Individual differences in anterograde memory for details relate to posterior hippocampal volume

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Abstract

In recent years, there has been a growing interest in individual differences in autobiographical memory. The ability to recall details from personal past events correlates with the volume of specific hippocampal subfields in healthy adults. Although the posterior hippocampus is believed to process detailed memory representations independently of the memory's age, little is known about individual differences in the ability to recall newly encoded events in detail, and how these differences relate to hippocampal subregions. In this preregistered study, we scored the story recalls from 89 healthy middle-aged participants with a newly designed method that allows to distinguish information recalled in detail from gist recall (i.e., when only the general idea is recalled). After a 20-minute delay, detailed information was transformed into gists, which is in line with recent evidence that gists can emerge rapidly after a new experience. In addition, we segmented the anterior and posterior hippocampal subfields CA1, CA2/3, dentate gyrus, and subiculum from high-resolution structural MRI. As predicted, the volume of the posterior hippocampus was positively correlated with the detail score but not with the gist score, yet this effect was significant in the right hemisphere only. We also observed trends towards associations between the detail score and specific subfields of the right posterior hippocampus, but none survived statistical correction for multiple comparisons. Finally, we found no evidence for the expected age-related increase in the use of gists over details. Taken together, these results suggest that the posterior hippocampus supports detail memory in the recall of both remote and newly acquired memories.

Introduction

Individual differences in episodic memory, and more specifically in autobiographical memory (AM) abilities, have attracted growing interest recently (Palombo, Sheldon, et al., 2018). Individual variability can be observed in the number of memories people can access when thinking about their personal past. In addition, the quality of the memories has also been found to vary between participants, as some people are able to recall past events in great details whereas others tend to remember only the general idea of events, or *gists* (Grilli & Sheldon, 2022; Robin & Moscovitch, 2017). One reason for this variability lies in individual differences in the brain structures that support AM. Research on the neural correlates of these individual differences has focused on the hippocampus, a key structure in episodic memory. The number of details that people can recall about past personal events has been associated with the volume of the hippocampus in healthy individuals, and more specifically with the volume of the pre/para-subiculum, subiculum, dentate gyrus (DG), and Cornu Ammonis (CA) 2/3 (Barry et al., 2021; Chadwick et al., 2014; Clark et al., 2023; Palombo, Bacopulos, et al., 2018). A particular emphasis has been put on the DG and CA3, since functional neuroimaging studies have evidenced a role for these subfields in pattern separation, the neural mechanism by which similar events are encoded as distinct nonoverlapping memory traces, and in pattern completion, the reactivation of a memory trace from a partial/degraded input (Berron et al., 2016; Grande et al., 2019; Lacy et al., 2011; Yassa & Stark, 2011). Notably, pattern-separation abilities were found to correlate with AM specificity (Matsumoto et al., 2022). Moreover, lesion studies revealed that AM is impaired in case of damage restricted to CA3 (Miller et al., 2020) and to DG (Baker et al., 2016; Hanert, Rave, et al., 2019). Interestingly, CA1 lesion in case of transient global amnesia also disrupt AM (Bartsch et al., 2011) and pattern separation (Hanert, Pedersen, et al., 2019).

In addition to differences between subfields, the long-axis specialization of the hippocampus also plays a role: whereas gist memory relies on its anterior segment, memory for details involves the posterior hippocampus (Robin & Moscovitch, 2017). The neural mechanisms underlying this hierarchical specialization would be shared between the representation of episodic memory, space, and time (Collin et al., 2017). This is consistent with the proposal by Poppenk and colleagues (2013) that the hippocampus long-axis is functionally organised according to representational sharpness, or granularity, in a domain-general fashion.

Indeed, sharp representations mediated by the posterior hippocampus include episodic recollection (Poppenk & Moscovitch, 2011), but also precise spatial locations (Brunec et al., 2018; Evensmoen et al., 2015; Snytte et al., 2022). Similarly, coarse representations supported by the anterior hippocampus encompass general/gist-like memories (Audrain et al., 2022; Collin et al., 2015) and global spatial representations (Dalton et al., 2018; Evensmoen et al., 2015). When taking into consideration both the subfields and longitudinal specialisations within the hippocampus, one might expect the posterior CA2/3 and/or posterior DG, specifically, to be associated with the ability to recall details from AM. Strikingly, Clark et al. (2023) recently reported that posterior CA2/3 volume, specifically, correlates with the internal detail score in AM (i.e., episodic details) in healthy young adults.

