Supplementary Materials

"Neural Correlates and Reinstatement of Recent and Remote Memory: A Comparison Between Children and Young Adults"

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S1. Supplementary Methods

S1.1. Assessment of demographic and cognitive covariates

Other cognitive covariate tasks, such as cognitive switching and object-location memory, were run on each session but they are not included in the current paper.
Day 0: After the experimental task, several subtests of the K-ABC II Test *(e.g., Atlantis, Rover, Rebus, Riddle and Atlantis delayed) were administered to children, while young adults were tested with the WAIS-IV Test.
Day 1: In addition, children performed several subtests of the K-ABC II Test *(e.g., Expressive Vocabulary, Triangles, Pattern Reasoning), and a cognitive switching task.
Day 14: Children performed several subtests of the K-ABC II Test *(e.g., Patterns, Verbal Knowledge, Word Order), and a object-location memory task.

In addition to the experimental paradigm, a sleep diary to assess the quality and duration of sleep was completed daily for the 14-day period between learning and long-delay.

S1.2. FMRI data pre-processing

The following description of the fMRI data pre-processing was generated by fMRIPrep 22.0.0:
Results included in this manuscript come from preprocessing performed using *fMRIPrep* 22.0.0 (Esteban et al., 2018, 2019; RRID:SCR_016216), which is based on *Nipype* 1.8.3 (Gorgolewski et al., 2011; Gorgolewski et al., 2016); RRID:SCR_002502).

S1.2.1.Preprocessing of B_0 inhomogeneity mappings

A total of 2 fieldmaps were found available within the input BIDS structure for this particular subject. A B_0-nonuniformity map (or *fieldmap*) was estimated based on two (or more) echo-planar imaging (EPI) references with topup (Andersson et al. (2003) ; FSL 6.0.5.1:57b01774).

S1.2.2. Anatomical data preprocessing

A total of 2 T1-weighted (T1w) images were found within the input BIDS dataset. All of them were corrected for intensity non-uniformity (INU) with N4BiasFieldCorrection (Tustison et al., 2010), distributed with ANTs 2.3.3 (Avants et al. (2008); RRID:SCR_004757). The T1w-reference was then skull-stripped with a *Nipype* implementation of the antsBrainExtraction.sh workflow (from ANTs), using OASIS30ANTs as target template. Brain tissue segmentation of cerebrospinal fluid (CSF), white-matter (WM) and gray-matter (GM) was performed on the brain-extracted T1w using fast (FSL 6.0.5.1:57b01774, RRID:SCR_002823; Zhang et al., (2001)). A T1w-reference map was computed after registration of 2 T1w images (after INU-correction) using mri_robust_template (FreeSurfer 7.2.0; Reuter et al., (2010)). Volume-based spatial normalization to two standard spaces (MNI152NLin6Asym, MNI152NLin2009cAsym) was performed through nonlinear registration with antsRegistration (ANTs 2.3.3), using brain-extracted versions of both T1w reference and the T1w template. The following templates were selected for spatial normalization: *FSL's MNI ICBM 152 non-linear 6th Generation Asymmetric Average Brain Stereotaxic Registration Model* [Evans et al. (2012); RRID:SCR_002823; TemplateFlow ID: MNI152NLin6Asym], *ICBM 152 Nonlinear Asymmetrical template version 2009c* [Fonov et al. (2009); RRID:SCR_008796; TemplateFlow ID: MNI152NLin2009cAsym].

