

# BrainTrain Bugle

Brains Matter!

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## Real-Time Artifact Corrected Neurofeedback Works Better!



The principle underlying neurofeedback is that individuals, through frequent and intense brainwave feedback, develop the ability to transform their own brainwaves in order to improve their focus and concentration and activate a mental state that enables them to sustain their attention and avoid becoming distracted. Research studies have identified that many people with attention problems have proportionally greater low frequency brainwaves (i.e., delta or theta) in comparison to high frequency brainwaves (i.e., beta). However, eye blinks, eye movement and facial muscle tension mimic slow brain activity, and facial muscle artifact can artificially elevate fast brainwaves; these artifacts contaminate the EEG signal. The SmartMind 3 system is unique in that it removes EEG artifact “on-the-fly” without interrupting the training, thus potentially providing more accurate feedback. A new double-blind study by Dr. Jeff LaMarca at Seton Hall University compared the effectiveness of the SmartMind 3 artifact-corrected system with the typical non-artifact-corrected training protocol most commonly used.

The results of this double blind study were presented at the 2017 International Society for Neurofeedback and Research (ISNR) conference. The study included 14 subjects who were severely impaired in their attentional functioning but were not currently taking stimulant medications. They were randomly assigned in equal numbers to either the Artifact Corrected (AC) or the Non-Artifact Corrected (NAC) group. The two groups did not differ in respect to their attention problems before beginning training, and the training exercises and procedures used were identical for both groups. The only difference was that one group was trained using AC settings, and the other used NAC settings. Neither trainers nor trainees knew which group they were assigned to. The training was automated, and trainers did not provide any coaching or help other than to make sure that the equipment was operating properly. Training was completed in 12 forty-minute sessions.

The effectiveness of the training was evaluated using the IVA-2 CPT to compare auditory and visual attention for each group pre and post training. Significant changes in both auditory and visual general and sustained attention were found only for the AC group with a very large effect size found for improvements in auditory attention (Hedges’  $g=1.2$ ) and large effect sizes for visual attention (Hedges’  $g=.9$ ). The NAC group did not reflect significant improvement in general auditory attention, but was found to improve significantly in visual attention small effect size, Hedges’  $g=.3$ ). Moreover, after training, the mean attention scores for the AC group were all in the

average range, while, in contrast, the NAC group’s attention scores found them still to be severely impaired for both (auditory and visual attention despite a statistically significant improvement in visual attentional functioning. Changes in the theta-beta ratio after training were also compared for the AC and NAC groups. The AC group’s theta-beta power ratio decreased and the NAC group’s power ratio increased. A statistically significant difference between the two groups was found ( $p < .01$ ) with a very large effect size (Hedges’  $g=1.5$ ).

This study clearly supports that artifact corrected training with SmartMind 3 results in significantly greater improvements in attention than traditional non-artifact corrected neurofeedback. While after training, both the auditory and visual attention scores of the AC group moved from the severely impaired range into the average range, the mean visual and auditory attention scores of the traditional neurofeedback group remained in the severely impaired range. The significant changes in the theta-beta ratio for the SmartMind 3 group also reflect the effectiveness of AC neurofeedback in changing the brain’s neuronal network, supporting the clinical efficacy of AC neurofeedback as having “real” effects that are not the result of placebo. The findings of this study would indicate that SmartMind 3’s more accurate feedback may help individuals with ADHD learn to more quickly and effectively develop an alert, attentive and focused mental state.