SUPPLEMENTARY INFORMATION

Memory quality modulates the effect of aging on memory consolidation during sleep:
Reduced maintenance but intact gain

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*Supplementary Table 1. Bivariate correlations between sleep variables, brain regions of interest, and memory measures in the **whole sample***

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Fast SP density													
2	Slow SP density	**0.517** **(<.001)**												
3	SO density	0.183 (.182)	–0.132 (.335)											
4	SWA	0.285 (.035)	0.059 (.669)	**0.458** **(<.001)**										
5	mPFC	**0.583** **(<.001)**	**0.434** **(<.001)**	0.229 (.098)	**0.481** **(<.001)**									
6	Thalamus	0.440 (.001)	0.390 (.004)	–0.065 (.644)	0.160 (.253)	**0.635** **(<.001)**								
7	Hippocampus	**0.556** **(<.001)**	0.313 (.023)	0.074 (.595)	0.413 (.002)	**0.726** **(<.001)**	**0.662** **(<.001)**							
8	Entorhinal cortex	**0.489** **(<.001)**	0.372 (.006)	0.052 (.712)	0.393 (.004)	**0.616** **(<.001)**	**0.548** **(<.001)**	**0.800** **(<.001)**						
9	Age	**–0.682** **(<.001)**	**–0.460** **(<.001)**	–0.180 (.194)	**–0.426** **(<.001)**	**–0.758** **(<.001)**	**–0.603** **(<.001)**	**–0.722** **(<.001)**	**–0.666** **(<.001)**					
10	Low quality (gain)	–0.013 (.925)	0.028 (.839)	–0.071 (.607)	–0.160 (.243)	0.108 (.400)	0.318 (.011)	0.142 (.267)	0.131 (.306)	–0.088 (.488)				
11	Medium quality (maintenance)	**0.674** **(<.001)**	0.337 (.012)	0.274 (.043)	0.396 (.003)	**0.665** **(<.001)**	**0.568** **(<.001)**	**0.584** **(<.001)**	**0.527** **(<.001)**	**–0.766** **(<.001)**	0.264 (.032)			
12	High quality (maintenance)	**0.512** **(<.001)**	0.338 (.012)	0.329 (.014)	0.360 (.007)	**0.610** **(<.001)**	**0.575** **(<.001)**	**0.458** **(<.001)**	**0.406** **(<.001)**	**–0.688** **(<.001)**	0.325 (.008)	**0.808** **(<.001)**		
13	LSPS	**–0.867** **(<.001)**	**–0.572** **(<.001)**	–0.419 (.002)	**–0.610** **(<.001)**	**–0.712** **(<.001)**	**–0.414** **(<.001)**	**–0.575** **(<.001)**	**–0.533** **(<.001)**	**0.727** **(<.001)**	0.057 (.680)	**–0.689** **(<.001)**	**–0.640** **(<.001)**	
14	LBSS	**–0.609** **(<.001)**	**–0.429** (.002)	–0.090 (.525)	**–0.421** (.002)	**–0.870** **(<.001)**	**–0.813** **(<.001)**	**–0.919** **(<.001)**	**–0.848** **(<.001)**	**0.775** **(<.001)**	–0.219 (.087)	**–0.680** **(<.001)**	**–0.608** **(<.001)**	**0.653** **(<.001)**

Note. Spearman's correlation coefficients. Correlations in black fall below an α-level of .05. Bold black correlation coefficients fall below the Bonferroni-adjusted α-level of .00028. LBSS: latent brain structure score, LSPS: latent sleep profile score, mPFC: medial prefrontal cortex, SP: spindle, SO: slow oscillation, SWA: slow-wave activity.

*Supplementary Table 2. Bivariate correlations between sleep variables, brain regions of interest, and memory measures in **younger adults***