S1.2.3. Functional data preprocessing

For each of the 5 BOLD runs found per subject (across all tasks and sessions), the following preprocessing was performed. First, a reference volume and its skull-stripped version were generated by aligning and averaging 1 single-band references (SBRefs). Head-motion parameters with respect to the BOLD reference (transformation matrices, and six corresponding rotation and translation parameters) are estimated before any spatiotemporal filtering using mcflirt (FSL 6.0.5.1:57b01774; Jenkinson et al. (2002)). The estimated *fieldmap* was then aligned with rigid-registration to the target EPI (echo-planar imaging) reference run. The field coefficients were mapped on to the reference EPI using the transform. BOLD runs were slice-time corrected to 0.346s (0.5 of slice acquisition range 0s-0.693s) using 3dTshift from AFNI (Cox & Hyde, (1997); RRID:SCR_005927). The BOLD reference was then co-registered to the T1w reference using mri_coreg (FreeSurfer) followed by flirt (FSL 6.0.5.1:57b01774; Jenkinson & Smith (2001) with the boundary-based registration (Greve & Fischl, 2009) cost-function. Co-registration was configured with six degrees of freedom. First, a reference volume and its skull-stripped version were generated using a custom methodology of *fMRIPrep*. Several confounding time-series were calculated based on the *preprocessed BOLD*: framewise displacement (FD), DVARS and three region-wise global signals. FD was computed using two formulations following Power (absolute sum of relative motions, Power et al. (2014) and Jenkinson et al. (2002) (relative root mean square displacement between affines). FD and DVARS are calculated for each functional run, both using their implementations in *Nipype* (following the definitions by Power et al. (2014)). The three global signals are extracted within the CSF, the WM, and the whole-brain masks. Additionally, a set of physiological regressors were extracted to allow for component-based noise correction (*CompCor*; Behzadi et al. (2007)). Principal components are estimated after high-pass filtering the *preprocessed BOLD* time-series (using a discrete cosine filter with 128s cut-off) for the two *CompCor* variants: temporal (tCompCor) and anatomical (aCompCor). tCompCor components are then calculated from the top 2% variable voxels within the brain mask. For aCompCor, three probabilistic masks (CSF, WM and combined CSF+WM) are generated in anatomical space. The implementation differs from that of Behzadi et al. in that instead of eroding the masks by 2 pixels on BOLD space, a mask of pixels that likely contain a volume fraction of GM is subtracted from the aCompCor masks. This mask is obtained by thresholding the corresponding partial volume map at 0.05, and it ensures components are not extracted from voxels containing a minimal fraction of GM. Finally, these masks are resampled into BOLD space and binarized by thresholding at 0.99 (as in the original implementation). Components are also calculated separately within the WM and CSF masks. For each CompCor decomposition, the *k* components with the largest singular values are retained, such that the retained components' time series are sufficient to explain 50 percent of variance across the nuisance mask (CSF, WM, combined, or temporal). The remaining components are dropped from consideration. The head-motion estimates calculated in the correction step were also placed within the corresponding confounds file. The confound time series derived from head motion estimates and global signals were expanded with the inclusion of temporal derivatives and quadratic terms for each (Satterthwaite et al., 2013). Frames that exceeded a threshold of 0.5 mm FD or 1.5 standardized DVARS were annotated as motion outliers. Additional nuisance timeseries are calculated by means of principal components analysis of the signal found within a thin band (*crown*) of voxels around the edge of the brain, as proposed by Patriat et al. (2017). The BOLD time-series were resampled into several standard spaces, correspondingly generating the following *spatially-normalized, preprocessed BOLD runs*: MNI152NLin6Asym, MNI152NLin2009cAsym. First, a reference volume and its skull-stripped version were generated using a custom methodology of *fMRIPrep*. Automatic removal of motion artifacts using independent component analysis (ICA-AROMA; Pruim et al. (2015)) was performed on the *preprocessed BOLD on MNI space* time-series after removal of non-steady state volumes and spatial smoothing with an isotropic, Gaussian kernel of 6mm FWHM (full-width half-maximum). Corresponding “non-aggresively” denoised runs were produced after such smoothing. Additionally, the “aggressive” noise-regressors were collected and placed in the corresponding confounds file. All resamplings can be performed with *a single interpolation step* by composing all the pertinent transformations (i.e. head-motion transform matrices, susceptibility distortion correction when available, and co-registrations to anatomical and output spaces). Gridded (volumetric) resamplings were performed using antsApplyTransforms (ANTs), configured with Lanczos interpolation to minimize the smoothing effects of other kernels (Lanczos, 1964). Non-gridded (surface) resamplings were performed using mri_vol2surf (FreeSurfer). Many internal operations of *fMRIPrep* use *Nilearn* 0.9.1 (Abraham et al. (2014); RRID:SCR_001362), mostly within the functional processing workflow.

