 7	mean, s.d., max, min	Results para 2, Table S1	-	-	-	-
+ -	2b	permutation analysis, corrected for multiple comparisons using FDR	Results para 4-5	17	Brain maps of participants	Methods, para 14-16	-	-	q = 0.05	Fig. Legend	-	-
+ -	2c	-	Results para 4-5	17	Brain maps of participants	Methods, para 14-16	individual data points, mean, error bars are mean +/- SEM	Fig. Legend	-	-	-	-
+ -	2e	permutation analysis, corrected for multiple comparisons using FDR	Results para 8	17	Brain maps of participants	Methods, para 14-16	-	-	q = 0.05	Fig. legend	-	-
+ -	2f	-	Results para 8	17	Average reinstatement values for each participant	Methods, para 14-16	individual data points, mean, error bars are mean +/- SEM	Fig. Legend	-	Fig. legend	-	-
+ -	3b	-	Results para 10	17	Brain maps of participants	Methods, para 14-16	-	-	q = 0.05	Fig. legend	-	-
+ -	3c	-	Results, para 11-12	17	Average recall-recall correlation for each participant	Methods, para 14-16	individual data points, mean, error bars are mean +/- SEM	-	-	-	-	-
+ -	4a	permutation analysis, corrected for multiple comparisons using FDR	Results para 12-13, Methods para 17-18	200	Mean classification accuracy of all scenes from 200 random combinations of two group sizes N = 8 and N = 9	Results para 12-13, Methods para 17-18	Average classification accuracy	Results para 12-13,	q = 0.001	Results para 12-13	-	-
+ -	4b	permutation analysis, corrected for multiple comparisons using FDR	Results para 12-13, Methods para 17-18	200	Mean classification rank of each scene from 200 random combinations of two group sizes N = 8 and N = 9	Results para 12-13, Methods para 17-18	Mean classification rank for each scene	Results para 12-13,	q = 0.001	Results para 12-13	-	-

+ -	4c	permutation analysis, corrected for multiple comparisons using FDR	Results para 12-13, Methods para 17-18	200	Mean classification accuracy of recalled scenes from 200 random combinations of two group sizes N = 8 and N = 9	Results para 12-13, Methods para 17-18	Mean classification rank for each scene	Results para 12-13,	q = 0.001	Results para 12-13	-	-
+ -	4d	permutation analysis, corrected for multiple comparisons using FDR	Results para 12-13, Methods para 17-18	200	Mean classification accuracy of recalled scenes from 200 random combinations of two group sizes N = 8 and N = 9	Results para 12-13, Methods para 17-18	Average classification accuracy	Results para 12-13,	q = 0.001	Results para 12-13	-	-
+ -	5	-	Results para 14, Methods para 19	3-75	Classification accuracy with different number of feature dimensions	Results para 14, Methods para 19	Average classification accuracy	Results para 14, Methods para 19	-	-	-	-
+ -	6	-	Results, para 15, Methods para 20	8	Random subset of participants	Results, para 15, Methods para 20	-	-	-	-	-	-
+ -	7b	permutation analysis, corrected for multiple comparisons using FDR	Results, para 17	17	Brain maps of participants	Results, para 17; Methods para 21	-	-	-	-	-	-
+ -	7c	-	Results, para 17	3571	t-statistic of a searchlight	-	-	-	-		-	-
+ -	8a	-	Results, para 20-21	17	Within-participant RDMs	Methods para 23-25	-	-	-	-	-	-
+ -	8b	-	Results, para 20-21	272	Between-participant RDMs	Methods para 23-25	-	-	-	-	-	-
+ -	8c	permutation analysis, corrected for multiple comparisons using FDR	Results, para 20-21	17,272	Within-participant RDMs and Between-participant RDMs	Methods para 23-25	-	-	q = 0.05	-	-	-
+ -	S2	-	Fig. legend	17	Average correlation between first time point in recall scene to each time point in movie scene for each participant	Average recall-recall pattern similarity in ROIFig. legend	error bars are mean +/- SEM	-	-	-	-	-
+ -	S3b	permutation analysis, corrected for multiple comparisons using FDR	Results para 7	17	Brain maps of participants	Methods, Para 14-16	-	-	q = 0.05	Methods, Para 14-16	-	-
+ -	S3c	-	Fig. legend	17	Average between-participant pattern similarity during movie-viewing	Methods, Para 14-16	individual data points, mean, error bars are mean +/- SEM	Fig. legend	-	-	-	-

