Results: No significant difference was found between the dominant and non-dominant extremities of the musicians in terms of RMT, SAI and SICI. Furthermore, when the dominant and non-dominant extremities were compared between the musician and control groups, no significant difference was found in these parameters.
Discussion: Our findings show that impaired somatosensory integration previously demonstrated in focal dystonia is intact in musicians without dystonia. Furthermore, no changes were detected in the resting motor threshold and SICI, which indicate motor cortex excitability. These findings show no significant difference in sensorimotor integration and motor cortex excitability between professional musicians without focal dystonia and healthy controls.

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TU-103. Real-time EEG-triggered TMS of M1 during sleep to characterize the phasic modulation of corticospinal excitability during the thalamocortical sleep spindle

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Introduction: Thalamocortical sleep spindles (oscillatory patterns at 12-15 Hz with waxing and waning amplitude and 0.5-2 s duration) are a hallmark of non-rapid eye movement (NREM) sleep and believed to play a key role in the sleep-dependent memory reactivation (Bergmann etal., Neuroimage 2012) and consolidation (Diekelmann & Born, Nat Rev Neurosci 2010). Generated in the thalamus and projecting to neocortex and hippocampus, a hierarchical cross-frequency coupling can be observed, with neocortical slow oscillations phasically modulating spindles in turn phasically modulating hippocampal sharp-wave ripples (Staresina, Bergmann, etal. Nat Neurosci 2015). This nesting of oscillations may allow phase-dependent plasticity to occur in the neocortex during sleep (Bergmann & Born, Neuron 2018). While spindles can thus be considered windows of plasticity in the sleeping brain, it is yet unknown whether and how they modulate cortical excitability in a phasic manner.
Methods: We used real-time EEG-triggered TMS of the primary motor cortex (M1) hand area to measure motor evoked potentials (MEP) in 20 sleeping participants, targeting either spindles at four different phase angles (peak, trough, falling, and rising flank), spindle- and slow oscillation-free baseline NREM epochs, or immediate post-spindle NREM periods, pseudorandomized in order across trials. The experiment was conducted with the BEST toolbox (www.best-toolbox.org; Hassan etal., Brain Stim 2021) using a 64-channel EEG amplifier (NeurOne Tesla, Bittium) streaming to a real-time system (bossdevice, sync2brain) for spindle phase detection and triggering of neuronavigated TMS.
Results: In our preliminary analysis, we found a net suppression of MEP amplitudes during spindles relative to spindle-free NREM sleep, with maximal suppression during the falling flank and reduced suppression during the rising flank of the spindle oscillation, but no suppression during their peaks and troughs. These findings remained when restricting the analysis to solitary spindles that were not associated with slow oscillations.
Discussion: While a phasic excitability pattern fluctuating at twice the oscillatory frequency is surprising and warrants further investigation, its asymmetry nevertheless suggests that spindles exert pulsed inhibition of motor corticospinal excitability. Our findings thus complement earlier EEG-TMS work showing a phasic modulation of corticospinal excitability by the sleep slow oscillations (Bergmann etal., J Neurosci 2012) as well as pulsed facilitation by the sensorimotor mu-alpha rhythm during wakefulness (Zrenner etal., Brain Stim 2018; Bergmann etal., J Neurosci 2019). They also pave the way for future studies using TMS to phasically interact with spindles to investigate their role in brain plasticity and memory reactivation/consolidation.

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TU-104. Personalized theta frequency-modulated transcranial electric stimulation for associative memory improvement

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Introduction: Noninvasive brain stimulation (NIBS) has gained increased interest in research of associative memory (AM) and its impairments. However, the one-size-fits-all approach yields inconsistent findings, thus putting forward the need for the development of personalized frequency-modulated NIBS protocols to increase the focality and the effectiveness of the interventions. Specifically, transcranial altering current stimulation (tACS) and transcranial oscillatory current stimulation (otDCS) with theta-band frequencies (4-8Hz) are a promising path for further AM directed neuromodulation. The aim of the current study was (1) to develop a method for extracting the individual theta-band frequency (ITF) to be used as an input parameter for personalized theta-modulated tACS and otDCS; (2) to assess the effects tACS and otDCS in comparison to constant anodal tDCS and sham on different AM measures including short-term AM, delayed recognition, and cued recall. In a sample of 42 healthy volunteers, we extracted the frequencies with the highest event-related spectral perturbation from 19 overlapping time windows and six centroparietal electrodes from the EEG signal recorded during successful encoding in an AM task. The ITF was defined as modal frequency (4-8 Hz in 0.5 Hz steps) in time x electrode matrix. The method showed 93% success rate, good reliability, and the full range of variability of the extracted ITFs. In cross-over counterbalanced design, different stimulation protocols (tACS/otDCS/tDCS/sham) were delivered in separate sessions (7 days apart) for 20 minutes over posterior parietal cortex. Results showed either AM enhancement or no effects of tACS/otDCS/tDCS depending on the outcome measure that was used. We will discuss individual differences in theta-band activity during AM encoding, together with ITF-extraction challenges, and possible methodological and conceptual explanations for the inconsistent effects.

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