S2. Supplementary results

S2.1. Supplementary behavioural results

S2.1.1. *Learning process analysis*

Concerning the learning duration, a LME model revealed a significant *Group* effect, $F_{(1,563)} = 23.65$, $p < .0001$, $w^2 = .04$, with children needing more learning cycles to reach the learning criteria in comparison to adults $t(563) = -3.70$, $p = .0002$. The number of learning cycles did not differ between sessions as revealed by non-significant *Session* effect and *Group x Session* interaction (all $p > .63$).

S.2.1.2. Memory retention analysis

Table S1

Statistical overview of the linear mixed effects model for memory retention rates.

	Memory Retention

Predictors	*Estimates*	*CI*	*p*
(Intercept)	**81.25**	**77.50 – 85.00**	**<.001**
Session	**-4.88**	**-8.22 – -1.54**	**.004**
Item Type	**-4.55**	**-7.72 – -1.38**	**.005**
Group	**17.29**	**12.19 – 22.39**	**<.001**
IQ	**0.16**	**0.01 – 0.32**	**.037**
Sex	2.56	-1.31 – 6.43	.194
Handedness$_{\text{(right vs left)}}$	-5.17	-14.50 – 4.15	.276
Handedness$_{\text{(right vs ambidextrous)}}$	-1.35	-12.18 – 9.48	.806
Session x Item Type	**-13.45**	**-18.05 – -8.86**	**<.001**
Session x Group	3.43	-1.47 – 8.33	.169
Item Type x Group	0.02	-4.64 – 4.69	.993
Session x Item Type x Group	-4.17	-10.97 – 2.62	.228
Random Effects			
σ^2	58.91		
$\tau_{00\ \text{subNo}}$	65.58		
ICC	0.53		
N_{subNo}	88		
Observations	320		
Marginal R^2 / Conditional R^2	0.557 / 0.790		

Notes. Subject was included as random intercept. Group (children and young adults), Session (Day 1, Day 14), Item Type (recent vs remote) were included as fixed effects. IQ, Sex, Handedness were included as covariates. ^{a}The following reference levels where used: for Session, Day 1; for Group, Children; for Item Type; for Sex, male; for Handedness, right-side handedness. IQ = Intelligence Quotient; σ2 – residuals, τ00 – variance of the random intercept. Type III Analysis of Variance Table with Satterthwaite's method. *p < .05; ** <.01, ***<.001 (significant difference).

Table S2

Statistical overview of model-based post-hoc tests for memory retention rates.

Contrasts	*Estimates*	*95% CI*	*SE*	*DF*	*t ratio*	*p*
Day 1 vs 14 Children (Recent)	4.88	[.31 – .9.45]	1.72	247	2.83	.029
Day 1 vs 14 Children (Remote)	18.33	[13.83 – 22.83]	1.70	246	10.81	<.0001
Day 1 vs 14 Adults (Recent)	1.45	[-3.45 – 6.35]	1.85	242	0.78	.967
Day 1 vs 14 Adults (Remote)	19.08	[14.85 – 23.97]	1.85	242	10.33	<.001
Day 1 vs 14 Children vs Adults (Recent)	3.43	[-3.27 – 10.13]	2.52	245	1.35	.686
Day 1 vs 14 Children vs Adults (Remote)	-.74	[-7.39 – 5.91]	2.51	244	-0.30	.999

Notes. Results were averaged over the levels of sex and handedness. Degrees of freedom were adjusted based on Kenward-Roger methods. P values were adjusted based on Sidak adjustment for 6 comparisons. *p < .05; ** <.01, ***<.001 (significant difference).

S3.1. Supplementary fMRI univariate analysis

Table S3

Regions exhibiting stronger activation for remote vs. recent items in (i) young adults, (ii) children, (iii) children vs young adults, and (iv) young adults vs children on Day 1 (short delay). To capture the involved brain region better, local maxima are presented in addition to cluster maxima for the largest clusters.