Most studies on individual differences in AM abilities have focused on retrograde memory. Arguably, asking participants to recall personal memories provides a more ecological measure of memory abilities than laboratory-based tasks. However, Gilboa and Moscovitch (2021) proposed that different kinds of representations, including detailed memories, gists, and schemas, can be extracted in parallel from new experiences, before consolidation processes take place (see also Sekeres et al., 2018). Consistently, there is evidence that gists appear rapidly after learning, instead of merely arising from the gradual loss of details (Antony et al., 2022; Matorina & Poppenk, 2021). Furthermore, the involvement of the anterior hippocampus in reconstructing a memory (or retrieving the gist of the event), prior to elaborating on it, is independent of the age of the memory (Audrain et al., 2022). Damage to the hippocampus and surrounding medial temporal regions results in a loss of details in both remote and recent spatial memory (Li et al., 2024). More generally, the age-related bias towards gist-like representations to the detriment of details is not limited to AM or to retrograde memory tasks in general, but also impacts anterograde memory, including laboratory-based tasks (for review Grilli & Sheldon, 2022). Therefore, individual tendencies to rely preferentially on gist-like vs detailed memories should also exist in the way people encode new memories and relate to the anterior versus posterior hippocampus.

Recently, Cooper and Ritchey provided evidence for individual differences in memory for gists versus details when encoding newly imagined events, yet these two forms of memory were assessed with separate recognition tasks in this study (Cooper & Ritchey, 2022). For measuring details in anterograde memory, story recall appears as more ecological than recognition tasks or word list recall and would represent a parallel to AM for studying individual variability in learning new complex events. Lin and colleagues (2023) analysed *how specifically* participants recalled stories: they split the stories into information units, and rated for each unit whether participants recalled it as it was presented (i.e., detail), or the general idea (i.e., gist). Detail memory after a short delay (i.e., < 30 minutes) was associated with the integrity of medial temporal lobe structures in patients with mild cognitive impairment and healthy older adults, only when the story was presented in audiovisual format. In their study, however, the volumes of the bilateral whole hippocampus and thickness of bilateral entorhinal cortex were combined into a composite score, precluding linking the memory scores to any specific subregion of the hippocampus. In the present study, we aimed at investigating whether individual differences in the tendency to rely on details vs gists when recalling newly encoded experiences (1) can be measured using a standard story recall task (i.e., the logical memory test, LM), and (2) relates to the volume of specific hippocampal subregions. To this end, we took advantage of the Cognitive Fitness in Ageing dataset (COFITAGE, e.g., Chylinski et al., 2022), which includes high-resolution T2w MRI structural scans as well as neuropsychological examinations of 89 late middle-aged participants (i.e., 50 to 69 years old).

Preregistered hypotheses

The hypotheses and analyses of this study were preregistered (OSF link: https://osf.io/8gnar). Considering previous results mentioned above, we expected the volume of the posterior hippocampus to be associated with the level of detail in story recall. In contrast, we hypothesised that the gist score would be associated with the volume of the anterior hippocampus. Regarding the hippocampal subfields, we had no clear prediction but suspected the volume of posterior CA2/3 and/or posterior DG and/or posterior subiculum to be associated with detail recall abilities. Because previous studies reported correlations between memory performance and the volume of the hippocampus in the left or right hemisphere specifically (Barry et al., 2021; Maguire et al., 2003; Palombo, Bacopulos, et al., 2018; Palombo et al., 2015), we analysed the left and right hippocampus separately. Finally, since the posterior hippocampus is impacted earlier than the anterior hippocampus by normal ageing (Langnes et al., 2020; see also Setton et al., 2022), and considering the age-related shift towards gist-like memory (Greene & Naveh-Benjamin, 2023; Grilli & Sheldon, 2022), we expected age to be associated with a decreased reliance on details during story recall. If this effect was found, we would then investigate whether it was mediated by the volume of the posterior hippocampus.

