

The Effect of a Moderate Difficulty Guided Mindfulness-Meditation Regimen on the Attentional Network Efficiencies of High School Students

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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. Repeated practices of guided-meditation may influence the efficiency of the different attentional networks, which can be measured using the Attentional Network Test (ANT).

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 component networks. The Alerting Network is the ability to achieve and maintain a state of high sensitivity to sensory information (5); the amount of time a human can sustain this is known as attention-span. The Orienting Network is the selection of sensory

information (5). The Executive Control Network 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).

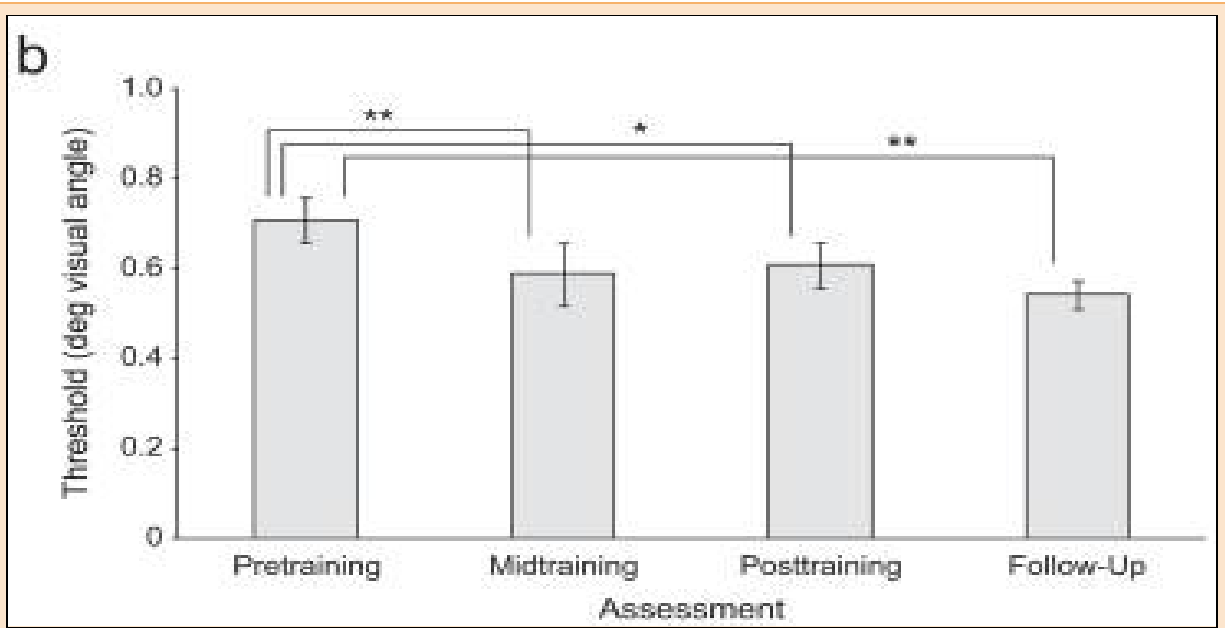


Fig. 1. This is a graph (1) that shows one of the variables that is influenced during meditation that can allow for enhanced sustained attentional capabilities. Threshold is the amount of information that is allowed into processing, and the smaller the threshold, the less distractions and the stronger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

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

METHODOLOGY

Computers will administer the Guided Meditation and the Attentional Network Test (ANT) which can be downloaded from the internet onto individual's computers. Participants will undergo two-weeks of Mindfulness-Meditation training instruction through pre-recorded guided

meditation. Participants will be administered an attention measuring test to determine initial attentional efficiencies via the ANT. Testing will take approximately a half-hour and will be taken on an online program to be completed on a personal computer. After initial testing, with two-weeks towards completion (weekends will not be a part of the study) participants will practice guided-meditation using the meditation application, Declutter the Mind. After school participants must clear an hour to themselves in a space where there will not be significant distractions (noise and otherwise). Participants will select the 20 minute "Mindfulness for Focus" session in the Productivity Course on Declutter the Mind and practice for the allotted time (20 minutes). This MUST be done once EVERY DAY for the entire two weeks of the study. The following Friday will have participants retested to measure for any statistically significant results. Participants will consist of High School students of varying classes with approximately equal parts men and women. Participants will be 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. The Alerting component network contrasts performance with and without cues. The Orienting component contrasts performance on the task with or without a reliable spatial cue. The executive control (conflict) component is measured by assessing interference from distractors or incongruent surrounding arrows; see Figure 2). 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). 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.