Day 1 (Short Delay)					
		Young adults			
Region	**x**	**y**	**x**	**Z-max**	**# voxels**

Left Middle Frontal Gyrus	- 44	2	40	6.67	2990
Left Insula Cortex	- 34	22	2	6.58	
Left Inferior Frontal Gyrus, Pars Opercularis	- 44	6	34	6.03	
Left Lateral Occipital Cortex	- 28	- 76	36	6.82	2272
Left Superior Parietal Lobule	- 34	- 50	44	5.11	
Left Fusiform Gyrus	- 44	- 60	- 12	6.7	1661
Left Parahippocampal Gyrus	- 34	- 34	- 16	4.58	
Right Cerebellum	30	- 60	- 28	6.03	1049
Right Lateral Occipital Cortex	34	- 72	40	5.96	943
Right Inferior Parietal Lobule	38	- 78	26	4.3	
Right Parahippocampal Gyrus	32	- 34	- 16	5.29	718
Right Inferior Temporal Gyrus	52	- 54	- 10	5.17	
Left Superior Frontal Gyrus	- 4	16	48	5.04	405
Right insular cortex	30	24	2	5.25	279
Right Middle Frontal Gyrus, Pars Triangularis	40	30	20	3.61	
Right precentral Gyrus	42	2	30	4.97	146
Right Middle Frontal Gyrus, Pars Opercularis	50	16	32	3.41	
Left Frontal Orbital Cortex	- 26	32	- 10	4.51	123
Left Cingulate Gyrus	- 4	2	28	4.86	103
Children					
Right Temporal Occipital Fusiform Cortex	26	- 44	- 8	5.1	658
Right Parahippocampal Gyrus	30	- 36	- 16	4.93	
Right Precuneus	8	- 52	6	4.79	
Left Temporal Fusiform Gyrus	- 34	- 42	- 12	5.59	500
Left Parahippocampal Gyrus	- 18	- 42	- 10	4.91	
Left Precuneus Cortex	- 14	- 60	10	4.47	160
Left Lateral Occipital Cortex	- 36	- 84	26	4.95	112
Children > Young Adults					
Right precuneus	4	- 48	30	5.25	1051
Left precuneus	- 4	- 48	40	4.68	
Right Superior Parietal Lobule	12	- 32	50	4.99	203
Right Parietal Operculum Cortex	54	- 30	24	3.32	149
Young Adults > Children					
Left Precentral Gyrus, Middle Frontal Gyrus	- 44	2	40	4.8	501
Left Inferior Frontal Gyrus	- 54	14	10	3.39	
Left Frontal Operculum Cortex	- 34	22	2	5.48	260
Right Cerebellum	12	- 76	- 20	4.7	141
Left Medial Frontal Gyrus	- 2	16	48	4.2	118
Left/Right Insular Cortex	32	22	2	4.66	113
Left/Right Lateral Occipital Cortex	- 26	- 74	36	4.5	107

Table S4

Regions exhibiting stronger activation for remote vs. recent items in (i) young adults, (ii) children, (iii) children vs young adults, and (iv) young adults vs children on Day 14 (long delay). To capture the involved brain region better, local maxima are presented in addition to cluster maxima for the largest clusters.

Day 14 (Long Delay)					
Young Adults					
Region	**x**	**y**	**x**	**Z-max**	**# voxels**
Left/Right Occipital Fusiform Gyrus	- 46	- 58	- 16	7.62	19227