Methods

Data availability statement

Study data and analysis code are available in the project OSF page: https://osf.io/sq4bg/

Participants

The data analysed in this study are part of the COFITAGE study, designed to investigate lifestyle factors, cognition and brain integrity in healthy ageing with multimodal data (trial registration number EudraCT 2016-001436-35). A full description of the study and cohort can be found in previous publications (Chylinski et al., 2022; Van Egroo et al., 2019). MRI data and recorded recall of the LM test were available for 89 French-speaking participants aged 50-69 (table 1). No participant reported current neurological or psychiatric disorders or was taking medication likely to affect the central nervous system. All had normal or corrected-to-normal vision and hearing. All participants showed normal performance on the Mattis Dementia Rating Scale (Mattis, 1976). The study was approved by the local Ethics Committee (Faculty of Medicine, University of Liege). Participants gave written informed consent prior to taking part and received a financial compensation.

Table 1. Descriptive statistics of demographic information (N=89).

	Mean	**SD**	**Range**
Age	59.26	5.41	[50 – 69]
Sex (nb of females)		58 (61.1%)	
Education (nb of years)	15.21	3.07	[9 - 25]
Mattis DRS	142.46	1.95	[134 – 144]
French National Reading Test	28.74	4.06	[13 – 36]

DRS: Dementia rating scale.

Logical memory scale scoring

We analysed immediate and delayed LM subtests from the Wechsler Memory Scale III, which was administered during the neuropsychological examination (Wechsler, 1997). All recalls were recorded and later transcribed for scoring. The aim of this study was to investigate participants' tendency to recall a story in detail/as a gist, therefore, we employed a custom scoring method similar to that used by Lin et al. (2023). We divided the story into 26 information units. Each unit was scored as either 0 to both scores (not recalled), 1 to the detail score only (recalled with precision), 1 to the gist score only (recall of the main idea), or 0.5 to both the detail and gist scores (recalled in a slightly altered form, such as with synonyms). The scoring criteria are summarised in table 2. Two exclusive scores, for the details and the gists, were then created by summing the score of all units in each category. In addition, a *false information* score and an *intrusion* score were created. False information refers to information recalled with an error (e.g., "three children" instead of "four children"), whereas intrusions refer to the recall of elements that were not mentioned in the initial story (e.g., "she was robbed *by two criminals*"). Double scoring was performed for 20 randomly selected recalls (JG and CB). Similar to previous studies, we calculated inter-class correlation coefficients, with two-way random effects models for absolute agreement. All coefficients showed reliable inter-judge agreement (detail score: 0.91, gist score: 0.89, false information: 0.82). Inter-class coefficients were irrelevant in the case of the intrusion score since there were very few intrusions (i.e., 76% and 70% of the participants had no intrusions in the immediate and delayed recalls, respectively), resulting in a large majority of zero values.

Table 2. Scoring criteria for the detail and gist scores. For each information unit, a score of 1 to detail only, 1 to gist only, 0.5 to both, or 0 to both, was applied using these criteria. *Note*: The French version of the story was administered.

	Definition	Detail score	Gist score
Detail	Information recalled exactly as it was presented, or use of synonyms that do not alter the main words	1	0
Gist	Main idea of the information is recalled	0	1
Synonym	Correct information expressed through synonyms that alter the main words	0.5	0.5
Forgotten	Information not recalled, or displaced	0	0
	Example for the unit "[the policeman, touched] by the **woman's story**"		
Detail	"by the **woman's story**" / "by the **story of this woman**"	1	0
Gist	"by the situation" / "by what happened"	0	1
Synonym	"**by the woman's account**"	0.5	0.5
Forgotten	No recall of the unit	0	0

MRI data acquisition

T2-weighted turbo spin echo MRI images (TR = 9240ms, TE = 80ms, FA = 80°, acquisition matrix = 448 x 448 x 60, voxel size = 0.4 x 0.4 x 1.2 mm^3) were acquired with a 3-Tesla MRI scanner (Siemens MAGNETOM Prisma, Siemens Healthineers, Erlangen, Germany) in an oblique-coronal orientation perpendicular to the long axis of the hippocampus and positioned to cover the entire structure. T1-weighted images were also acquired (TR = 1900 ms, TE = 2.19 ms, acquisition matrix = 240 x 256 x 224, voxel size = 1 x 1 x 1 mm^3) and, for the acquisition of the T2-weighted image, were used to confirm slices placement over the hippocampus.

