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COGNITIVE PERFORMANCE TEST FOR DETECTING SLEEPINESS-INDUCED IMPAIRMENT

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Introduction: The detection of dangerous impairment levels induced by poor or insufficient sleep can be of benefit in certain situations, such as the screening of workers with safety-critical jobs. The present study was conducted to evaluate a new cognitive performance test as a potential tool for impairment detection. The BLT test (developed by Bowles-Langley Technologies, Inc.) is a brief, simple computerized shape recognition test that requires the user to make a Yes/No decision about whether all items in a given screen are the same. After a series of 50 screens the resulting speed/accuracy-based score is compared to the user's baseline.
Methods: Fifteen subjects (aged 25-50 years) participated in a sleep restriction study. They stayed in the lab for two consecutive days and nights and were only allowed to sleep for three hours in the morning before the second test day. On each test day, they completed ten bi-hourly test sessions (starting at 1200). Each test session included several subjective tests (e.g., Visual Analog Scales, Thayer Activation-Deactivation Adjective Checklist, Karolinka Sleepiness Scale), 5-min simple reaction time test (PVT), 25-min driving simulation task, 50-screen four-choice reaction time test, and four shape recognition tests (SRT).
Results: The various testbed measures (subjective tests, PVT, four-choice test and driving task) showed the expected circadian trend with consistently impaired levels at night. SRT scores were significantly lower at night (0200, 0400, 0600) as compared to the two highest-score test sessions of the same test day (paired t-tests). On the group level, the SRT score (standard scoring algorithm 1.0) correlated well with many of the testbed measures (Spearman R>0.8, separate analysis for each test day). However, on the individual level, correlations were less strong and varied greatly between subjects.
Conclusion: The aim of further analysis is to refine the SRT scoring algorithm in order to improve the intra-individual correlations between the score of the shape recognition test and other testbed measures, and to define impairment thresholds.
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CAN SLEEP DIARIES BE ACCURATELY COMPLETED RETROSPECTIVELY?

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Introduction: Sleep diaries are commonly used in research in which quantitative measures of sleep are of interest. Sleep diaries yield accurate and reliable estimates of sleep and wake times. In many psychosocial studies there is an interest in assessing sleep to ascertain possible relationships between sleep and other psychosocial factors. However, at times it is impractical to have participants complete daily diaries. These studies often rely on qualitative measures of sleep. These types of measures are not able to provide researchers with specific quantitative descriptors of sleep but rather estimates. Other areas of behavioral research have shown that individuals are able to accurately report past behaviors over a specified period of time. The purpose of this study is to evaluate the accuracy of individuals' abilities to provide (in a one-time evaluation) their nightly estimates of sleep activity over the preceding week.
Methods: Participants responded to a recruitment ad requesting volunteers for an activity study and were unaware of the true purpose of the study. Participants wore an actigraphy monitor for one week and received minimal instructions so as to not sensitize them to the study's real purpose. They were instructed to wear the watch 24 hours a day and press the event marker at bedtime and waketime to separate sleep from waking activity. At the end of the week, participants completed a 7-day sleep diary and answered additional questions.
Results: Preliminary analyses have been completed on 11 participants (5 males). Intraclass correlations between actigraphy and diary data were calculated per night for total sleep time, sleep onset latency, WASO, time in bed and sleep efficiency. Consistency varied across variables. Time in bed yielded the highest intraclass correlations and the greatest number of significant correlations (significant r's ranged between .56 and .95, with 6 of 7 days having values with p's<.05). Total sleep time was second with 5 of 7 days showing significant intraclass correlations that ranged from .43 to .70. Sleep efficiency showed the least consistency with no significant intraclass correlations.
Conclusion: Preliminary data suggest that individuals may have the capacity to accurately estimate some aspects of their sleep retrospectively, although the data must be interpreted cautiously as consistency varies across sleep variables. Research in this area should further examine these relationships and establish which variables are best recalled retrospectively.

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POINCARÉ ANALYSES PROVIDE NOVEL INSIGHTS INTO THE TEMPORAL ORGANIZATION OF SLEEP

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Introduction: Poincaré analyses provide a method to display cyclic data as discrete points within two time dimensions and extend characterization derived from inferential statistics. Poincaré analyses have been used to characterize heart rate variability (Sleep 14:526, 1991; 19:117, 1996) and EEG (Sleep 16:586, 1993) during sleep. We have demonstrated (Sleep 31: Abstract in press, 2008) that rats bred for low intrinsic aerobic running capacity (LCR) exhibit decreased and disrupted sleep compared to rats bred for high intrinsic aerobic running capacity (HCR). This study is testing the hypothesis that Poincaré analyses offer unique insights into the temporal organization of sleep.
Methods: Six HCR and six LCR rats (Science 307:418, 2005) were implanted with electrodes for recording states of arousal. Every 10 seconds of each 24 h recording (n=12) was scored as REM sleep, NREM sleep, or wakefulness. Poincaré graphs of REM sleep were generated by plotting the length of each REM episode as a function of its immediate antecedent value. Measurements of standard deviation in relation to the line of identity (SD1) and a line perpendicular at the mean (SD2) quantified short-term (epoch to epoch) and long-term (24 h) variability, respectively.
Results: LCR rats had an SD1 15.4% larger than HCR rats, indicating that low aerobic capacity is associated with more short-term variability in REM epoch length. LCR rats also displayed a 19.7% larger SD2 value ($p < 0.05$) than HCR rats, showing that low aerobic capacity is associated with greater variability in REM epoch length for the entire recording.
Conclusion: Poincaré analyses unmasked REM sleep variability not visible using inferential statistics. These analyses provide new insight into the stability of sleep architecture across time by directly comparing each REM episode to its predecessor. Poincaré analyses quantify subtle changes in sleep architecture.
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