+ -	S4b	-	Results para 10	17	Average recall-recall pattern similarity in ROI	Fig. Legend	R values for each ROI, error bars are mean +/- SEM	Fig. legend	-	-	-	-
+ -	S5a	-	Results, para 13	17	Participants	Methods, para 17-18	Average R values for each scene, error bars are mean +/- SEM	Fig. legend	-	-	-	-
+ -	S5b	-	Results, para 13	17	Participants	Methods, para 17-18	Average R values for each scene, error bars are mean +/- SEM	Fig. legend	-	-	-	-
+ -	S5c	-	Results, para 13	17	Participants	Methods, para 17-18	Average R values for each scene, error bars are mean +/- SEM	Fig. legend	-	-	-	-
+ -	S6b	-	Results, para 14	1-10	Classification accuracy with different number of predictors	Fig. Legend	Average classification accuracy	Fig. legend	-	-	-	-
+ -	S8a	-	Results, para 20-21	50	Movie scenes	Methods, para 23-25	Difference in r between recall-recall and movie-recall	Methods, para 23-25	-	-	-	-
+ -	S8b	-	Results, para 20-21	17	Participants	Methods, para 23-25	Difference in Rs	Methods, para 20	-	-	-	-
+ -	S9a	Spearman rank correlation	Fig. legend	50	Movie scenes	Fig. legend	-	-	p = 0.03	Fig. Legend	R = 0.33	Fig. legend
+ -	S9b	Spearman rank correlation	Fig. legend	50	Movie scenes	Fig. legend	-	-	p = 0.93	Fig. Legend	R = -0.01	Fig. legend
+ -	S9c	Spearman rank correlation	Fig. legend	50	Movie scenes	Fig. legend	-	-	p = 0.43	Fig. Legend	R = 0.12	Fig. legend
+ -	S10	two-tailed paired t-test	Fig. legend	50	Hippocampal inter-participant correlation during scene	Fig. legend	-	-	p = 0.045	Fig. Legend	t(49) = 2.17	Fig. Legend
+ -	S11	-	Results, para 19	-	Scene Correlations	Fig. legend	-	-	-	-	-	-

Representative figures

1. Are any representative images shown (including Western blots and immunohistochemistry/staining) in the paper?

   If so, what figure(s)?

   N.A.

2. For each representative image, is there a clear statement of how many times this experiment was successfully repeated and a discussion of any limitations in repeatability?

   If so, where is this reported (section, paragraph #)?

   N.A.

