The Influence of Guided Mindfulness-Meditation on Attentional Capacities

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ABSTRACT

Mindfulness-meditation has a history as a practice of cultivation of the mind with a specific focus on the cognitive function of attention. The Attentional Network Theory has provided a basis for the development of an assessment to measure attention as a function of the mind. Through the measuring of reaction times during certain exercises, the three attentional networks: alerting, orienting and executive control can be accurately evaluated in their efficiency. A short-term guided-meditation regimen does not significantly influence the efficiency of the different attentional networks.

INTRODUCTION

Attention can be defined as the mental process of selectively concentrating on a discrete stimuli, or specific pieces of perceived information, while ignoring other perceivable information.

Attention has three components:
- Alerting is the ability to achieve and maintain a state of high sensitivity to sensory information (5)
- Re-Orienting is the ability to select discrete sensory information (5)
- Executive Control is the mechanism involved in resolving conflict within incoming sensory information (5).

Another variable, the default-mode network, is a network of brain areas that support self-referential processing which correlates heavily with the state of mind-wandering (2). Mind-wandering is the absence of focus and the existence of an inefficiency of attention.

Meditation is a practice where an individual uses a technique – such as mindfulness, or focusing the mind on a particular object, thought or activity – to train attention and awareness, and achieve a mentally clear and emotionally calm and stable state. There is evidence to meditation influencing attention as training can improve aspects of attention and it is specifically suggested that an enhanced sustained-attention ability and the variables that are manipulated to allow for this can be linked to long-term meditation practice (1). Regular meditation resulted in less activation of the posterior-cingulate cortex, as well as the superior, middle and medial-temporal gyri and uncus which all constitute the default-mode network (2).
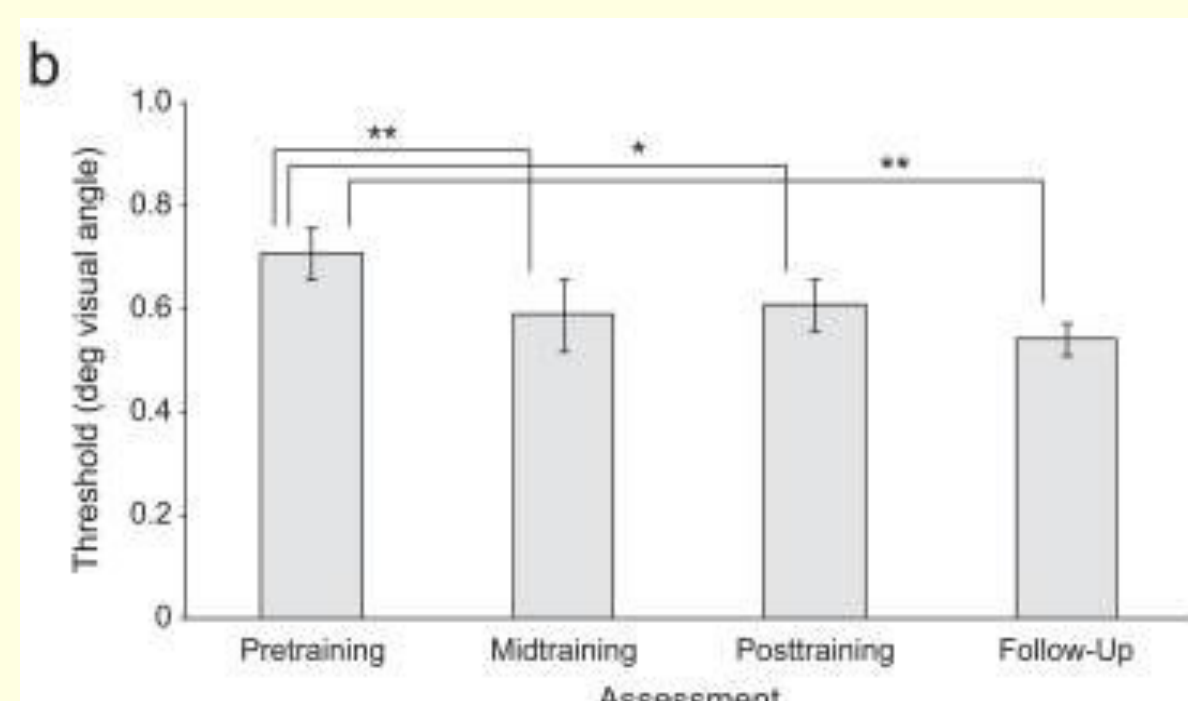