Left Lateral Occipital Cortex	- 30	- 60	- 14	7.25	
Left Middle Frontal Gyrus, Pars Opercularis,				7.17	2890
Left Superior Frontal Gyrus	- 6	12	56	6.78	
Right Inferior Frontal Gyrus, Pars Opercularis, Pars Trinagularis	46	12	28	6	691
Left Insular Cortex	- 32	22	2	6.7	501
Left Caudate	- 10	4	10	5.58	456
Right Frontal Orbital Cortex	34	28	0	6.11	298
Right Cerebellum	16	- 44	- 46	4.97	250
Right Caudate	8	12	2	5.27	215
Left Cerebellum	- 34	- 68	- 54	6.1	211
Children					
Left Temporal Fusiform Gyrus	- 34	- 26	- 24	4.91	580
Left anterior Parahippocampal Gyrus, Hippocampus	- 36	- 18	- 24	4.4	
Left Lateral Occipital Cortex	- 48	- 58	- 16	4.25	
Right Temporal Occipital Fusiform Cortex	40	- 54	- 18	4.34	448
Right Lateral Occipital Cortex	50	- 70	- 12	4.2	
Children > Young Adults					
Right/Left angular gyrus	62	- 40	44	4.8	847
Right/Left Lateral Occipital Cortex	46	- 66	48	4.44	
Right Superior Frontal Gyrus	20	30	58	4.58	640
Right/Left Superior Temporal Gyrus				4.73	493
Right Precuneous	8	- 52	30	4.51	332
Right Medial Frontal Cortex	8	50	- 2	4.35	287
Right Middle Temporal Gyrus	66	- 18	- 20	4.17	203
Left Middle Frontal Gyrus	- 20	36	38	4.31	154
Left Cingulate Gyrus	- 14	- 50	30	4.36	138
Young Adults > Children					
Right/Left Cerebellum	14	- 72	- 22	5.77	3162
Left Occipital Fusiform Gyrus	- 20	- 90	- 14	5.22	1229
Left Lateral Occipital Cortex	- 30	- 80	36	5.62	620
Left Middle Frontal Gyrus, Inferior Frontal Gyrus	- 44	12	30	4.8	387
Right Precuneous	18	- 58	20	4.39	205
Left Superior Frontal Gyrus	- 6	12	56	5.12	165
Left Posterior Parahippocampal Gyrus, Hippocampus	- 28	- 32	- 18	3.9	96

Table S5

Regions exhibiting stronger activation for remote vs. recent items that decreases over time (i) in young adults stronger than in children (ii) children stronger than in adults; that increases over time (iii) in young adults stronger than in children, and (iv) in children stronger than in young adults. To capture the involved brain region better, local maxima are presented in addition to cluster maxima for the largest clusters.

Decrease Across Time					
Young Adults > Children					
Region	**x**	**y**	**x**	**Z-max**	**# voxels**
Right Superior Parietal Lobule, Agular Gyrus	42	- 50	58	3.69	946
Right Middle Frontal Gyrus	42	56	2	4.16	546
Left Middle Frontal Gyrus	- 38	24	48	3.9	379

Right Superior Frontal Gyrus	8	48	30	3.44	329
Children > Adults					
Left Lateral Occipital Cortex	- 32	- 88	6	4.81	4474
Left Hippocampus, Posterior Parahippocampal Gyrus	- 30	- 30	- 6	4.09	
Right Lateral Occipital Cortex, Occipital Fusiform Gyrus, Lingual Gyrus	30	- 86	4	4.73	1717
Increase Over Time					
Young Adults > Children					
Left Lateral Occipital Cortex	- 32	- 88	6	4.81	4474
Left Hippocampus	- 30	- 30	- 6	4.09	
Left Lingual gyrus	- 10	- 56	- 6	4.04	
Right Lateral Occipital Cortex, Occipital Fusiform Gyrus, Precuneus	- 30	86	4	4.73	1717
Children > Young Adults					
Right Superior Parietal Lobule, Angular Gyrus	42	- 50	58	3.69	946
Right Middle Frontal Gyrus	42	56	2	4.16	546
Left Middle Frontal Gyrus, Superior Frontal Gyrus	- 38	24	48	3.9	379
Right Superior Frontal Gyrus, Paracingulate Gyrus	8	48	30	3.44	329

Table 6

Statistical overview of LME-model based Sidak corrected post hoc comparisons for neural activation differences (based on LME-model described in Table 2).