Segmentation of hippocampal subfields

Left and right hippocampal subfields (i.e., CA1-3, DG, and subiculum) were automatically segmented with Automatic Segmentation of Hippocampal Subfield (Yushkevich et al., 2015) (ASHS, atlas package version: 'ashs_atlas_upennpmc_20170810', figure 1). Each segmentation was visually checked for quality control, and manually corrected in case of failure using ITK-snap (Yushkevich et al., 2016). The CA2 and CA3 subfields were grouped into a single CA2/3 subfield (Wisse et al., 2017; Yushkevich et al., 2015). All subfields were then manually divided into an anterior and a posterior portion, and the volume of each subregion was extracted. This division was based on the position of the uncal apex: the most posterior slice where the uncus was present was the last slice of the anterior section, and the slice immediately posterior to this landmark was the most anterior slice of the posterior section (Clark et al., 2023; Hrybouski et al., 2019; Poppenk et al., 2013; figure 1-B). Similar to previous studies (de Flores et al., 2023), total intracranial volume (TIV) was calculated using SPM12 by summing the grey matter, white matter, and cerebrospinal fluid volumes derived from the segmentation of the T1-weighted image.

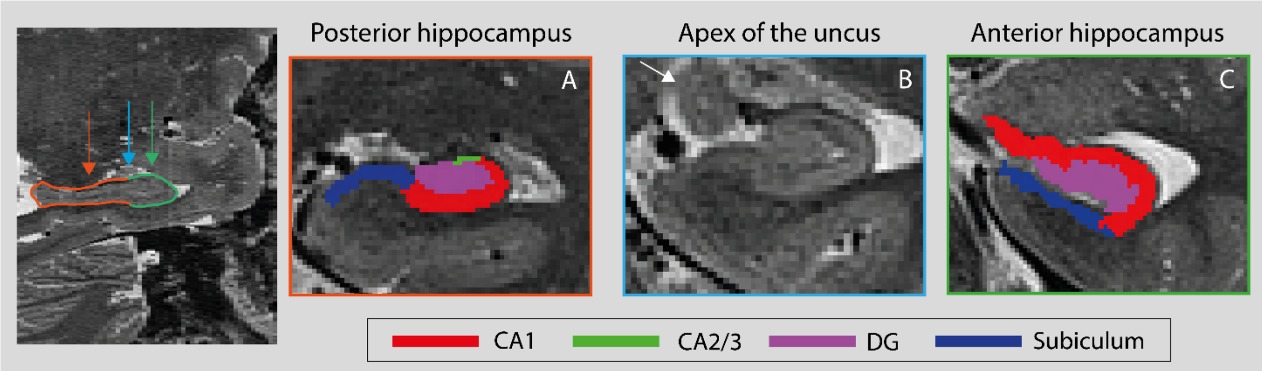

Figure 1. Example of subfields segmentation in posterior (A) and anterior (C) hippocampus, and apex of the uncus used as landmark for the anterior/posterior division (B, white arrow). CA: cornu ammonis, DG: dentate gyrus.

Statistical analyses

Following pre-registered analyses, we calculated partial correlations between memory scores and volumes of left and right posterior and anterior hippocampus. In the case of a significant correlation, follow-up analyses were performed for each hippocampal subfield. For these analyses, we corrected the statistical threshold for multiple comparisons using the Bonferroni method (corrected threshold: 0.05/4 = 0.0125). Analyses were performed in R (version 4.3.2) using the ppcor package (Kim, 2015) (version 1.1). Age, sex, education, TIV, and National Reading Test French version (fNART) were included as covariates in all analyses. The fNART was found to be a reliable marker of cognitive reserve in the COFITAGE cohort (Narbutas et al., 2019). Finally, for correlations involving the detail score, the gist score was used as covariate, and *vice versa*.

Results

1. Memory scores

Our first question was whether individual tendencies to rely more on details versus gists could be identified using the LM recall test. We thus explored the relation between the detail, gist, and false information scores in the delayed recall phase, as well as the evolution of these scores between the immediate and delayed recall phases. In the delayed recall, the detail and gist scores were negatively associated ($r(89) = -.39$, $p < .001$). The false information score was correlated with the gist score when controlling for the detail score ($r(89) = .43$, $p < .001$), whereas the correlation between the detail and false information scores was not significant when controlling for the gist score ($p = .39$). We also calculated a detail/gist ratio score such as R = (detail - gist) / (detail + gist). To illustrate individual variability, the distribution of the ratio score is displayed in figure 2.A. Paired t-tests revealed that both the detail score ($t(88) = -9.24$, $p < .001$), and the ratio score ($t(88) = -8.33$, $p < .001$) decreased between the immediate and delayed recall. In contrast, the gist score ($t(88) = 6.99$, $p < .001$), and the false information score ($t(88) = 3.41$, $p < .001$) increased between the immediate recall and delayed recall. Finally, we calculated difference scores (D_{detail} = Immediate$_{detail}$ – Delayed$_{detail}$ and D_{gist} = Delayed$_{gist}$ - Immediate$_{gist}$) that reflect the evolution of the detail and gist scores for each participant. The decrease in detail scores was strongly correlated with the increase in the gist scores ($r(89) = .65$, $p < .001$). These results are summarised in figure 2.