Statistics and general methods

1. Is there a justification of the sample size? If so, how was it justified? Where (section, paragraph #)? Even if no sample size calculation was performed, authors should report why the sample size is adequate to measure their effect size.	No. Results are displayed for all individual subjects in all conditions: Fig 2C, 2F, 3C, Fig S3C.
2. Are statistical tests justified as appropriate for every figure? Where (section, paragraph #)?	Yes
a. If there is a section summarizing the statistical methods in the methods, is the statistical test for each experiment clearly defined?	Summary of permutation analyses used to assess statistical significance of brain maps can be found in Methods, para 15
b. Do the data meet the assumptions of the specific statistical test you chose (e.g. normality for a parametric test)? Where is this described (section, paragraph #)?	We used non-parametric permutation analyses to assess statistical significance. The null distribution is generated by shuffling scene labels.
c. Is there any estimate of variance within each group of data? Is the variance similar between groups that are being statistically compared? Where is this described (section, paragraph #)?	Inter-participant reliability is reported for each condition (Fig 2C, 2F, 3C, Fig S3C, Fig S3). Variance is similar for cases where conditions are compared: a) Fig 6B, between-brain Recall-vs-Recall compared to between-participant Movie-vs-Recall, using non-parametric permutation analysis; b) Fig 7, pairwise within-participant Movie-RDM vs Recall-RDM compared to pairwise between-participant Movie-RDM vs Recall-RDM, using non-parametric permutation analysis.
d. Are tests specified as one- or two-sided?	All tests are two-sided unless otherwise specified
e. Are there adjustments for multiple comparisons?	Yes, brain maps were FDR corrected, q = 0.05
3. To promote transparency, *Nature Neuroscience* has stopped allowing bar graphs to report statistics in the papers it publishes. If you have bar graphs in your paper, please make sure to switch them to dot-plots (with central and dispersion statistics displayed) or to box-and-whisker plots to show data distributions.	There are no bar plots in the main figures.
4. Are criteria for excluding data points reported? Was this criterion established prior to data collection? Where is this described (section, paragraph #)?	Yes. Exclusion criteria is reported in Methods, para 1, and were established prior to data collection.

5. Define the method of randomization used to assign subjects (or samples) to the experimental groups and to collect and process data. If no randomization was used, state so. Where does this appear (section, paragraph #)?	There was only one group of subjects -- no randomization was used.
6. Is a statement of the extent to which investigator knew the group allocation during the experiment and in assessing outcome included? If no blinding was done, state so. Where (section, paragraph #)?	There was no group allocation.
7. For experiments in live vertebrates, is a statement of compliance with ethical guidelines/regulations included? Where (section, paragraph #)?	Yes, all experimental procedures were approved by the Princeton University Institutional Review Board. Methods Para 1
8. Is the species of the animals used reported? Where (section, paragraph #)?	Yes. We used human participants. Methods Para 1
9. Is the strain of the animals (including background strains of KO/ transgenic animals used) reported? Where (section, paragraph #)?	N.A.
10. Is the sex of the animals/subjects used reported? Where (section, paragraph #)?	Yes. There were 12 male participants and 10 female participants. Methods Para 1
11. Is the age of the animals/subjects reported? Where (section, paragraph #)?	Yes. Participants were between 18-26 years old Methods Para 1
12. For animals housed in a vivarium, is the light/dark cycle reported? Where (section, paragraph #)?	N.A.
13. For animals housed in a vivarium, is the housing group (i.e. number of animals per cage) reported? Where (section, paragraph #)?	N.A.
14. For behavioral experiments, is the time of day reported (e.g. light or dark cycle)? Where (section, paragraph #)?	No.
15. Is the previous history of the animals/subjects (e.g. prior drug administration, surgery, behavioral testing) reported? Where (section, paragraph #)?	N.A.

a. If multiple behavioral tests were conducted in the same group of animals, is this reported?

Where (section, paragraph #)?

N.A.

16. If any animals/subjects were excluded from analysis, is this reported?

Where (section, paragraph #)?

Yes. Exclusion criteria is reported in Methods, para 1, and were established prior to data collection.

a. How were the criteria for exclusion defined?

Where is this described (section, paragraph #)?

We discarded two participants for excessive head motion (> 1 voxel), two participants for short recall (< 10 minutes) and 1 participant for falling asleep.

Methods, Para 1

b. Specify reasons for any discrepancy between the number of animals at the beginning and end of the study.

Where is this described (section, paragraph #)?

See above

Reagents

1. Have antibodies been validated for use in the system under study (assay and species)?

N.A.

a. Is antibody catalog number given?

Where does this appear (section, paragraph #)?

N.A.

b. Where were the validation data reported (citation, supplementary information, Antibodypedia)?

Where does this appear (section, paragraph #)?

N.A.

2. Cell line identity

a. Are any cell lines used in this paper listed in the database of commonly misidentified cell lines maintained by ICLAC and NCBI Biosample?