Fig. 1. This is a graph that shows one of the variables that is influenced during meditation that can allow for enhanced sustained attentional capabilities. Threshold is the amount of information that is allowed into processing, and the smaller the threshold, the less distractions and the stronger the focus. Threshold decreases during meditation.

HYPOTHESIS

If High School student participants engage in ten classes of guided Mindfulness-Meditation throughout two weeks, their ability to use the three components of attention will improve significantly.

METHODOLOGY

Materials: Computers administered the Guided Meditation and the Attentional Network Test (ANT) which was downloaded from the internet onto participants computers.

Methods: Participants underwent two-weeks of Mindfulness-Meditation training instruction through pre-recorded guided meditation. There will be ten twenty-minute sessions throughout these two weeks. Participants will consist of High School students of varying classes with approximately equal parts men and women.

Sample Collection: Participants were measured using the Attentional Network Test (ANT) which measures Alerting, Orienting and Executive Control.

During the test, three things happen:
1. A spatial cue is shown (see **Figure 1**)
2. Five arrows are presented at either the Top or the Bottom of the computer screen (see **Figure 2**)
3. Subjects are required to indicate the direction of the central arrow of the five.

Each network is assessed via reaction times (rt). The Alerting component network score is the difference of mean rts with Double Cue conditions and No Cue conditions (see **Figure 2**). The Orienting component score is the difference of mean rts with Spatial Cue conditions and Center Cue conditions (see **Figure 2**). The executive control (conflict) component score is the difference in mean rts with Congruent conditions from Incongruent conditions (see **Figure 2**).
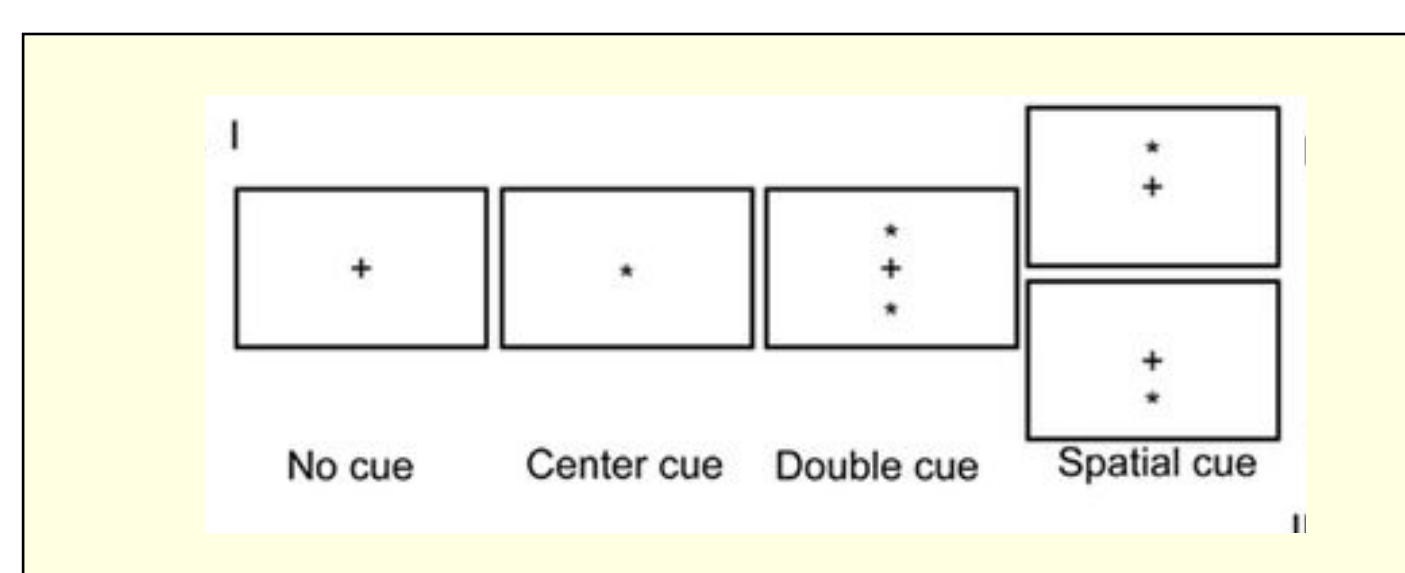