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Fast SP density													
2	Slow SP density	0.661 (.001)												
3	SO density	–0.447 (.030)	–0.107 (.618)											
4	SWA	–0.333 (.112)	–0.275 (.193)	**0.503 (.013)**										
5	mPFC	0.042 (.835)	0.064 (.765)	–0.066 (.759)	–0.013 (.953)									
6	Thalamus	0.349 (.075)	0.250 (.237)	–0.351 (.093)	–0.379 (.069)	**0.444 (.015)**								
7	Hippocampus	0.093 (.642)	–0.210 (.324)	–0.366 (.079)	–0.283 (.180)	0.322 (.083)	**0.477 (.008)**							
8	Entorhinal cortex	0.209 (.293)	0.154 (.471)	–0.237 (.265)	–0.138 (.518)	0.022 (.910)	0.342 (.065)	**0.483 (.007)**						
9	Age	**–0.441 (.025)**	–0.370 (.083)	0.308 (.152)	0.023 (.919)	–0.081 (.676)	–0.129 (.503)	–0.067 (.731)	–0.111 (.564)					
10	Low quality (gain)	–0.008 (.967)	0.306 (.146)	–0.134 (.531)	**–0.407 (.049)**	0.176 (.351)	0.232 (.217)	0.060 (.752)	0.155 (.414)	0.153 (.427)				
11	Medium quality (maintenance)	0.207 (.299)	0.365 (.080)	0.086 (.688)	–0.163 (.444)	–0.017 (.929)	0.200 (.287)	–0.244 (.193)	–0.190 (.313)	–0.359 (.057)	0.305 (.101)			
12	High quality (maintenance)	0.127 (.527)	0.358 (.086)	0.096 (.657)	0.002 (.993)	0.179 (.344)	0.279 (.136)	–0.248 (.187)	–0.132 (.486)	**–0.382 (.041)**	0.219 (.244)	**0.535 (.002)**		
13	LSPS	**–0.593 (.003)**	**–0.588 (.041)**	–0.218 (.315)	–0.396 (.062)	–0.065 (.767)	0.054 (.806)	0.322 (.134)	–0.016 (.944)	0.259 (.232)	0.094 (.670)	–0.114 (.604)	–0.132 (.548)	
14	LBSS	–0.247 (.223)	–0.079 (.719)	0.328 (.127)	0.239 (.271)	**–0.620 (<.001)**	**–0.808 (<.001)**	**–0.841 (<.001)**	**–0.628 (<.001)**	0.178 (.353)	–0.198 (.302)	0.052 (.790)	–0.049 (.802)	–0.079 (.719)

Note. Spearman's correlation coefficients. Correlations in black fall below an α-level of .05. Bold black correlation coefficients fall below the Bonferroni-adjusted α-level of .00028. LBSS: latent brain structure score, LSPS: latent sleep profile score, mPFC: medial prefrontal cortex, SP: spindle, SO: slow oscillation, SWA: slow-wave activity.

*Supplementary Table 3. Bivariate correlations between sleep variables, brain regions of interest, and memory measures in **older adults***

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Fast SP density													
2	Slow SP density	0.306 (.094)												
3	SO density	0.151 (.415)	−0.402 (.026)											
4	SWA	−0.114 (.541)	−0.107 (.566)	0.312 (.087)										
5	mPFC	−0.052 (.788)	0.232 (.225)	0.127 (.511)	0.033 (.867)									
6	Thalamus	−0.006 (.977)	0.133 (.488)	−0.142 (.461)	−0.039 (.839)	0.364 (.038)								
7	Hippocampus	0.101 (.599)	0.160 (.405)	−0.027 (.889)	0.065 (.739)	0.228 (.201)	0.457 (.008)							
8	Entorhinal cortex	−0.068 (.723)	0.029 (.881)	−0.196 (.308)	0.023 (.905)	0.082 (.648)	0.183 (.306)	**0.648 (<.001)**						
9	Age	−0.143 (.444)	−0.130 (.486)	0.060 (.747)	0.131 (.482)	−0.171 (.341)	−0.374 (.032)	−0.380 (.029)	−0.198 (.270)					
10	Low quality (gain)	0.052 (.779)	−0.063 (.734)	−0.049 (.794)	−0.005 (.978)	0.252 (.156)	0.489 (.004)	0.324 (.067)	0.194 (.278)	−0.409 (.013)				
11	Medium quality (maintenance)	0.338 (.063)	−0.281 (.126)	0.097 (.603)	−0.128 (.492)	−0.021 (.908)	0.338 (.054)	0.234 (.189)	0.030 (.867)	−0.255 (.133)	0.463 (.004)			
12	High quality (maintenance)	0.118 (.527)	−0.169 (.362)	0.218 (.237)	−0.017 (.928)	0.202 (.259)	0.469 (.006)	0.228 (.201)	0.003 (.987)	−0.358 (.032)	0.502 (.002)	**0.620 (<.001)**		
13	LSPS	**−0.690 (<.001)**	−0.426 (.018)	−0.379 (.036)	−0.408 (.023)	−0.203 (.290)	−0.012 (.950)	−0.237 (.214)	0.090 (.641)	0.114 (.541)	0.008 (.968)	−0.004 (.982)	−0.094 (.612)	
14	LBSS	−0.033 (.867)	−0.180 (.348)	0.073 (.706)	−0.049 (.799)	−0.554 (.001)	**−0.640 (<.001)**	**−0.789 (<.001)**	**−0.694 (<.001)**	0.278 (.117)	−0.465 (.007)	−0.260 (.144)	−0.311 (.078)	-0.130 (.500)

Note. Spearman's correlation coefficients. Correlations in black fall below an α-level of .05. Bold black correlation coefficients fall below the Bonferroni-adjusted α-level of .00028. LBSS: latent brain structure score, LSPS: latent sleep profile score, mPFC: medial prefrontal cortex, SP: spindle, SO: slow oscillation, SWA: slow-wave activity.

