Fichten, C., Vitouchanskaia, C., Bailes, S., Creti, L., Rizzo, D. & Libman, E. (2016). Toy or tool redux: A second look at a consumer brain-behavior EEG headset. **Sleep Abstract Supplement, 39**, A61. Abstract 0163.

Conclusion: These results align with previous studies demonstrating that found West Coast teams of the NFL have a chronobiologic and ecological advantage for winning games. Future studies relevant to circadian misalignment and injury metrics ought to focus on injury type and biological underpinnings of injury prevention and risk.

0162

A 5-YEAR RETROSPECTIVE STUDY ON THE CIRCADIAN DISADVANTAGE IN THREE MAJOR SPORT LEAGUES IN NORTH AMERICA

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Introduction: The purpose of this study was to investigate the effects of a circadian disadvantage on the winning percentages in three major sport leagues in North America: the National Basketball Association (NBA), the National Football League (NFL) and the National Hockey League (NHL).
Methods: We reviewed the past 5 years of regular season games in the NBA, the NFL and the NHL and noted the winning percentage of the visiting team depending on the direction of travel (east vs west), and the number of time zones crossed for every game. T-tests and ANOVAs were performed to study the effect of the circadian disadvantage and its direction on winning percentage.
Results: The results showed an advantage, in all three leagues, for the teams travelling from west to east, but the effect was only significant in the NBA ($F(2,594) = 6.82$, $p < .001$). The effects for the NHL ($F(2,563) = 1,73$, $p = 0,17$) and the NFL ($F(2,503) = 2,09$, $p = 0,12$) were not significant, but the same tendencies were observed. In the NBA, teams travelling from west to east had a winning percentage of 45.38% compared to 36.23% for teams travelling from east to west. In the NHL, teams travelling from west to east had a winning percentage of 47.62% compared to 42.48% for teams travelling in the opposite direction. Finally, in the NFL, teams travelling from west to east had a winning percentage of 46.54% compared to 37.98% for teams travelling from east to west.
Conclusion: These results highlight the importance of the direction of the circadian disadvantage on the probability of success. Teams, from the three sports studied, traveling from Western to Eastern time zones had a greater winning percentage than those travelling in the opposite direction. Evening scheduling may be part of this phenomenon and need to be addressed in further studies.

0163

TOY OR TOOL REDUX: A SECOND LOOK AT A CONSUMER BRAIN-COMPUTER INTERFACE EEG HEADSET

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Introduction: Circadian research shows that individuals experience a drop in energy levels (attention) and feel sleepier at around 3 PM. This low point is usually detectable by EEG, which records electrical brain activity. Our goal was to test whether a popular consumer brain-computer interface (MindWave Mobile portable EEG headset) would detect this drop in energy levels through its algorithms for "attention", "meditation", and "eye blink intensity". We expected level of "attention" to decrease and level of "meditation" (a measure of relaxation) to increase around 3 PM. We had no hypothesis about "blink intensity."
Methods: Ten female volunteers (age range 20-78) wore the headset between 2 PM and 4 PM while engaged in office work. Scores for attention, meditation, and blink intensity were recorded every second and averaged for five 25-minute intervals, except for the third interval, which was 20 minutes long and averaged scores between 2:51 and 3:10 PM. Difficulties with the Bluetooth connection, low signal strength, movement of the headset on people's foreheads, and frequent adjustments of the headset due to slipping and discomfort resulted in data loss. Missing intervals (i.e., < 5 minutes of data) were mean substituted.
Results: There were no significant differences or trends on attention, meditation, or blink intensity among any of the time intervals.
Conclusion: Similar to results previously presented on pre and post 1½ hours of driving in a simulator, the results show no significant findings on any of the measures, suggesting that the portable EEG headset has substantial limitations in scientific usage. Nevertheless, lack of significant results could be due to the device itself (i.e., discomfort, etc), the opaqueness of the algorithms, or the brief time interval between 2 PM and 4 PM. Future research should examine whether the headset detects changes in circadian rhythm throughout the day.
Support (If Any): Fonds de recherche du Québec - Nature et technologies

0164

MULTISCALE MATHEMATICAL MODELING OF VIGILANCE STATE EFFECTS ON THE CIRCADIAN CLOCK

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Introduction: The electrophysiology of neurons in the suprachiasmatic nucleus (SCN) varies with time of day. In addition to driving SCN outputs, this variable electrophysiology represents a mechanism by which the SCN may gate its inputs. Recent work has demonstrated a functional connection between the laterodorsal tegmental nucleus (LDT) and the SCN that may transmit information about vigilance states to the clock. To investigate the mechanisms by which LDT activity affects the molecular clock in SCN neurons, we simulated LDT inputs in a multiscale mathematical model representing the interaction between SCN per1 neuron electrophysiology and a simplified gene feedback network.
Methods: Using an integrated model introduced by Diekman and colleagues, we first considered the effects of general excitatory/inhibitory inputs on individual per1 SCN neurons at different times of day to identify the role of electrophysiology in gating the response of the SCN neuron. Then we simulated excitatory effects consistent with projections from LDT neurons. In this modeling framework, changes to SCN electrophysiology drove changes in intracellular calcium concentration thereby affecting gene regulation and the timing of the internal clock.
Results: Consistent with previous reports, we found that model SCN neurons demonstrated distinct electrophysiological properties at different circadian phases. These electrophysiological differences translated to altered time courses for intracellular calcium concentrations, which, in turn, advanced or delayed the phase of the gene network. Thus, the clock demonstrated phase-dependent responses to simulated LDT inputs.
Conclusion: This model suggests mechanisms by which variable electrophysiology of SCN neurons gates inputs from LDT. Since these inputs are vigilance state-dependent, these findings have implications for