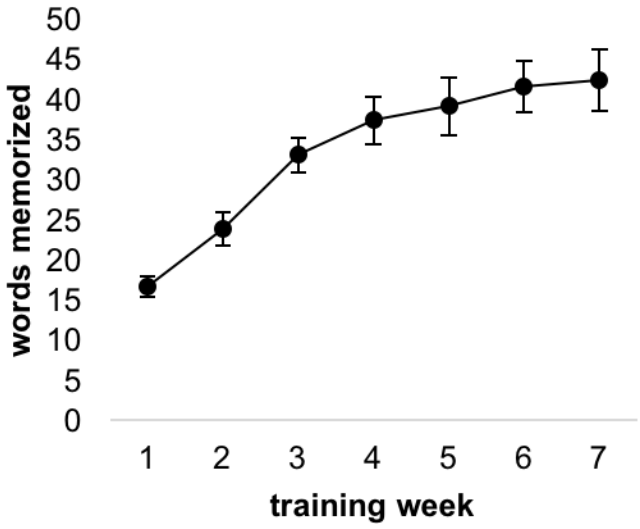

Figure S1. Related to Quantification and Statistical Analysis. Participants of the mnemonic training condition showed a steady increase in word memorization performance over the course of six weeks of training. All participants of the mnemonic training condition performed 6 weeks of training in the method of loci online using the online training platform memocamp.com. Besides the training discipline „memorizing random words in five minutes", which most closely resembles the task conditions during the fMRI sessions, participants were encouraged perform also other memorization disciplines suitable for application of the method of loci as implemented in memocamp.com, e.g. word memorization with longer durations or image sequence memorization. Given are the group means (±SEM) of the first day of training and of the weekly means of individual top scores per session, i.e. in case a participant performed of "random words / 5 minutes" more than once in a given training session, only his best performance was considered.

	memory athletes	matched controls	mnemonic training	active control	passive control
n	23	23	17	17	17
males	14	14	17	17	17
age (years): mean ±SD	27.8 ±8.6	28.1 ±8.1	23.7 ±2.7	24.2 ±2.6	24.4 ±3.8
age (years): range	19-51	20-53	20-29	20-29	18-30
reasoning	131.8 ±12.1	131.7 ±12.1	117.4 ±12.7	117.7 ±15.1	118.2 ±13.2
memory	not tested	103.5 ±25.5	103.3 ±13.3	101.8 ±21.6	101.8 ±16.2
left-handers	3	3	0	0	0
smokers	1	1	0	0	0

Table S1. Related to Experimental Model and Subject Details. Participant details of the five different groups. Sample size, number of males, left-handers, smokers are given as absolute numbers; reasoning and memory abilities are given as mean IQ scores ± standard deviations.

	mnemonic training	active control	passive control
pre-training 20 min	26.5 ±16.2	31.3 ±14.8	29.5 ±16.1
post-training 20 min	62.5 ±11.1	42.7 ±17.1	36.6 ±19.5
training change 20 min	+35.9 ±17.0	+11.4 ±11.8	+7.1 ±13.3
pre-training 24 h	16.5 ±14.0	19.6 ±12.7	18.7 ±15.7
post-training 24 h	55.7 ±16.9	31.1 ±18.6	21.8 ±19.1
training change 24 h	+39.2 ±17.8	+11.4 ±12.7	+3.1 ±10.7
4 month follow-up 15 min	50.3 ±16.5	30.4 ±9.5	27.4 ±9.8
4 month change 20/15 min	+22.4 ±18.9	+0.5 ±11.8	-2.2 ±11.4

Table S2. Related to Quantification and Statistical Analysis. Short- and long-term recall performance before and after training and in a retest after 4 months. Shown are mean numbers of remembered words during free recall ± standard deviations and mean increases/decreases from session 1 (pre-training) to session 2 (post-training) and from session 1 to the retest after four months.

	average FD	
groups	first session	second session
memory athletes	0.1±0.01	
matched controls	0.1±0.06	
mnemonic training	0.1±0.02	0.1±0.02
active controls	0.1±0.01	0.1±0.01
passive controls	0.1±0.01	0.1±0.01

Table S3. **Related to Quantification and Statistical Analysis.** Motion during rs-fMRI: displayed is the average framewise displacement (FD) during rs-fMRI for each experimental group (mean ± SEM). Scan-to-scan motion did not differ between groups (all $p>0.05$).

	% excluded scans		average FD	
groups	first session	second session	first session	second session
memory athletes	0.03±0.01		0.1±0.01	
matched controls	0.07±0.06		0.1±0.06	
mnemonic training	0.02±0.01	0.07±0.02	0.1±0.01	0.2±0.02
active control	0.03±0.01	0.06±0.02	0.1±0.01	0.1±0.01
passive control	0.03±0.01	0.04±0.02	0.1±0.06	0.1±0.01

Table S4. Related to Quantification and Statistical Analysis. Motion during task: displayed are the % excluded scans and the average framewise displacement (FD) during encoding for each experimental group (mean ± SEM).