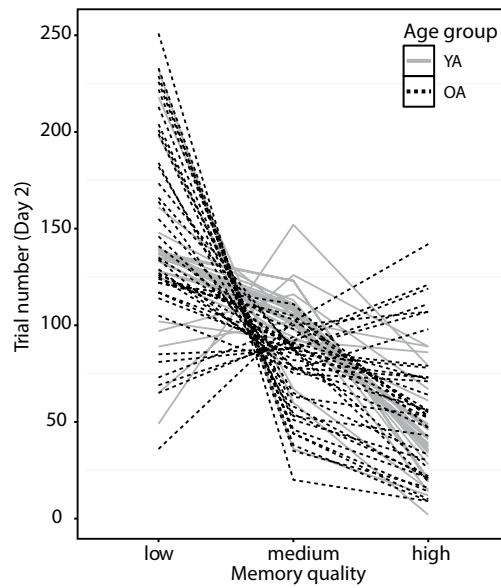*Supplementary Table 4. Memory gain and maintenance by sleep profile subgroup*

	SLEEP PROFILE			
	Younger adults		Older adults	
	young–Young (*n* = 12)	old–Young (*n* = 11)	young–Old (*n* = 7)	old–Old (*n* = 24)
GAIN				
low-quality memory	10.11 [7.11; 11.13]	8.76 [6.91; 12.53]	9.64 [4.05; 11.26]	11.36 [6.09; 15.71]
MAINTENANCE				
medium-quality memory	91.55 [89.73; 94.71]	89.29 [85.29; 94.95]	62.82 [59.57; 72.92]	66.35 [55.8; 71.47]
high-quality memory	98.88 [95.00; 100.00]	97.62 [94.39; 100.00]	88.43 [84.57; 91.72]	85.48 [80.27; 90.1]

Note. Sleep profile subgroups correspond to the subgroups marked in Figure 3b that pinpoint younger and older adults with comparable and distinct sleep profiles: young–Young (= younger adults showing a clearly distinct sleep profile from older adults), old–Young (= younger adults exhibiting a sleep profile comparable to older adults), young–Old (= older adults with a 'youth-like' sleep profile), old–Old (=older adults with a sleep profile clearly distinct from younger adults).
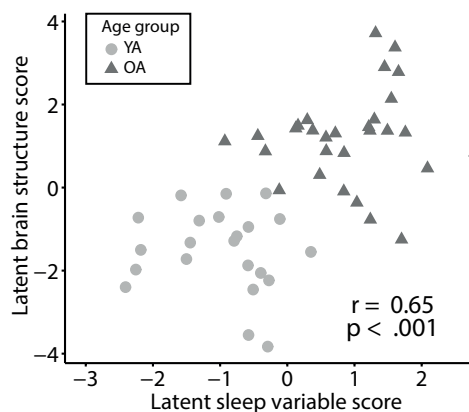
Supplementary Table 5. Memory gain and maintenance by brain structure subgroup

	BRAIN STRUCTURE			
	Younger adults		Older adults	
	young–Young (*n* = 17)	old–Young (*n* = 12)	young–Old (*n* = 5)	old–Old (*n* = 28)
GAIN				
low-quality memory	9.60 [7.86; 11.72]	8.57 [5.86; 10.3]	15.28 [13.51; 18.9]	8 [4.64; 11.91]
MAINTENANCE				
medium-quality memory	89.29 [87.76; 94.40]	90.71 [83.45; 92.05]	66.04 [59.52; 70.42]	65.97 [56.36; 71.47]
high-quality memory	97.62 [96.42; 100.00]	98.91 [92.72; 100.00]	88.43 [87.23; 90.00]	87.41 [79.81; 90.5]

Note. Brain structure subgroups correspond to the subgroups marked in Figure 4b that pinpoint younger and older adults with comparable and distinct brain structure profiles: young–Young (= younger adults with structural brain integrity clearly distinct from older adults), old–Young (= younger adults exhibiting a brain structure profile comparable to older adults), young–Old (= older adults with 'youth-like' structural brain integrity), old–Old (=older adults with a brain structure profile clearly distinct from younger adults).

Supplementary Figure 1. Trial composition on Day 2. The number of trials during delayed retrieval on Day 2 is displayed for each memory quality condition (as defined by recall success on Day 1). Lines represent single subjects. Note the great inter-individual variability in trial composition on Day 2, which is caused by differential learning trajectories on Day 1. YA: younger adults, OA: older adults.

Supplementary Figure 2. Latent variable association. Each participant's latent brain structure score is plotted against the latent sleep profile score. *Spearman's* rank-order correlation coefficient for the whole sample is displayed. YA: younger adults, OA: older adults.