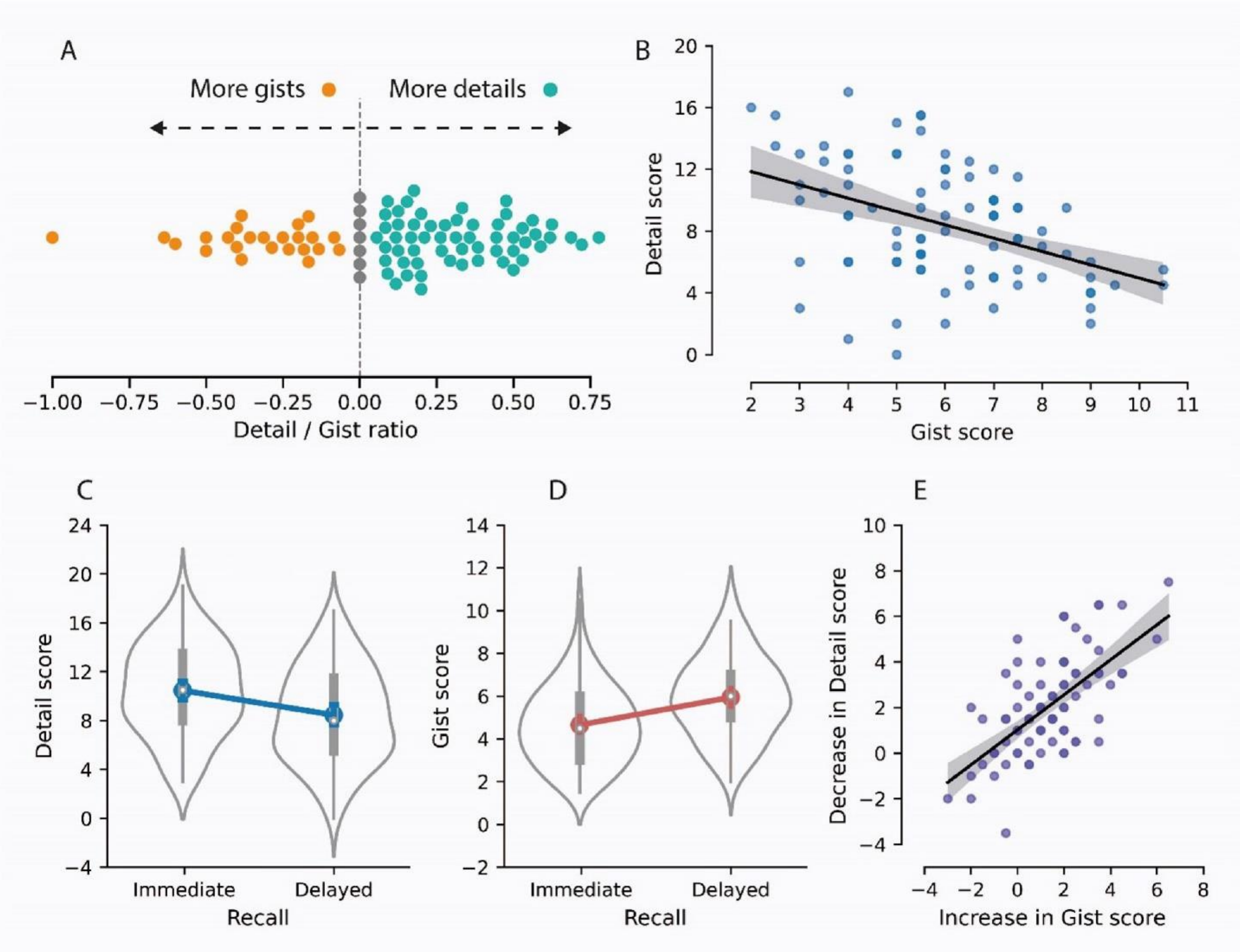

Figure 2. Summary of the detail and gist scores results. A. Distribution of the detail/gist ratio score in the delayed recall phase showing that while some participants recalled mainly gists, others recalled more details. B. Correlation between the detail and gist scores in the delayed recall phase. C. and D. Evolution of the detail and gist scores, respectively, between the immediate and delayed recall phases. E. Correlation between the detail and gist difference scores (i.e., D_{detail} and D_{gists}, see section Results – 1. Memory scores) showing that the more the detail score decreased, the more the gist score increased, between the immediate and delayed recall phases.

2. *Effect of age on memory scores and hippocampal volumes*

We next investigated the effects of age on delayed memory scores and hippocampal volumes. When controlling for sex, education, fNART, and TIV, there was no significant correlation between age and any of the memory scores (both $p > .09$). In the left hemisphere, the volume of the posterior hippocampus was negatively associated with age ($r(89) = -.26$, $p < .05$), whereas the correlation between the anterior hippocampus volume and age was marginal ($r(89) = -.21$, $p = .051$). Conversely, in the right hemisphere, age was negatively correlated with the volume of the anterior hippocampus ($r(89) = -.24$, $p < .05$) but not with the volume of the posterior hippocampus ($p = .108$). We next explored