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B-ALERT™
by Advanced Brain Monitoring

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Published Studies Bibliography

Study	Sample Size	P-Value	Citations
Accelerated learning			
Improving the Pace and Efficiency of Rifle Marksmanship	n=10 (exp) n=10 (novice) n= 9 (APPT) Total n=29	Shot group: 2.34 X improvement p<0.01 Shot classification: 2.09 X greater probability classified expert p<0.01	Berka, C., A. Behneman, et al. (2009). Using Interactive Neuro- Educational Technology to Increase the Pace & Efficiency of Rifle Marksmanship Training. Society for Neuroscience 2009. Chicago, IL, #503.3; Raphael, G., Berka, C., Popovic, D., Chung, G., Nagashima, S., Behneman, A., Davis, G., Johnson, R (2009). Peak Performance Trainer (PPT®): Interactive Neuro- Educational Technology to Increase the Pace and Efficiency of Rifle Marksmanship Training. 13th International Conference on Human Computer Interaction, San Diego, CA
Accelerated Learning: Applications in Marksmanship, Archery and Golf	n= 3 (archer) n= 4 (golf) n=13(marks) n=51 (novice) Total n=71	Shot group, F(3, 132)=4.76 p<0.01 Alpha for APPT: t=2.05, p<0.01	Berka, C., A. Behneman, et al. (2010). "Acclerating Training Using Interactive Neuro- Educational Technologies: Aplications to Archery, Golf, and Rifle Marksmanship." International Journal of Sports and Society
Neuro-profiles that Predict Skill Competence	n=10 (exp) n=30 (novice) Total n=40	Experts have higher VSPS (p<0.05), higher SA (p<0.01) and lower sympathetic HRV (p<0.05) than novices.	Pojman, N., Behneman, A., Kintz, N. Johnson, R., Chung, G., Nagashima, S., Espinosa, P., Berka, C. (2009). Characterizing the Psychophysiological Profile Expert and Novice Marksmen. 13th International Conference on Human-Computer Interaction, San Diego, CA.
Enhancement of Intelligence Analysts' Extraction of Text Based Content	N=69	Right/ Parietal (F4, C4, P3, P4, and POz) increase in fast theta (linear regression from beg of sentence to end), F= (2,370) ≥ 3.382, $p \leq 0.05$	Behneman, A., Kintz, N., Johnson, R., Berka, C., Hale, K., Fuchs, S., Axelsson, P., Baskin, A. (2009). Enhancing Text-Based Analysis Using Neurophysiological Measures. 13th International Conference on Human-Computer Interaction, San Diego, CA.
Threat Identification in the Virtual Battlespace 2 (VBS2) Training Simulation	N=14	Mean ERP amplitude distinguished threats from non-threats (p<0.05), and laterality differences (p<0.05).	Berka, C., N. Pojman, et al. (2010). NeuroGaming: Merging Cognitive Neuroscience & Virtual Simulation in an Interactive Training Platform. Applied Human Factors and Ergonomics. Miami, FL, CRC Press / Taylor & Francis, Ltd.: 10
Neurophysiological Correlates of Team Performance and Group Dynamics	N= 5 teams of 3 Total n=15	Neurophysiologic synchronies identified by task with some synchronies preferentially expressed during the mental model forming stage; others more prevalent during the mental model convergence and revision stage (chi square = 1291, p=< 0.001).	Stevens, R., C. Berka, et al. (2010). Temporal Sequences of Neurophysiologic Synchronies can Identify Changes in Team Cognition. Human Factors And Ergonomics Society Annual Meeting. San Francisco, CA: 6.

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Psychophysiological Characterization of Learning and Skill Acquisition	N=18	There were no significant differences in E whether or not the problem was solved but WL was significantly lower when the solution to the problem was missed twice (0.59 ± 0.02 vs. 0. 64 ± 0.02, p = .002)	Stevens, R., T. Galloway, et al. (2007). Allocation of Time, EEG-Engagement and EEG-Workload Resources as Scientific Problem Solving Skills are Acquired in the Classroom. Augmented Cognition: Past, Present, & Future. D. Schmorrow, Stanney, K., Reeves, L. Arlington, VA, Strategic Analysis, Inc.
Interfacing Humans & Computers			
Impact of Simulator Fidelity on Behavior and Neurophysiology	N=12	Late P300 component confirms previous reports (Kok, 1985) of degraded stimuli eliciting reduced amplitude P300	Skinner, A., J. Vice, et al. (2009). Perceptually-Informed Virtual Environment (PerceiVE) Design Tool. Foundations of Augmented Cognition. Neuroergonomics and Operational Neuroscience. D. Schmorrow, I. Estabrooke and M. Grootjen, Springer Berlin / Heidelberg. 5638: 650-657.
EEG-based Quantification of Alertness, Cognition and Memory with a Wireless Sensor Headset	N=45	EEG-WL effectively tracked task difficulty (3 levels) in Warship commander task (F = 7.369, p < 0.005) in novices, as well as tracked improvement as experience was obtained, F = 3.118, p < 0.01. These data were replicated in a basic neurocognitive task with three levels (F = 21.962, p < 0.001).	Berka C, Levendowski D, Cvetinovic M, Petrovic M, Davis G, Lumicao M, Zivkovic V, Popovic M, Olmstead R. Real-time Analysis of EEG Indices of Alertness, Cognition, and Memory Acquired with a Wireless EEG Headset. International Journal of Human-Computer Interaction 17 (2):151-170, 2004.
Impact of Visio-Haptic Feedback on EEG Alertness	N=5	90% of events in a video gaming environment that were tagged for the user with haptic feedback were associated with peaks in EEG measures of high engagement/attention. This feedback was most effective in first person shooting types of games, and very effective for racing and sports types as well.	Kahol K, French J, Panchanathan S, Davis G, Berka C. Evaluating the Role of Visio-Haptic Feedback in Multimodal Interfaces through EEG Analysis. In: Schmorrow D, Stanney K, Reeves L, eds. Augmented Cognition: Past, Present and Future. Arlington, VA, Strategic Analysis, Inc., 289-296; 2006.
EEG-based detection of Workload	N=80	Development (n=13) and validation (n=67) of the EEG-WL model. The developed model tracked task difficulty across 5 tasks with increasing cognitive difficulty over time within the task. WL was found to be elevated during the learning portion of multiple learning and memory tasks (F(1,49)=34.79, p<0.001)	Berka, C., et al. (2007). "EEG Correlates of Task Engagement and Mental Workload in Vigilance, Learning and Memory Tasks." Aviation Space and Environmental Medicine 78(5): B231-B244.
Managing Fatigue			