Fig. 2. These are all of the different types of cues that appear in the (ANT) before the set of arrows is presented.
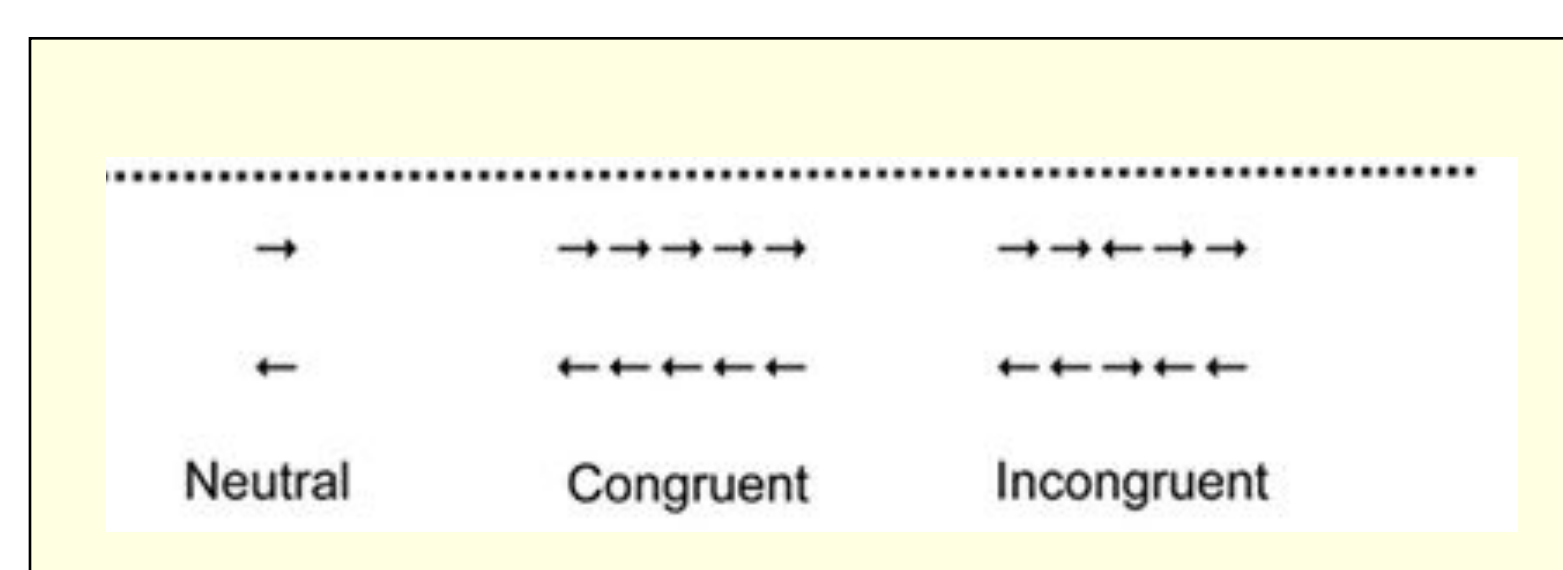

Fig. 3. These are all different arrow-sets that appear in the (ANT) after the cues are presented.

