compared to short and intermediate sleep duration (p=0.018). No associations were found for stride length. These findings are consistent with studies demonstrating negative health outcomes for long vs. short and intermediate sleepers.
Conclusions: This study demonstrates early pre-clinical manifestations of comorbidity between sleep and gait, both of which significantly affect daily functioning in older adults. The Dual-Task Paradigm is a sensitive tool that can easily be used for early diagnosis of comorbid gait-sleep deterioration. Such investigations may pave the way to a better understanding of the mechanisms underlying their comorbidity and lay the groundwork for interventions.
Acknowledgements: Basic Research

ALTERED SLEEP BEHAVIOR IN A GENETIC MOUSE MODEL OF ALZHEIMER'S DISEASE FOLLOWING ANESTHETIC EXPOSURE

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Introduction: Due to demographic changes, the number of senior patients undergoing surgery and suffering from Alzheimer's disease (AD) is expected to expand. It has been hypothesized that anesthetics may deteriorate or even trigger the development of AD. Upon administration of anesthetics, AD patients may experience sleep disturbances, exacerbated initial postoperative emergence delirium or even postoperative delirium (POD), which may concomitantly lead to worsening of cognitive impairments. Recent research suggests that certain volatile anesthetics such as sevoflurane may not only cause short-term cognitive dysfunction but may even exacerbate AD-related long-term cognitive decline. Concurrently, accumulating evidence indicates a linkage of sleep disorders with AD not only as a symptom, but also as a potential facilitator of the disease. With this study, we aimed to examine face validity and constructive validity of the AD ArcAβ mouse model by inspecting whether anesthetic exposure has an altered detriment on sleep architecture. Additionally, we investigated potential predictive EEG-biomarkers deriving from the basal sleep/wake behavior for estimating the extent of anesthetic detriment following its exposure.
Materials and methods: We used 14 ArcAβ mice (7 transgenic with AD pathology and 7 wildtype) with an age of 8-11 months. Chronic electroencephalogram (EEG) and electromyogram (EMG) recordings were performed to assess sleep/wake behavior. Following baseline recordings, experimental administration of sevoflurane was performed (0.2%vol every 2 min up to 3%vol max.) until EEG burst suppression was achieved (10s inter-burst interval). Sevoflurane concentration was then reverted to 0%vol in 0.2%vol steps, followed by another set of EEG/EMG recordings.
Results: Age-independent baseline EEG recordings showed significant differences in spectral features, most importantly decreased delta power in transgenic mice during NREMS compared to wildtype littermates with a relative increase in remaining power spectra. Administration of experimental anesthesia in wildtype mice, regardless of age, did not result in any profound alterations in sleep architecture. On the other hand, transgenic mice showed increased transitions from NREMS to wakefulness, accompanied by a decrease in delta power during NREMS compared to wildtype littermates, independent of the age group.
Conclusions: Our results, supporting face validity and constructive validity, suggest that anesthetic administration results in an age-independent disruption of sleep-wake behavior in ArcAβ mice. Further, wildtype mice appeared to regain basal sleep/wake behavior, whereas transgenic mice showed a reduction in sleep quality and an alteration of sleep architecture after anesthesia. Spectral EEG-biomarkers, as found in our study, could potentially play a role in predicting cognitive decline after anesthesia. Our future experiments will focus on impaired sleep quality in ArcAβ mice after anesthetic exposure as a potential trigger for cognitive impairments due to anesthetics.

AN EEG STUDY ON SLEEP HOMEOSTASIS IN A SONGBIRD SPECIES, THE EUROPEAN STARLING (*STURNUS VULGARIS*): REM SLEEP, WHY BOTHER?