	*Model-based post hoc comparisons**			
Comparisons	*b*	$t_{(DF)}$	95% CI	*p*
Posterior Parahippocampal Gyrus				
YA > CH	.05	$2.28_{(87)}$	[.006 – .09]	**.025**
Day 1 < Day 14 (CH)	-.02	$-.08_{(87)}$	[-.08 – .03]	.66
Day 1 < Day 14 (YA)	.09	$3.19_{(83)}$	[.02 – .15]	**.006**
Day 1 < Day 14 (CH) < Day 1 < Day 14 (YA)	.11	$3.06_{(85)}$	[.02 – .20]	**.009**
Medial Prefrontal Cortex				
YA > CH	-.07	$-2.27_{(88)}$	[-.14 – .009]	**.026**
Ventrolateral Prefrontal Cortex				
YA > CH	.14	$5.64_{(86)}$	[.09 – .19]	**< .001**
Day 1 < Day 14	.08	$3.64_{(85)}$	[.04 – .13]	**.005**
Cerebellum				
Day 1 < Day 14	.04	$2.09_{(86)}$	[.002 – .07]	**.04**
Day 1 < Day 14 (CH)	-.01	$-.05_{(88)}$	[-.07 – .05],	.96
Day 1 < Day 14 (YA)	.09	$3.24_{(84)}$	[.02 – .15]	**.005**
Day 1 < Day 14 (CH) < Day 1 < Day 14 (YA)	.10	$2.71_{(86)}$	[.01 – .18]	**.024**
Retrosplenial Cortex				
Day 1 < Day 14 (CH)	-.08	$-3.13_{(88)}$	[-.14 – -.02]	**.007**
Day 1 < Day 14 (YA)	.03	$1.15_{(84)}$	[-.03 – .10]	.584
Day 1 < Day 14 (CH) < Day 1 < Day 14 (YA)	.11	$3.00_{(86)}$	[.02 – .20]	**.012**
Precuneus				
YA > CH	-.053	$2.60_{(86)}$	[-.10 – -.01]	**.012**
Day 1 < Day 14	-.054	$2.60_{(86)}$	[-.10 – -.01]	**.011**

Lateral Occipital Cortex				
YA > CH	.05	$2.30_{(87)}$	[.006 – .09]	**.024**
Day 1 < Day 14	.08	$4.45_{(84)}$	[.04 – .12]	**< .001**
Day 1 < Day 14 (CH)	.03	$1.39_{(86)}$	[-.03 – .09]	.424
Day 1 < Day 14 (YA)	.13	$4.76_{(82)}$	[.06 – .19]	**< .001**
Day 1 < Day 14 (CH) < Day 1 < Day 14 (YA)	.092	$2.57_{(84)}$	[.005 – .18]	**.035**

Notes. Degrees of freedom were adjusted based on Kenward-Roger methods. P-values were adjusted based on Sidak adjustment. YA – young adults; CH – children; b – Beta values; t – t-value; DF – degrees of freedom; p – p-value; CI – confidence interval; *p < .05; ** <.01, ***<.001 (significant difference).

Table S7

Test of scene-specific reinstatement index for significance (higher than zero).

	Recent Pre-activation		Short-Delay Pre-activation		Long-Delay Pre-activation	
			Children			
ROI	*mean*	$p_{(FDRadj)}$	*mean*	$p_{(FDRadj)}$	*mean*	$p_{(FDRadj)}$
mPFC	.488	<.001	.295	<.001	.099	.123
vlPFC	.543	<.001	.318	<.001	.204	<.001
HC	.606	<.001	.251	<.001	.161	.026
PHG	.582	<.001	.269	<.001	.148	.061
CE	.484	<.001	.165	<.001	.121	.041
PC	.569	<.001	.284	<.001	.105	.078
RSC	.646	<.001	.289	<.001	.090	.281
LOC	.534	<.001	.262	<.001	.271	<.001
			Young Adults			
	mean	$p_{(FDRadj)}$	*mean*	$p_{(FDRadj)}$	*mean*	$p_{(FDRadj)}$
mPFC	.654	<.001	.375	<.001	.396	<.001
vlPFC	.561	<.001	.291	<.001	.198	<.001
HC	.758	<.001	.416	<.001	.497	<.001
PHG	.695	<.001	.334	<.001	.353	<.001
CE	.639	<.001	.367	<.001	.321	<.001
PC	.700	<.001	.440	<.001	.401	<.001
RSC	.771	<.001	.476	<.001	.377	<.001
LOC	.715	<.001	.463	<.001	.347	<.001

*Notes.*To test for significance we used one-sample permutation t-test for more robust calculations with Monte-Carlo permutation percentile confidence interval. All p-values for False Discovery Rate (FDR) corrected for 48 comparisons. ROI – region of interest; p – p-value; FDRadj – False Discovery Rate adjustment; mPFC – medial prefrontal cortex; vlPFC – ventrolateral prefrontal cortex; HC – hippocampus; PHG – parahippocampal cortex; CE – cerebellum; PC – precuneus; RSC – retrosplenial cortex; LOC – lateral occipital cortex. *p < .05; ** <.01, ***<.001 (significant difference).