RESULTS

The sample set indicated that there were no statistically significant differences in results after participation in the meditation regimen (experimental group) in contrast with their initial results prior to the regimen.
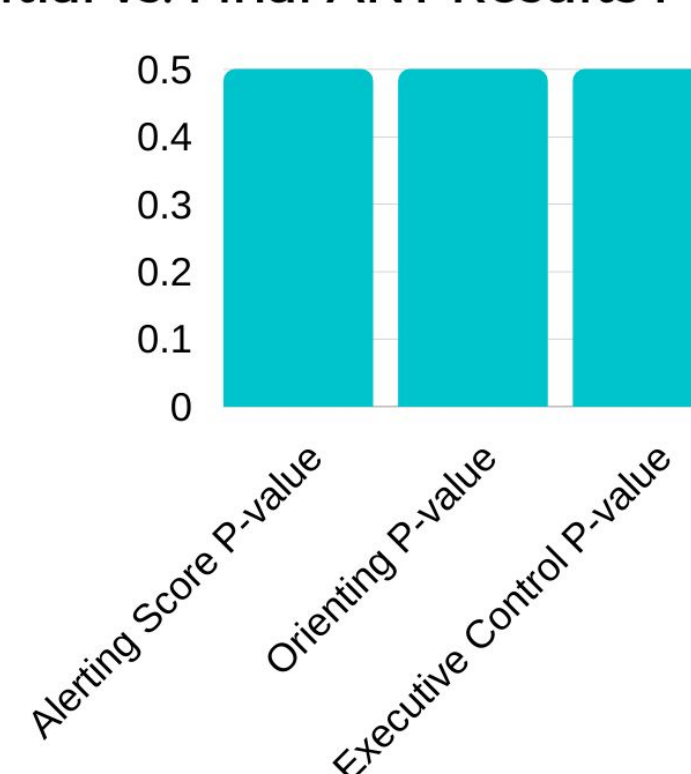

Fig. 4. According to a Matching-Pairs test, the p-values for all attentional network components were too large to reject the null hypothesis. In Psychological Studies 0.05 is the generally accepted P-value for Statistical Significance.

DISCUSSION

Individual results between participants showed high variance and no significant differences between experimental and control groups. Among these four samples there were no consistent results indicating any significant influence.
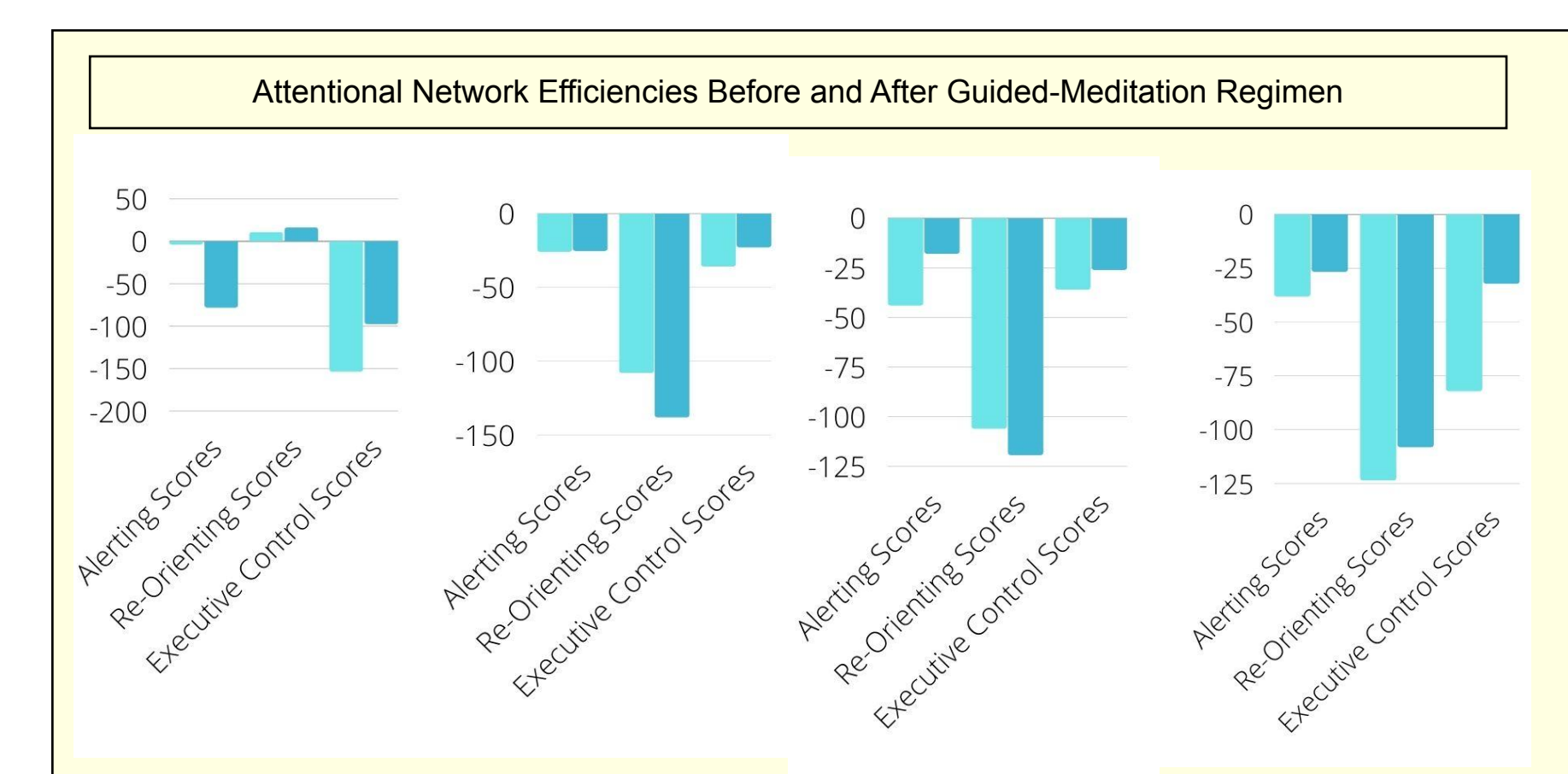