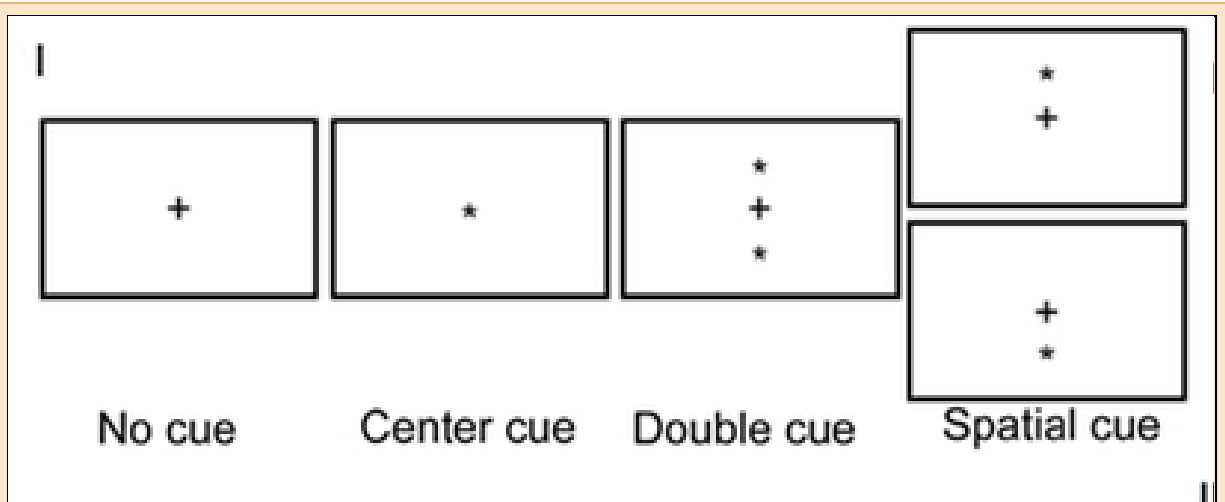


Fig. 2. These are all of the different types of cues (5) that will appear in the (ANT) before the set of arrows is presented. Before any cue is shown, a plus sign remains in the center of the screen (no cue). A center cue or a double cue is a neutral cue, the same as no cue being presented, and the reaction time when this occurs measures alerting network capacity. Spatial cues where the asterisk appears on either the top or bottom of the screen, indicating where the arrows may appear, may either be accurate or inaccurate. This means that the set of arrows will appear where the asterisk indicates (or not) which influences reaction time and that is measured to determine orienting.