Study	Sample Size	P-Value	Citations
Identification of Individuals Susceptible to Sleep Deprivation	N=24	Thresholds were applied across time-points to the PVT, PAL and MWT measures in an effort to stratify individuals into three groups (good, fair, poor performers) based on vulnerability to sleep deprivation [2,3]. A 3(group) X 10(time-points) repeated measures ANOVA revealed significant effects between groups during the PVT for B-Alert %Sleepy ($p<0.001$) and %Drowsy ($p<0.002$), %Correct and RT ($p<0.001$). The ANOVA during the PAL revealed significant effects between groups for Technician Observation-Drowsy and -Asleep ($p<0.004$), B-Alert %Drowsy ($p<0.032$) and %Sleepy ($p<0.003$), %Correct and RT ($p<0.001$).	Mitler,M. et al., SLEEP, 2002. Berka C, et al. EEG Quantification of Alertness: Methods for Early Identification of Individuals Most Susceptible to Sleep Deprivation. In: Caldwell JA, Wesensten NJ, eds. Biomonitoring for Physiological and Cognitive Performance during Military Operations. SPIE: The International Society for Optical Engineering, 78-89; 2005.
Objective Quantification of Daytime Drowsiness	N=135	Repeated measures ANOVA revealed a significant main effect of time (FR vs SD) for both reaction time, Fs (9,215) ≥ 13.99, ps < .0001; and inaccuracy Fs (9,215) ≥ 10.58 ps < .0001 for 3CVT, IIR and SIR. Drowsiness Fs (2,194) ≥ 12.12, ps < .0001, correlations: r= .55-58)	Johnson, R., Popovic, D. (in submission). Drowsiness determination through EEG: development and validation. Biological Psychology
Impact of Closed-Loop Drowsiness Feedback on Driving Performance	N=14	Significant interaction for feedback group X session ($F = 3.054$, $p < .05$), indicating that providing feedback in the later ½ of the day reduced accidents and driving behaviors associated with accidents (veers, lane changes).	Berka C, Levendowski D, Westbrook P, Davis G, Lumicao M, Ramsey C, Petrovic M, Zivkovic V, Olmstead R. Implementation of a Closed-Loop Real-Time EEG-Based Drowsiness Detection System: Effects of Feedback Alarms on Performance in a Driving Simulator. International Conference on Augmented Cognition, Las Vegas, NV, July 2005.
Operational Profiling of Sleep Deprivation and Stress	N=17	HR increased over the course of training, as did drowsiness, while performance in Q4 of the 3CVT became decrements ($P < .01$). No self report measures of fatigue were significant.	Berka, C., G. Davis, et al. (2007). "Psychophysiological Profiles of Sleep Deprivation and Stress during Marine Corps Training." Sleep 30: A132.
Effect of Nicotine and Withdrawal on Attention, Memory and Workload	N=26	Nicotine increased accuracy and speed on neuropsychological tasks ($t=2.134$, $p<.05$); ($t=2.63$, $p<.05$). During the ILR-I, EEG-engagement and EEG-workload levels were significantly higher during the encoding (“training”) period of memory tests when compared	Berka, C., D. Levendowski, et al. (2006). Nicotine Administration and Withdrawal Effects on EEG metrics of Attention, Memory and Workload: Implications for Cognitive Resource Allocation. Augmented Cognition: Past, Present and Future. D. Schmorrow, K. Stanney and L. Reeves. Arlington, VA, Strategic Analysis, Inc.: 174-183.

Study	Sample Size	P-Value	Citations
		to the recognition (“testing”) period (EEG-engagement t=2.59, p<0.05 and EEG-workload t=4.35, p<0.001).	
Mitigating Sleep Deprivation with Omega-3 Fatty Acids	N=30 (Omega/ placebo)	Omega-3 preserves performance, ERP P-300 amplitude, and IL-6 level (ps < .01), and reduce IL-1 and (ps < .01)	Johnson, R., A. Behneman, et al. (2010). Mitigation of sleep deprivation through Omega-3 fatty acids: neurocognitive, inflammatory, EEG and EKG evidence. Society for Neuroscience 2010. San Diego, CA, #297.16