Where (section, paragraph #)?

N.A.

b. If yes, include in the Methods section a scientific justification of their use--indicate here in which section and paragraph the justification can be found.

N.A.

c. For each cell line, include in the Methods section a statement that specifies:
- the source of the cell lines
- have the cell lines been authenticated? If so, by which method?
- have the cell lines been tested for mycoplasma contamination?

Where (section, paragraph #)?

N.A.

Data deposition

Provide a Data availability statement in the Methods section under "Data availability", which should include, where applicable:
• Accession codes for deposited data
• Other unique identifiers (such as DOIs and hyperlinks for any other datasets)
• At a minimum, a statement confirming that all relevant data are available from the authors
• Formal citations of datasets that are assigned DOIs
• A statement regarding data available in the manuscript as source data
• A statement regarding data available with restrictions

See our data availability and data citations policy page for more information.

Data deposition in a public repository is mandatory for:

a. Protein, DNA and RNA sequences
b. Macromolecular structures
c. Crystallographic data for small molecules
d. Microarray data

Deposition is strongly recommended for many other datasets for which structured public repositories exist; more details on our data policy are available here. We encourage the provision of other source data in supplementary information or in unstructured repositories such as Figshare and Dryad.

We encourage publication of Data Descriptors (see Scientific Data) to maximize data reuse.

Where is the Data Availability statement provided (section, paragraph #)?

The data that support the findings of this study are available online at: http://dataspace.princeton.edu/jspui/handle/88435/dsp01nz8062179

This is available in the Data Availability section.

Computer code/software

Any custom algorithm/software that is central to the methods must be supplied by the authors in a usable and readable form for readers at the time of publication. However, referees may ask for this information at any time during the review process.

1. Identify all custom software or scripts that were required to conduct the study and where in the procedures each was used.

In house MATLAB scripts were used to run the analyses.

2. If computer code was used to generate results that are central to the paper's conclusions, include a statement in the Methods section under "**Code availability**" to indicate whether and how the code can be accessed. Include version information as necessary and any restrictions on availability.

Code supporting the findings of this study are available from the corresponding author upon request.

Human subjects

1. Which IRB approved the protocol?

   Where is this stated (section, paragraph #)?

   This study was approved by the Princeton University Institutional Review Board (Methods, para 1).

2. Is demographic information on all subjects provided?

   Where (section, paragraph #)?

   Participants' demographic information is provided in Methods, para 1.

3. Is the number of human subjects, their age and sex clearly defined?

   Where (section, paragraph #)?

   The number of subjects, their age and sex is defined in Methods, para 1.

4. Are the inclusion and exclusion criteria (if any) clearly specified?

   Where (section, paragraph #)?

   Exclusion criteria is specified in Methods, para 1.

5. How well were the groups matched?

   Where is this information described (section, paragraph #)?

   We did not divide participants into different experimental groups.

6. Is a statement included confirming that informed consent was obtained from all subjects?

   Where (section, paragraph #)?

   All participants provided informed written consent prior to the start of the study. This is stated in Methods, para 1.

7. For publication of patient photos, is a statement included confirming that consent to publish was obtained?

   Where (section, paragraph #)?

   N.A.

fMRI studies

For papers reporting functional imaging (fMRI) results please ensure that these minimal reporting guidelines are met and that all this information is clearly provided in the methods:

1. Were any subjects scanned but then rejected for the analysis after the data was collected?

   Data from 5 participants were discarded.

   a. If yes, is the number rejected and reasons for rejection described?

      Where (section, paragraph #)?

      Yes. This is described in Methods, para 1.