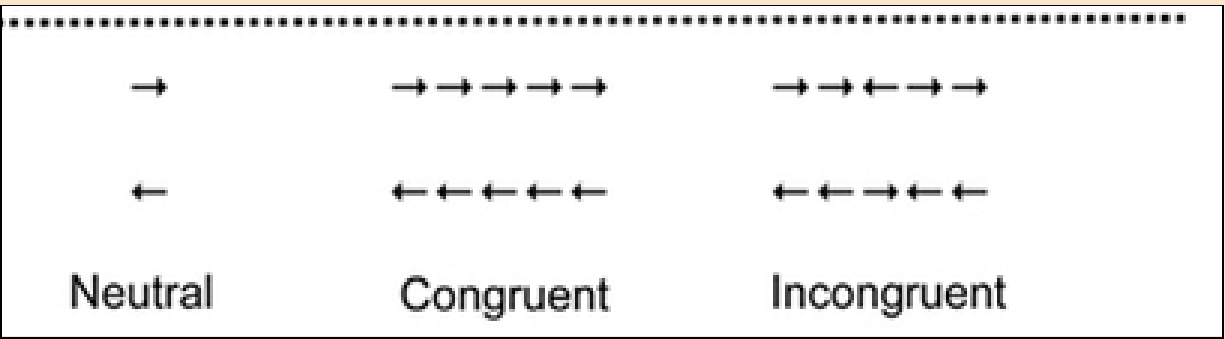


Fig. 3. These are all different sets of cues (5) that might appear in the (ANT). The first set of arrows (rather just one arrow) and the second set of arrows (all arrows going the same way) are meant to be neutral and appear in order to provide how fast reaction time is without distractors. Then the last set of arrows is with distractors, (the pair of arrows on either side of the middle arrow) which influences reaction time which is measured in order to determine executive control scores.

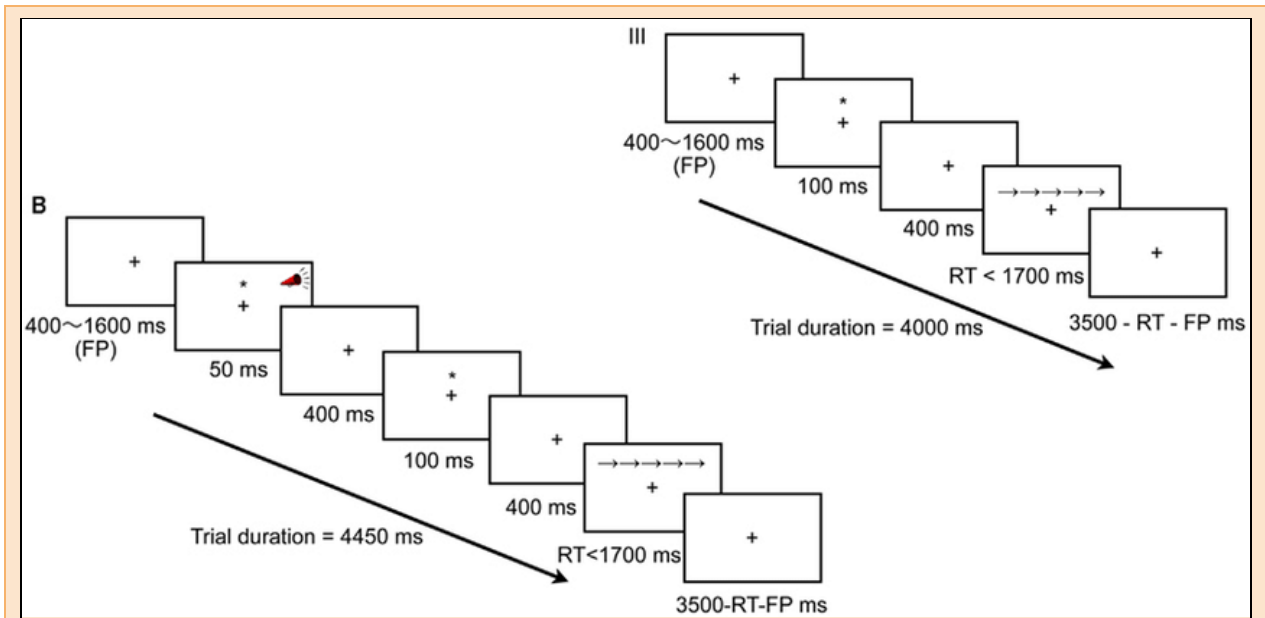


Fig. 4. This is a sequence of slides (5) in chronological order with time stamps for how long slides are shown in milliseconds.

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.

