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SLEEP-DEPENDENT PROSPECTIVE MEMORY CONSOLIDATION IS IMPAIRED WITH AGING

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Introduction: Existing literature suggests that sleep-dependent memory consolidation is impaired in older adults but may be preserved for personally relevant information. Prospective memory (PM) involves remembering to execute future intentions in a timely manner and has behavioural importance. As previous work suggests that N3 sleep is important for PM in young adults, we investigated if the role of N3 sleep in PM consolidation would be maintained in older adults.
Methods: 49 young adults (mean age±SD: 21.8±1.61 years) and 49 healthy older adults (mean age±SD: 65.7±6.30 years) were randomized into sleep and wake groups. After a semantic categorization task, participants encoded intentions comprising 4 related and 4 unrelated cue-action pairs. They were instructed to remember to perform these actions in response to cue words presented during a second semantic categorization task 12h later that encompassed either daytime wake (09:00-21:00) or overnight sleep with polysomnography (21:00-09:00).
Results: The significant condition x age group x relatedness interaction suggested that the sleep benefit on PM intentions varied according to age group and relatedness ($p=0.01$). For related intentions, sleep relative to wake benefitted young adults' performance ($p<0.001$) but not older adults ($p=0.30$). For unrelated intentions, sleep did not improve PM for either age group. While post-encoding N3 was significantly associated with related intentions' execution in young adults ($r=0.43$, $p=0.02$), this relationship was not found for older adults ($r=-0.07$, $p=0.763$).
Conclusion: The age-related impairment of sleep-dependent memory consolidation extends to prospective memory. Our findings add to an existing body of work suggesting that the link between sleep and memory is functionally weakened in older adulthood.
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FEAR-POTENTIATED STARTLE AND SLEEP IN TRAUMA-EXPOSED MEN AND WOMEN WITH AND WITHOUT PTSD

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Introduction: Animal and human studies indicate that fear conditioning disrupts subsequent sleep, including REM sleep (REMS). REMS is thought to be central to fear information processing. We utilized an afternoon nap protocol to examine the effects of fear-potentiated startle (FPS), a variant of fear conditioning, on subsequent sleep integrity and REMS in trauma-exposed participants with varying levels of PTSD. We also examined the effects of changes in sleep integrity and REMS on subsequent retention and extinction of pre-sleep learning.
Methods: Participants (N=47) participated in 3 nap visits. The first was an adaptation nap. The second and third nap visits were counterbalanced: a stress-condition nap, during which participants underwent FPS procedures prior to a nap and assessment of retention of fear and safety signal learning and fear extinction after the nap, and a control visit during which participants had a nap opportunity without stressful procedures. Canonical correlation analysis assessed the relationship between FPS responses and change in subsequent sleep relative to a control nap, as well as the relationship between change in sleep from control to stress condition and both subsequent fear and safety learning retention, and subsequent extinction.
Results: Results demonstrated a relationship between fear learning and change in sleep and supported a relationship between safety signal learning and subsequent REMS, as well as differential conditioning and wake after sleep onset. Sleep did not predict measures of fear retention or extinction. PTSD symptoms did not predict fear learning or sleep measures.
Conclusion: These findings replicate prior work showing a relationship between safety learning and REMS, suggesting that this is a core mechanism through which stress impacts fear processing. Further research is critical to further understand this effect, and to examine how different aspects of fear learning impact different components of sleep. This study also demonstrates that nap studies can be a valuable approach for studying the stress-sleep relationship.
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INCREASED COGNITIVE LOAD UNDER STRESS MODULATES SLEEP SPINDLES AND SLOW OSCILLATIONS IN A SLEEP-STAGE DEPENDENT MANNER

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Introduction: The effect of increased cognitive load especially under duress has been known to affect brain rhythms in humans. However, this effect has been shown primarily in the awake brain; the effect of stressful cognitive load on sleep rhythms is yet unclear. We leveraged a unique opportunity to understand the effect of cognitive load under laboratory stress on sleep spindles and slow oscillations that are hallmark rhythms of NREM sleep.
Methods: Cortical 6-channel EEG nap data were collected from 45 subjects over two separate days: after a control session without laboratory stressors and after an experimental session in which they underwent fear condiitoning and negative-emotional-image viewing sessions. We detected sleep spindles (11-13Hz over frontal regions and 13-16Hz over centroposterior regions) and slow oscillations (0.16–1.25Hz oscillations) as discrete events at each of the six electrodes, and staged them by the sleep hypnogram. We evaluated the spindle rate in N2 sleep and the proportion of slow oscillations nested with a spindle in N3 sleep.
Results: Over all 6 EEG electrodes, N2 spindle rates increased on average by 14% in the experimental session compared to the control session (mixed-effect models $p<0.001$). In addition, over all 6 electrodes, the proportion of slow oscillations in N3 nested with a spindle increased by 2.3% in the experimental session compared to the control session (mixed effect model, $p=0.005$).
Conclusion: We show for the first time how increased cognitive load under stressful laboratory conditions affects sleep rhythms. Such an increased response in sleep might correspond to a continued emotional response due to the cognitive load under duress. Ongoing work seeks to tie these findings to possible emotional memory consolidation.
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