Table S8

Test of category-based reinstatement index for significance (higher than zero).

	Recent Pre-activation		Short-Delay Pre-activation		Long-Delay Pre-activation	
			Children			
ROI	*mean*	$p_{(FDRadj)}$	*mean*	$p_{(FDRadj)}$	*mean*	$p_{(FDRadj)}$
mPFC	.379	<.001	.310	<.001	.568	<.001
vlPFC	.207	<.001	.095	.151	.243	.006
HC	.081	.047	.018	.601	.210	.003

PHG	.078	.036	.078	.069	.214		<.001
CE	.268	<.001	.252	<.001	.215		.015
PC	.112	.039	.059	.335	.161		.035
RSC	.102	.018	.089	.151	.199		.018
LOC	-.011	.957	.098	.151	.109		.151
				Young Adults			
	mean	*$p_{(FDRadj)}$*	*mean*	*$p_{(FDRadj)}$*	*mean*	*p*	*$p_{(FDRadj)}$*
mPFC	-.017	.997	-.066	.997	.038		.512
vlPFC	-.028	.997	-.027	.997	.018		.745
HC	-.039	.997	-.027	.997	-.096		.997
PHG	-.030	.997	-.079	.997	-.132		.997
CE	-.022	.997	-.079	.997	-.003		.946
PC	-.095	.997	-.025	.997	-.017		.982
RSC	-.055	.997	-.041	.997	-.012		.957
LOC	-.004	.957	-.003	.957	-.025		.997

*Notes.*To test for significance we used one-sample permutation t-test for more robust calculations with Monte-Carlo permutation percentile confidence interval. All p-values for False Discovery Rate (FDR) corrected for 48 comparisons. ROI – region of interest; p – p-value; FDRadj – False Discovery Rate adjustment; mPFC – medial prefrontal cortex; vlPFC – ventrolateral prefrontal cortex; HC – hippocampus; PHG – parahippocampal cortex; CE – cerebellum; PC – precuneus; RSC – retrosplenial cortex; LOC – lateral occipital cortex. *p < .05; ** <.01, ***<.001 (significant difference).

Table 9

Statistical overview of LME-model based Sidak corrected post hoc comparisons for scene-specific reinstatement differences (based on LME-model described in Table 3).

	*Model-based post hoc comparisons**			
Comparisons	*b*	*$t_{(DF)}$*	95% CI	*p*
		Hippocampus		
YA > YC	**.22**	**5.53$_{(86)}$**	**[.14 – .30]**	**<.001**
Recent > Remote (Day 1)	**.35**	**7.46(161)**	**[.24 – .45]**	**<.001**
Remote (Day 1) > Remote (Day 14)	.005	.10(171)	[-.11 – .12]	.994
		Parahippocampal Gyrus		
YA > YC	**.13**	**3.04$_{(87)}$**	**[.05 – .21]**	**.003**
Recent > Remote (Day 1)	**.34**	**7.30$_{(161)}$**	**[.23 – .44]**	**<.001**
Remote (Day 1)> Remote (Day 14)	.05	1.05$_{(170)}$	[-.06 – .16]	.504
		Medial Prefrontal Cortex		
YA > YC	**.18**	**3.90$_{(87)}$**	**[.09 – .27]**	**<.001**
Recent > Remote (Day 1)	**.24**	**5.34(160)**	**[.13 – .34]**	**<.001**
Remote (Day 1) > Remote (Day 14)	.09	1.82(168)	[-.02 – .19]	.136
		Ventrolateral Prefrontal Cortex		
Recent > Remote (Day 1)	**.25**	**6.07$_{(161)}$**	**[.16 – .34]**	**< .001**
Remote (Day 1) > Remote (Day 14)	**.10**	**2.35$_{(170)}$**	**[.004 – .20]**	**.039**
		Cerebellum		
YA > YC	**.19**	**4.88$_{(86)}$**	**[.11 – .26]**	**<.001**
Recent > Remote (Day 1)	**.30**	**6.54$_{(161)}$**	**[.19 – .40],**	**<.001**
Remote (Day 1) > Remote (Day 14)	.05	.95$_{(173)}$	[-.06 – .15]	.567
		Retrosplenial Cortex		
YA > YC	**.20**	**4.85$_{(86)}$**	**[.12 – .29]**	**<.001**
Recent > Remote (Day 1)	**.33**	**6.67$_{(161)}$**	**[.22 – .44]**	**<.001**
Remote (Day 1) > Remote (Day 14)	**.15**	**2.77$_{(173)}$**	**[.03 – .26]**	**.012**
		Precuneus		
YA > YC	**.20**	**4.92$_{(86)}$**	**[.12 – .27]**	**<.001**
Recent > Remote (Day 1)	**.27**	**5.84$_{(161)}$**	**[.17 – .38]**	**<.001**