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Introduction: Sleep is considered to be of crucial importance for optimal performance and health. However, most of what we know about sleep is based on a handful of mammalian species under laboratory conditions. Perhaps much can be learned from comparative studies in other species. Birds are interesting in that respect because they exhibit two sleep states that are similar to mammalian rapid eye movement (REM) and non-REM (NREM) sleep. We therefore did a series of electro-encephalogram (EEG) studies in European starlings (Sturnus vulgaris) for a detailed assessment of sleep architecture and sleep homeostasis under laboratory and semi-natural conditions.
Materials and Methods: We implanted 12 European starlings with epidural EEG electrodes and applied miniature dataloggers to record their sleep-wake behavior. In the first experiment under controlled indoor conditions, we measured baseline sleep and sleep homeostatic responses to 4 and 8-hour sleep deprivations. In the second experiment, we measured sleep under seminatural outdoor conditions across the seasons.
Results: The birds showed a homeostatic NREM sleep response reflected in elevated EEG spectral power across a broad frequency range and increased daytime napping. Starlings had hardly any REM sleep (1.6% of total sleep time) and no REM sleep rebound after sleep deprivation.
Under seminatural outdoor conditions, the birds showed extreme variation in the amount of NREM sleep across the seasons with 5 hours more sleep in winter than in summer (12.5 h and 7.5 h respectively, $p < 0.001$). The daily sleep variation was best explained by photoperiod ($p < 0.001$) and was also negatively affected by moonlight ($p < 0.001$). During long photoperiod, starlings showed an increased sleep pressure that was reflected in the slope of the decay of EEG spectral power during the nights ($p = 0.008$), resulting in an increase in daytime naps. Also, under seminatural conditions starlings only displayed negligible amounts of REM sleep.
Conclusions: This study confirms homeostatic regulation of NREM sleep in songbirds. Yet, it also demonstrates high flexibility and strong photoperiodic regulation of NREM sleep under natural conditions. Finally, this study does not support an important role for REM sleep.
Acknowledgements:
This study was supported by an Adaptive Life Program scholarship from the Groningen Institute for Evolutionary Life Sciences and an Ubbo Emmius scholarship provided by the Faculty of Science and Engineering at the University of Groningen. N.C.R. was supported by the Max Planck Society.

A NEW METHOD FOR PRECISE OSCILLATORY PHASE TARGETING AFFECTS SLOW WAVES AND SLEEP SPINDLES ON THE SHORT AND LONGER TERM

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Introduction: Several studies have shown manipulation of slow oscillations and sigma power through sensory stimulation during sleep. Most of the evidence, however, regards effects immediately following stimulation rather than longer-term effects. Moreover, effects on doscrete spindles have as yet not been assessed. Here we use a modeling-based approach to predict upcoming oscillatory activity in the EEG and phase-lock subtle acoustic stimuli to the start of the SO positive deflection.
Materials and Methods: Here we use a modeling-based approach to predict upcoming oscillatory activity in the EEG and precisely phase-lock subtle acoustic stimuli to the start of the SO positive deflection. We assess effects the effects of stimulation on discrete slow oscillations and spindles on the short (seconds) and longer () term. We relate our findings to

observations at the level of spectral measures and evoked potentials.
Results: Our observations show that slow wave measures were consistently increased, as apparent in measures of discrete SO's, SO and delta power and deflections in the ERP. On the other hand, fast spindle measures showed a short-term grouping (local increase) during a stimulus-induced Slow wave positive deflection around 1 second after stimulation, but were globally decreased, both on the short and long term. This was apparent in measures of discrete fast spindles and PSD across longer periods of sleep.
Conclusions: Acoustic stimuli precisely phase locked to the SO onset increase SO's and delta power globally, therewith deepening sleep. Fast sleep spindles are globally depressed. This appears to be due in part to interruption of ongoing spindles by the stimulus, and may furthermore reflect a depressing influence of slow oscillations (sleep depth) on fast spindle dynamics.
Acknowledgements: We thank the European Space Agency (ESA) for their support and colaboration on this study.

AUDITORY STIMULATION ALIGNED TO THE ASCENDING PHASE OF THETA OSCILLATIONS DURING REM SLEEP

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Introduction: Closed-loop auditory stimulation (CLAS) approaches have been gaining popularity and have been used extensively to investigate brain oscillations during non-REM sleep. Here, for the first time, we present a new method based on sine wave fitting approach to model and predict EEG oscillatory dynamics and to track and phase-target theta oscillations (4-8 Hz) during human REM sleep.
Materials and Methods: Twenty-four subjects (19 female, 5 male; M = 20.46 years, SD = 2.06) were recorded overnight with polysomnography. During periods of REM sleep, an advanced oscillatory phase prediction algorithm was deployed to target auditory stimuli at the start of the positive deflection (0°) of ongoing theta oscillations.
Results: Results showed that the up-wave of REM sleep theta waves was precisely targeted (336 +- 58 degrees), evoking significantly boosted theta and beta activity shortly after stimulus onset.
Conclusions: The present study concludes that sine wave fitting can be reliably applied to precisely detect phase of theta activity during human REM sleep theta activity. This study contributes to a technical advance, introducing a non-invasive method to influence theta wave activity in the brain during REM sleep. In this way, paving the way to reliably interact with arbitrarily chosen phases of theta waves, possibly bringing light to research questions that would benefit of direct interference on theta oscillations, to further explore its link to human cognition
Acknowledgements: We wish to thank Timo van Hattem for their help with this project

