0110

NAP-RELATED CHANGE IN MEMORY PRECISION MAY BE RELATED TO SLOW-WAVE SLEEP IN EARLY CHILDHOOD

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Introduction: In early childhood (3-5 years), naps comprise part of children's 24-hr sleep. Naps support some types of learning (declarative, emotional), enhancing children's ability to correctly identify previously seen items. During this time, children's ability to form precise memories also improves, likely due to ongoing hippocampal development and maturation of processes allowing for pattern separation. Whether naps support the ability to form precise memory representations, allowing children to discriminate between previously seen vs. similar but novel items, is unclear. Here, we used a mnemonic similarity task to examine whether daytime naps support children's recall of specific images more so than a period of wake. Further, we tested whether this nap-related improvement persists across overnight sleep. We hypothesized that task improvement would be associated with slow-wave sleep (SWS), as this stage has been shown to support episodic memory in preschool-aged children.

Methods: Participants (N=7, 4 females, Mage=56.1 mos) encoded items in the morning, verbally categorizing each image as something they would find "inside" or "outside". They recalled items at three time points: immediately following encoding, after their nap/wake period, and the following morning after overnight sleep. Recall involved being shown a single image and responding whether it had been previously seen or not. Recall items included targets, foils, and lures. PSG was recorded during the nap and overnight sleep bouts.

Results: When controlling for age, children forgot fewer target items following a nap than a comparable period of wake (p=.05). Following a nap and overnight sleep, children also exhibited marginally less forgetting of target items than following a period of wake and overnight sleep (p=.102). Lure discrimination index (LDI; false alarm lures minus false alarm foils) did not differ between nap and wake conditions. Change in target recall following the nap was associated with SWS% during the nap (r=.96, p=.01), but not nap duration (p=.27).

Conclusion: Napping supported children's ability to recall target items, but not to correctly reject lures, suggesting naps' benefit towards more generalized memory. Nap SWS% was associated with less forgetting of target items, supporting its role in hippocampal-dependent memory consolidation. Analyses of overnight sleep data and inclusion of more participants may help better elucidate the relationship between preschool children's sleep and memory development.

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0111

EFFECTS OF SLEEP ON WORKING MEMORY

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Introduction: Improvements in working memory (WM) are associated with increased vagal autonomic activity during sleep. Sex hormones, which fluctuate across a menstrual cycle, influence sleep, autonomic activity, and cognitive performance. Given this complex interaction, we examined whether the relation between WM improvement and autonomic activity across a night of sleep was modulated by menstrual phase.

Methods: Twenty-five healthy female participants with natural, regular menstrual cycles (age = 28.14 ± 4.41 years) were enrolled. We employed a within-subject design to investigate the role of menstrual phase on autonomic activity and sleep-dependent working memory improvement. All participants completed two in-lab visits, with one visit during their low hormones phase (LH: 0 to +2 days from the start of menses) and one visit during their high hormone phase (HH: +1 to +4 days from the start of ovulation). We measured WM with the Operation-Span Task at 9PM and 8AM. Participants' overnight sleep was monitored with EEG and ECG. We measured parasympathetic activity using the high-frequency heart rate variability (hfHRV) and the root-mean-square of successive differences between normal heartbeats (RMSSD). We used linear-mixed effect models and Pearson's r.

Results: No differences in WM were found between menstrual phases (all ps > .223). Interestingly, however, HRV during NREM positively correlated with WM improvement in LH (hfHRV: r = .329, p = .093; RMSSD: r = .327, p = .096), but not during HH (hfHRV: r = -.197, p = .355; RMSSD: r = -.179, p = .402). The differences between correlations were significant (hfHRV: p = .038; RMSSD: p = .045).

Conclusion: Prior meta-analysis revealed greater vagal autonomic activity during LH (menses), compared with other phases. Though we didn't replicate this finding, we did show a significantly stronger relation between vagal autonomic activity and overnight WM improvement during this low hormone phase. Our results suggest that menstrual phase shifts the reliance of sleep-dependent WM improvement to vagal autonomic mechanisms.

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0112

CLASSIFICATION OF RECONSTRUCTED DEPTH PROFILES SHOWS GLOBAL AND NON-GLOBAL SLOW OSCILLATIONS DIFFERENTIATE IN THE HIPPOCAMPUS AND THALAMUS

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Introduction: Sleep slow oscillations (SOs, 0.5-1.5 Hz) can be classified on the scalp as Global, Local or Frontal, where Global SOs are found in most electrodes within a short time delay and gate long-range information flow during NREM sleep. In this study, we estimate the current density within the brain that generates a Global SO, to evaluate which sub-cortical structures are involved in Global SO dynamics. We then train multiple machine learning algorithms to distinguish between Global SOs and other SO types, and probe variance of Global/non-Global SO profiles within and across subjects.Sleep slow oscillations (SOs, 0.5-1.5 Hz) can be classified on the scalp as Global, Local or Frontal, where Global SOs are found in most electrodes within a short time delay and gate long-range information flow during NREM sleep. In this study, we estimate the current density within the brain that generates a Global SO, to evaluate which sub-cortical structures are involved in Global SO dynamics. We then train multiple machine learning