Initial vs. Final ANT Results P-values

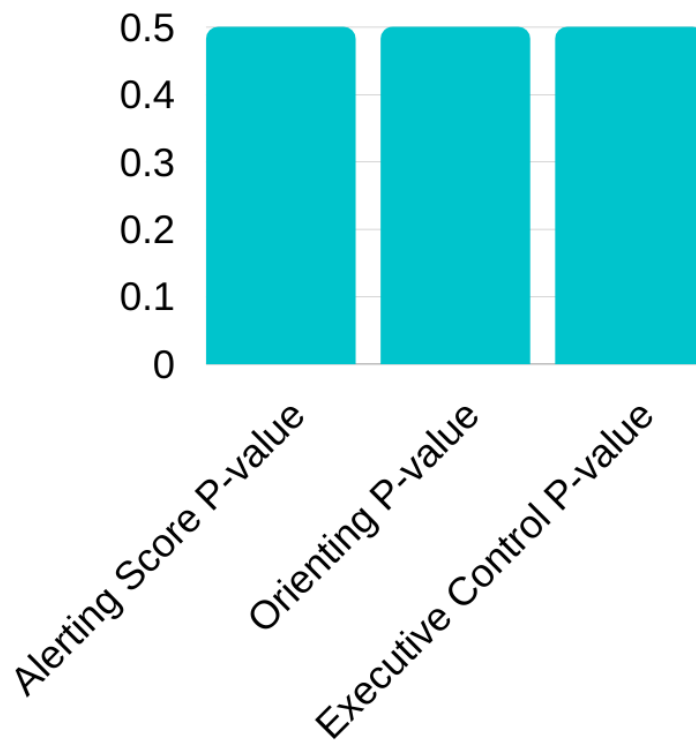


Fig. 5. According to a Matching-Pairs test, the p-values for all attentional network components were too large to reject the null hypothesis. In Psychological Studies 0.05 is the generally accepted P-value for Statistical Significance.

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.

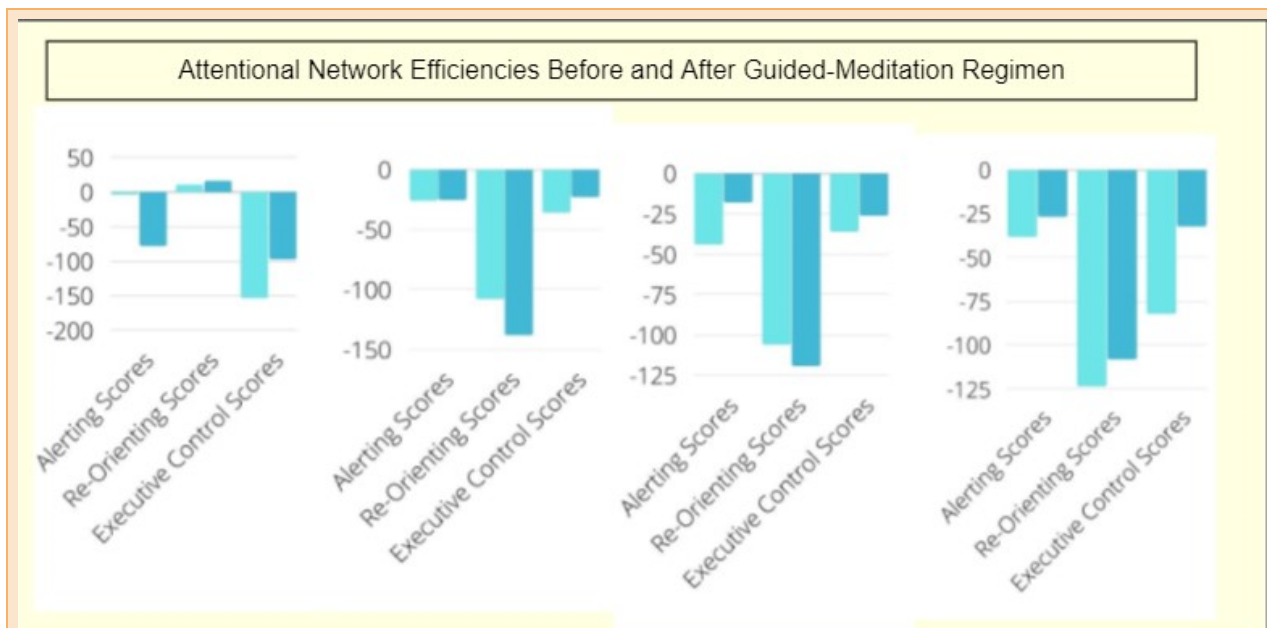


Fig. 5. Attentional Network Efficiency Scores are read in the way that the smaller the number of the score the more efficient the network appears. (5) There was a large variance between results and no consistent difference between before and after the meditation regimen in any one attentional network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

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