Remote (Day 1) > Remote (Day 14)	**.11**	**2.23$_{(171)}$**	**[-.001 – .22]**	**.053**
Lateral Occipital Cortex				
YA > YC	**.16**	**3.88$_{(87)}$**	**[.08 – .24]**	**<.001**
Recent > Remote (Day 1)	**.26**	**6.46$_{(160)}$**	**[.17 – .35]**	**< .001**
Remote (Day 1) > Remote (Day 14)	.05	1.29$_{(169)}$	[-.04 – .15]	.358

Notes. Degrees of freedom were adjusted based on Kenward-Roger methods. P-values were adjusted based on Sidak adjustment. YA – young adults; CH – children; b – Beta values; t – t-value; DF – degrees of freedom; p – p-value; CI – confidence interval; *p < .05; ** <.01, ***<.001 (significant difference).

Table 10

Statistical overview of LME-model based Sidak corrected post hoc comparisons for category-based reinstatement differences (based on LME-model described in Table 4).

*Model-based post hoc comparisons**				
Comparisons	*b*	*t$_{(DF)}$*	95% CI	*p*
Hippocampus				
YA > YC	**.16**	**4.14$_{(88)}$**	**[.08 – .24]**	**<.001**
Recent vs Remote (Day 1) for YC > YA	-.07	-.99$_{(162)}$	[-.24 – .10]	.540
Remote (Day 1) vs Remote (Day 1) for YC > YA	**.26**	**3.44$_{(170)}$**	**[.09 – .44]**	**.002**
Parahippocampal Gyrus				
YA > YC	**.21**	**5.14$_{(88)}$**	**[.13 – .29]**	**<.001**
Recent vs Remote (Day 1) for YC > YA	.05	.77$_{(162)}$	[-.10 – .21]	.690
Remote (Day 1) vs Remote (Day 1) for YC > YA	**.20**	**2.73$_{(168)}$**	**[.03 – .36]**	**.014**
Medial Prefrontal Cortex				
YA > YC	**.43**	**7.92$_{(87)}$**	**[.33 – .54]**	**<.001**
Recent > Remote (Day 1)	-.06	-.96(163)	[-.20 – .08]	.565
Remote (Day 1) > Remote (Day 14)	**.18**	**2.81(172)**	**[.04 – .33]**	**.011**
Ventrolateral Prefrontal Cortex				
YA > YC	**.20**	**3.68$_{(88)}$**	**[.09 – .31]**	**< .001**
Cerebellum				
YA > YC	**.29**	**5.34$_{(88)}$**	**[.18 – .39]**	**<.001**
Retrosplenial Cortex				
YA > YC	**.17**	**3.98$_{(88)}$**	**[.08 – .25]**	**<.001**
Precuneus				
YA > YC	**.16**	**3.41$_{(88)}$**	**[.07 – .26]**	**.001**

Notes. Degrees of freedom were adjusted based on Kenward-Roger methods. P-values were adjusted based on Sidak adjustment. YA – young adults; CH – children; b – Beta values; t – t-value; DF – degrees of freedom; p – p-value; CI – confidence interval; *p < .05; ** <.01, ***<.001 (significant difference).

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