Fig. 5. Attentional Network Efficiency Scores are read in the way that the smaller the number of the score the more efficient the network appears. (5) There was a large variance between results and no consistent difference between before and after the meditation regimen in any one attentional network component. (5)

These results can still be viewed as incomplete, considering the limits of the study. The sample size with which the study was conducted was limited both due to COVID-19 restriction and difficulty finding available participants willing to go through the regimen.

CONCLUSIONS

There was no statistical significance towards the hypothesis that a short-term mindfulness-meditation influences network efficiencies in a manner where scores improve.

FUTURE WORK

In the future, lengthened periods of meditation-training (more than two weeks) could be used to improve statistical significance of improving scores. Larger sample-sizes certainly could be applied to avoid any other variables interfering from the sample used in the study.

LITERATURE CITED

(1) Maclean, K. A., Ferrer, E., Aichele, S. R., Bridwell, D. A., Zanesco, A. P., Jacobs, T. L., . . . Saron, C. D. (2010). Intensive Meditation Training Improves Perceptual Discrimination and Sustained Attention. Psychological Science, 21(6), 829-839. doi:10.1177/0956797610371339

(2) Brewer, J. A., Worhunsky, P. D., Gray, J. R., Tang, Y., Weber, J., & Kober, H. (2011). Meditation experience is associated with differences in default mode network activity and connectivity. Proceedings of the National Academy of Sciences, 108(50), 20254-20259. doi:10.1073/pnas.1112029108

(3) Mrazek, M. D., Franklin, M. S., Phillips, D. T., Baird, B., & Schooler, J. W. (2013). Mindfulness Training Improves Working Memory Capacity and GRE Performance While Reducing Mind Wandering. Psychological Science, 24(5), 776–781. doi: 10.1177/0956797612459659

(4) Tang, Y. Y. (2014). Short-Term Meditation Intervention Improves Self-Regulation and Academic Performance. Journal of Child and Adolescent Behaviour, 02(04). doi: 10.4172/2375-4494.1000154

(5) J. Fan, B. D. McCandliss, T. Sommer, A. Raz and M. I. Posner, "Testing the Efficiency and Independence of Attentional Networks," in Journal of Cognitive Neuroscience, vol. 14, no. 3, pp. 340-347, 1 April 2002, doi: 10.1162/089892902317361886.

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