BED-SHARING IN THE FIRST 6 MONTHS: ASSOCIATIONS WITH INFANT-MOTHER ATTACHMENT, INFANT ATTENTION, MATERNAL BONDING, AND SENSITIVITY AT 18 MONTHS

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Introduction: The objective of this study was to investigate whether bed-sharing during the first 6 months of life is associated with infant's attachment and behavioral outcomes and mother's bonding and sensitive parenting at 18 months of age.
Materials and Methods: The sample with complete longitudinal data comprised 178 infants and their caretakers. Bed-sharing was assessed with maternal report at term, 3, 6, and 18 months. Infant attachment was measured at 18 months using the strange situation procedure. Infant behavioral outcomes (i.e., poor attention/hyperactivity and task persistence) were assessed with 2 observational measures at 18 months. Maternal sensitivity was observed at 3 and 18 months, and mothers reported on bonding to their infant at term, 3, and 18 months.
Results: Bed-sharing was common at term (41.2%), which decreased at 3 months (22.6%) followed by a slight increase at 6 (27.5%) and 18 months of age (31.3%). No associations between bed-sharing during the first 6 months and infant-mother attachment and infant behavioral outcomes at 18 months were found. Similarly, there were no associations between bed-sharing during the first 6 months and maternal bonding and sensitivity at consequent assessment points (i.e., 3 and 18 months).
Conclusions: Bed-sharing during the first 6 months is not associated with positive or negative outcomes about infant-mother attachment, infant behavior, maternal bonding, or sensitive parenting.
Acknowledgements: The authors would like to thank the researchers who assisted in recruitment and data collection: Tina Gutbrod, Libi Rust, and Karine Edme. The authors would also like to thank the participating hospitals (Addenbrookes Hospital, Cambridge; Luton and Dunstable Hospital, Luton; and Queen Elizabeth II Hospital, Welwyn Garden City) and the parents and their children.

BOOSTING VOCABULARY LEARNING DURING SLEEP VIA A PORTABLE CLOSED-LOOP TARGETED MEMORY REACTIVATION SYSTEM IN A HOME SETTING: A PILOT STUDY

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Introduction: Sleep plays a critical role in the process of memory consolidation. Targeted memory reactivation (TMR) is a well-established methodology to manipulate memory processing overnight, typically employed in a laboratory setting. Sensory cues are used to non-invasively reactivate associated memory traces during the deepest sleep stage (N3), thus promoting memory consolidation. Considering the comprehensive literature supporting the high efficacy of the TMR approach, the next step consists of translating this paradigm to daily life. We developed a portable closed-loop TMR (CL-TMR) system that automatically delivers sound stimuli during N3, relying on the ongoing electroencephalographic (EEG) activity recording of a commercial wearable EEG headband. We applied CL-TMR to enhance vocabulary learning by presenting verbal stimuli during sleep in a home setting.
Materials and Methods: A total of 12 healthy young Italian native speakers (mean age ± standard deviation, 24.50 years ± 2.32) participated in the pilot study. In the evening, subjects performed a vocabulary learning task requiring the acquisition of the Italian translation of pseudo-words (T1). During the subsequent night, half of the pseudo-words were aurally presented (*cued*) during the ascending phase of the slow oscillations (SOs) through the CL-TMR system. Half of them consisted of pseudo-words that participants translated correctly at T1, while the other half were pseudo-words whose translation was not learned. EEG signals were recorded with the *Dreem Headband* (*Rythm SAS*, Paris, France). Stimulations were triggered by the SO detection algorithm of the headband. Vocabulary memory performance was re-evaluated in the morning post-stimulation (T2). We compared the T1-T2 differences between *cued* and *uncued* correctly translated pseudo-words. At the electrophysiological level, we evaluated event-related potentials (ERPs) and event-related spectral perturbations in the 5-18 Hz range for *cued* pseudo-words. We compared cortical responses leading to a successful recall of the Italian translation with those associated with a not-remembered translation in the morning.
Results: Re-exposure to pseudo-words during sleep improved later memory for the Italian translation of the *cued* words (mean ± standard deviation, +13.20% ± 20.75) compared with *uncued* words (−5.26% ± 22.31; p=0.04). EEG analysis showed that successful reactivation during sleep was associated with higher frontal positivity and negativity in ERPs. Time-frequency analysis revealed an increase in the spindle band in the 1000−2000 msec time window after the stimulation onset (p<0.05) as the correlate of the reactivation of memory traces correctly recalled in the morning.
Conclusion: This pilot study showed the effectiveness of our CL-TMR system in boosting vocabulary learning during sleep in an ecological home setting. The successful cueing was characterized by increased spindle activity after stimulus presentation, confirming the importance of specific oscillatory dynamics in supporting the TMR effect. The application of a