algorithms to distinguish between Global SOs and other SO types, and probe variance of Global/non-Global SO profiles within and across subjects.
Methods: 32 volunteers (18 females) slept in the lab with polysomnography including 24 head EEG channels; their sleep was scored according to AASM criteria. SOs were algorithmically detected at each channel and classified as Global or non-Global using our method (Malerba et al., 2019). The depth profile of each SO was reconstructed with current source estimation (in Brainstorm followed by sLORETA), with a standardized head model including 17 regions. Each depth profile was embedded in a matrix averaging current by region and in three 200ms-long time bins: before, during and after the SO trough. Thirty classifiers were applied to this dataset, leveraging Matlab's supervised learning application. We compared accuracy within and across subjects and identified best-performing algorithms across dataset size. We then used univariate feature selection to quantify the relevance of each region-time pair to successful classification.
Results: Global/non-Global SOs current depth profiles have higher variance across subjects, and accuracy improves when data is sampled between rather than within individuals. Ensemble subspace methods reached highest accuracy (98.5%). Feature selectivity identified cortical, hippocampal, and thalamic currents at the trough of the SO as the most relevant for Global/non-Global SO classifications.
Conclusion: We introduce an analytical framework enabling the study of SO depth profiles, including their time evolution, as matrices. The predominant differentiation of Global/non-Global SOs in cortical, hippocampal, and thalamic currents supports the potential functional difference of these SO types.
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0113

DAILY PATTERNS OF SLEEP AND METACOGNITION IN COLLEGE STUDENTS

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Introduction: Sleep problems have been associated with subjective cognitive complaints (a type of metacognition) in older adults, but little research has examined if this same relationship exists in younger adults. Additionally, college students have high intra-individual variability with their sleep, making day-to-day sleep an understudied parameter of interest in this population. Considering that metacognition has been associated with academic outcomes (e.g., GPA) in college students, it is important to understand how daily sleep patterns might impact metacognition. The present study examined how intra-individual variability in sleep is associated with metacognitive ratings in college students.
Methods: College students (N=81, Mage=18.8, SD = 1.1, 64 females) completed seven days of sleep diaries reporting total sleep time (TST), sleep onset latency (SOL), number of nighttime awakenings, and wake after sleep onset (WASO). Students also provided morning metacognitive ratings regarding the perceived quality of mental functioning from very poor (0) to very good (100). Multilevel modeling analyses tested whether intraindividual variability in daily sleep variables was associated with daily metacognitive ratings, after controlling for interindividual sleep patterns, age, sex, sleep medication usage, and anxiety symptoms (via the Hospital Anxiety and Depression Scale).
Results: Daily TST was associated with metacognitive ratings (B=2.35, p=0.003), in that those who slept less than their typical average reported worse metacognitive ratings. Similarly, daily number of nighttime awakenings (B=-1.92, p=0.02) and WASO (B=-0.13, p=0.009) were also associated with metacognitive ratings, in that those with more awakenings and greater WASO than their typical average reported worse metacognitive ratings.
Conclusion: Findings suggest that deviation in typical daily sleep patterns (shorter TST, a greater number of nighttime awakenings, greater WASO) may impact daily metacognitive ratings in college students. Similar patterns are not observed at the average/interindividual level, prompting the need for future studies to examine daily sleep in college students. These findings point to the need for research examining whether sleep interventions (e.g., Cognitive Behavioral Therapy for Insomnia) for college students who experience sleep variability, could improve metacognition, which in turn could improve academic outcomes.
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0114

EVOLUTION OF BRAIN CIRCUITS SUPPORTING SPATIAL NAVIGATIONAL MEMORY ACROSS SLEEP

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Introduction: Systems consolidation is one of the major theories of sleep's function in memory. Sleep is thought to be important in integrating and distributing hippocampal information to cortical structures such that there is less hippocampal activation, while at the same time increasing striatal activation, upon subsequent experience in the same environment that co-occurs with improved performance. Here we sought to examine the evidence supporting systems consolidation across sleep in spatial navigational memory.
Methods: 15 subjects (28±5 yrs., 8 female) with no prior videogame experience and no sleep disorders were recruited to undergo spatial navigational memory testing before and after a night of sleep. Spatial navigational memory was tested across two functional MR (fMRI) sessions (approx. 7PM and 8AM) separated by in-lab nocturnal polysomnography (NPSG) measured sleep using a virtual 3D Maze. Each fMRI session consisted of six runs: three maze trials interleaved with three control trials. During maze trials participants were instructed to reach a prespecified goal as quickly as possible, whereas during the control trials, participants were instructed to navigate a Z-shaped corridor with no prespecified goal. fMRI data was analyzed in 2-step procedure using Analysis of Functional Neuroimages (AFNI) software package. To estimate hippocampal activity during fMRI, parameter estimates of the %change in blood-oxygen-level-dependent (BOLD) signal using the contrast maze-control were used as the primary metric. Regions of interest were limited to the bilateral hippocampus, parahippocampal gyrus, caudate, and putamen using the Eickhoff-Zilles macro labels from the MNI-N27 template.
Results: During in-lab NPSG, participants experienced a total sleep time of 6.1±1.1 hrs (8.7±2.9%stage1, 51.2±7.6%stage2, 21.8±8.5%stage3, 18.1±6%REM). Within subjects, compared to pre-sleep, a significantly lower activation of the bilateral hippocampus and parahippocampal gyrus was observed post-sleep (evening-morning %change=0.26±0.11, $p<0.05$). Compared to