which of the subfields in the left posterior and right anterior hippocampus were associated with age, using a corrected threshold of $p < .0125$ (0.05/4). Only the volume of left posterior CA1 was significantly associated with age ($r(89) = -.28$, $p = .007$, all other $p > .07$). No correlation reached significance in the right anterior hippocampus, although we note that it was nearly the case for the subiculum ($r(89) = -.26$, $p = .013$).

3. Association between hippocampal volumes and memory scores

In the left hemisphere, there was no association between the delayed detail score and the volume of the anterior and posterior hippocampus (both $p > .39$), whereas there was a positive correlation between the detail score and the volume of the right posterior hippocampus ($r(89) = .22$, $p < .05$, figure 3A) but with not the volume of the right anterior hippocampus ($p = .92$). We thus explored which of the subfields in the right posterior hippocampus was associated with the detail score, using a corrected threshold of $p < .0125$ (0.05/4, figure 3B). None of the correlations reached this corrected threshold, yet there were marginal effects for the right posterior CA2/3 ($r(89) = .24$, $p = .025$), CA1 ($r(89) = .24$, $p = .026$), and subiculum ($r(89) = .23$, $p = .033$), but not DG ($p = .25$). In contrast, none of the anterior and posterior hippocampal volumes was significantly associated with the gist score (all $p > .31$) or the ratio score (all $p > .25$).