2. Is the number of blocks, trials or experimental units per session and/or subjects specified? Where (section, paragraph #)?	Yes. This information is provided in Methods, para 3 and 5.
3. Is the length of each trial and interval between trials specified?	N.A.
4. Is a blocked, event-related, or mixed design being used? If applicable, please specify the block length or how the event-related or mixed design was optimized.	N.A.
5. Is the task design clearly described? Where (section, paragraph #)?	The task design is described in Methods, para 4-7
6. How was behavioral performance measured?	Transcripts were written of the audio recording of each participant's spoken recall. Timestamps were then identified that separated each audio recording into the same 50 scenes that had been previously selected for the audiovisual stimulus. A scene was counted as "recalled" if the participant described any part of the scene. Scenes were counted as "out of order" if they were initially skipped and then described later. (Methods, para 8-9)
7. Is an ANOVA or factorial design being used?	N.A.
8. For data acquisition, is a whole brain scan used? If not, state area of acquisition.	Yes.
a. How was this region determined?	N.A.
9. Is the field strength (in Tesla) of the MRI system stated?	A 3T scanner was used (Methods, para 10)
a. Is the pulse sequence type (gradient/spin echo, EPI/spiral) stated?	Functional images were acquired using a T2*-weighted echo planar imaging (EPI) pulse sequence. Anatomical images were acquired using a T1-weighted MPRAGE pulse sequence (Methods, para 10)
b. Are the field-of-view, matrix size, slice thickness, and TE/TR/flip angle clearly stated?	TR 1500 ms, TE 28 ms, flip angle 64, whole-brain coverage 27 slices of 4 mm thickness, FOV 192 x 192 mm2 (Methods, para 10)
10. Are the software and specific parameters (model/functions, smoothing kernel size if applicable, etc.) used for data processing and pre-processing clearly stated?	Preprocessing was performed in FSL including slice time correction, motion correction, linear detrending, high-pass filtering (140 s cutoff), and coregistration and affine transformation of the functional volumes to a template brain (MNI). Functional images were resampled to 3 mm isotropic voxels for all analyses. All calculations were performed in volume space. Projections onto a cortical surface for visualization were performed, as a final step, with NeuroElf (Methods, para 11)
11. Is the coordinate space for the anatomical/functional imaging data clearly defined as subject/native space or standardized stereotaxic space, e.g., original Talairach, MNI305, ICBM152, etc? Where (section, paragraph #)?	Images were registered to the MNI152 template (Methods, para 11).

12. If there was data normalization/standardization to a specific space template, are the type of transformation (linear vs. nonlinear) used and image types being transformed clearly described? Where (section, paragraph #)?	Images were registered to the MNI152 template using affine transformation (Methods, para 11).
13. How were anatomical locations determined, e.g., via an automated labeling algorithm (AAL), standardized coordinate database (Talairach daemon), probabilistic atlases, etc.?	PMC was defined using an atlas based on resting-state connectivity. Hippocampus was defined using a probabilistic anatomical atlas.
14. Were any additional regressors (behavioral covariates, motion etc) used?	No.
15. Is the contrast construction clearly defined?	We did not use a GLM.
16. Is a mixed/random effects or fixed inference used?	No.
a. If fixed effects inference used, is this justified?	
17. Were repeated measures used (multiple measurements per subject)?	No.
a. If so, are the method to account for within subject correlation and the assumptions made about variance clearly stated?	
18. If the threshold used for inference and visualization in figures varies, is this clearly stated?	Yes.
19. Are statistical inferences corrected for multiple comparisons?	Yes
a. If not, is this labeled as uncorrected?	
20. Are the results based on an ROI (region of interest) analysis?	Both whole-brain and ROI analyses were conducted.
a. If so, is the rationale clearly described?	The posterior medial cortex (PMC) was selected for illustration purposes because the region is implicated as having a long (on the order of minutes) memory-dependent integration window in studies that use real-life stimuli such as movies and stories (Results, para 5)
b. How were the ROI's defined (functional vs anatomical localization)?	PMC was defined using an atlas based on resting-state connectivity.
21. Is there correction for multiple comparisons within each voxel?	FDR correction was performed across all voxels within the brain (ie not a cluster threshold).
22. For cluster-wise significance, is the cluster-defining threshold and the corrected significance level defined?	N.A.

Additional comments

Additional Comments	