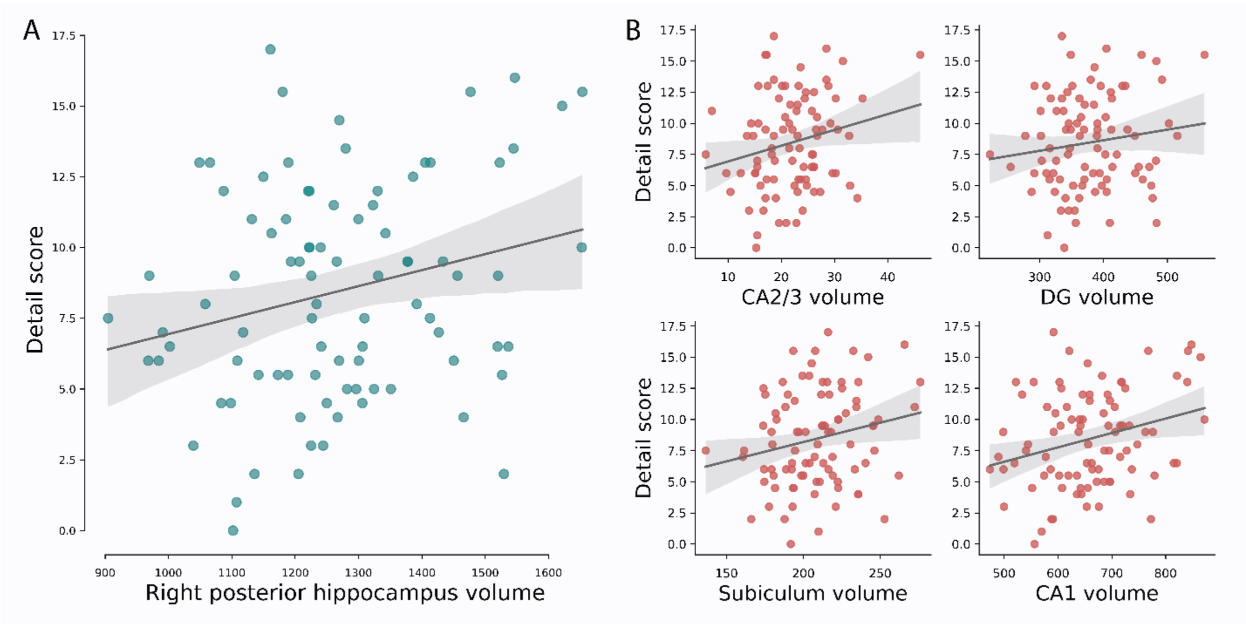

Figure 3. Correlations between the detail score and the right posterior hippocampus volume (A), divided into CA2/3, DG, subiculum, and CA1 subfields volumes (B). CA: cornu ammonis, DG: dentate gyrus.

4. Exploratory analyses

Planned analyses having highlighted a link between the posterior hippocampus and detail memory, we performed a series of exploratory analyses to determine whether these effects were related to the absolute volume of the posterior hippocampus or relative posterior/anterior volume. We therefore calculated posterior/anterior ratios ($R_{post/aant}$ = $Volume_{post}/Volume_{ant}$) for each left and right hippocampal subfield separately (Brunec et al., 2019; Poppenk & Moscovitch, 2011). Considering the exploratory nature of this analysis, we chose to use a highly conservative threshold of $p < 0.00625$ (0.05/8). In the right hemisphere, only the posterior/anterior CA2/3 ratio was significantly associated with the delayed detail score ($r(89) = .31$, $p = .003$; all other *ps* > .17), whereas in the left hemisphere, no significant correlation was observed (all *ps* > .30). Of note, this effect appeared to be driven mainly by three participants who present extreme right CA2/3 posterior/anterior ratios (z-scores: Z = 4.17, Z = 3.06, and Z = 5.61) and highly efficient detail memory (delayed detail scores: Z = 1.71, Z = 1.32, and Z = 1.84), while their overall right hippocampus volume is in the normal range (Z = 0.002, Z = 0.49, and Z = -0.07). We note that this result is unlikely to be explained by errors in subfields segmentation since these three participants have unusually high right posterior/anterior hippocampus ratios in general (Z = 3.07, Z = 1.39, and Z = 3.68), not only for CA2/3.

Discussion

In this study we investigated individual differences in the recall of newly acquired memories. More specifically, we were interested in how middle-aged participants tend to rely preferentially on detailed or gist-like memory representations (Cooper & Ritchey, 2022). To this aim, we designed a tailored scoring protocol of the standard LM recall test that allows to measure details and gists separately (this approach was adapted from Lin et al., 2023). In addition, we examined the association between these scores and the volume of anterior and posterior hippocampal subfields. Finally, we tested the hypothesis that memory for details would decline with age, to the benefit of gist memory.

First, the distribution of the detail/gist ratio after a delay showed that some participants mainly recalled the story in detail whereas others recalled most of the information in the form of gists. In addition, the decrease in the number of details recalled between the immediate and delayed recalls positively correlated with the increase in the number of elements recalled as gists. Given that immediate recall performance strongly relies on working memory, this effect reflects the emergence of gist-like memories shortly after the encoding of a new event, as evidenced by previous studies (Antony et al., 2022; Matorina & Poppenk, 2021). These observations are in agreement with the proposal that both detailed and gist memory representations can be extracted during and soon after new experiences (Gilboa & Moscovitch, 2021; Sekeres et al., 2018), in contrast with the view that gists solely emerge with the gradual loss of details through event repetition or rehearsal. If both detailed and gist-like memories can be extracted from a new episode, then these two types of representations could coexist, an intriguing hypothesis that could not be tested using the scoring methods employed here. Another limitation of our scoring method is that although participants were instructed to recall as many details as possible, we cannot rule out that narrative styles are confounded with detail memory abilities (Gaesser et al., 2011; Madore et al., 2014).

As predicted, we found a correlation between the volume of the posterior hippocampus and the delayed detail score, although unexpectedly this effect was only significant for the right hemisphere. In contrast, there was no relationship between the volume of the posterior hippocampus and the gist score or between the volume of the anterior hippocampus and the detail score. Overall, these results suggest that the scoring approach used here might be an effective marker of individual tendency to extract details or gists when encoding new events. Moreover, this tendency involves the posterior hippocampus, which would support detail memory independently of the memory age (Gilboa & Moscovitch, 2021; Robin & Moscovitch, 2017). An interesting avenue for future research is to determine whether the detail score in LM recall is associated with the internal detail score in AM tasks across individuals, which would strengthen this assumption. Based on previous research (Barry et al., 2021; Clark et al., 2023; Palombo, Bacopulos, et al., 2018), we expected the posterior CA2/3 and/or DG, and/or subiculum, to be associated with the detail score. Although we found trends for correlations involving the right posterior CA2/3, subiculum, and CA1, none of these effects survived statistical correction. Further research is needed to clarify the involvement of these hippocampal subregions in anterograde detail memory. In addition to studying larger samples, future work should focus on populations that present more variability than the one studied here. For instance, Clark et al. (2023) reported an association between the volume of posterior CA2/3 and internal detail score in AM only in the lower performing participants, suggesting that different patterns of results can be expected depending on the characteristics of the study cohort.

The observation that the detail score correlated with the volume of the right, but not with the left, posterior hippocampus, may seem contradictory to the role of the left medial temporal lobe in verbal memory recall (e.g., Lee et al., 2002). However, previous studies have found associations between the internal detail score in AM and the volume of right CA2/3 (Barry et al., 2021) and right subiculum (Palombo, Bacopulos, et al., 2018), although these effects did not survive statistical corrections. In addition, individuals with severely deficient autobiographical memory (SDAM) have reduced right, but not left, hippocampal volume compared to control participants (Palombo et al., 2015). These otherwise healthy individuals have impoverished AM specificity, as well as impaired recollection ability after a short delay (~ 30 minutes). Moreover, increased activation of the right posterior hippocampus was evidenced in people with highly superior memory abilities (Maguire et al., 2003). In line with these previous reports, we observed in an exploratory analysis three individuals with extreme right posterior/anterior hippocampus volume ratio and highly efficient detail memory. Our results thus aligned with previous ones in highlighting the importance of the right hippocampus in detail memory abilities even when assessed through verbal recall. Palombo et al. (2015) suggested that this link could be mediated by relational binding abilities. Clearly, further investigations are required to address this question. Interesting first steps for future research are to determine whether a volume reduction of the right posterior hippocampus, specifically, is responsible for the detail memory deficit observed in people with SDAM, and whether these individuals also have poorly detailed verbal recall of newly encoded events.

Finally, considering the age-related shift towards gists and gist-like memory to the detriment of details (Grilli & Sheldon, 2022; Sheldon et al., 2024), we predicted that the detail score would decrease, and that the gist score would increase, with age in the current study. We found no evidence in favour of either of these predictions. These results are nonetheless consistent with the observed link between the detail score and the right posterior hippocampus, since the volume of this region was not associated with age either in the current sample (in contrast with the left posterior and right anterior hippocampus). One possible explanation for this result, and a limitation of the present study, is that the COFITAGE cohort participants were selected for highly specific and intensive experimental conditions (e.g., sleep monitoring, multimodal neuroimaging sessions, extensive neuropsychological examinations) leading to strict exclusion criteria. Therefore, the effect of ageing on anterograde memory for details might be concealed in these high-functioning participants, allowing to study individual differences only. Whether the scoring approach of the LM test employed here allows to reveal an age-related tendency to extract gists rather than details from new events remains to be determined. Interestingly, however, the more participants recalled information in the form of gists, the more they recalled false information. This finding is in line with the observation that the increased reliance on gists in ageing can be a source of false recognitions (Koutstaal & Schacter, 1997).

In summary, the findings of the present study showed that individual differences in memory can be observed in the encoding of new events: whereas some people memorise them in great details, others tend to extract the gists. The results also suggest that the posterior hippocampus supports the ability to recall not only remote but also newly acquired memories in detail, at least in middle-aged adults. Future studies should generalise these results to different age groups and clarify the specific roles played by the right and left posterior hippocampi, as well as by the different hippocampal subfields, in detail memory.

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