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The Effect of Optimism on Determining Alpha Wave State

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Honor's Thesis: The Effect of Optimism on Determining Alpha Wave State

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Introduction:

In many scientific studies, it has been shown that participants can learn to recognize different brain states through the use of neurofeedback training, a form of biofeedback (Lubar, 1997). One state that individuals can learn to control and recognize is a high Alpha wave state, characterized by being in a state of wakeful relaxation, similar to a meditative state. In fact, studies have shown that people who practice mediation consistently achieve high levels of Alpha activity, their Alpha wave amplitude increasing as they enter into a meditative state compared to control groups (Banquet, 1973).

The fact that mediation and a high Alpha wave state have been scientifically shown to inhibit detrimental activation of the neurological stress axis lead some to believe Alpha wave biofeedback training can be used as a form of stress relief or as a possible treatment for depression or anxiety (Raymond, Varney, Parkinson, & Gruzelier, 2005).

In conjunction with this, individuals who are considered to have an 'optimistic' personality tend to show reduced amounts of stress in their day to day lives (e.g., Armata & Baldwin, 2008). Dispositional optimism refers to the tendency to expect a good outcome in most situations (Scheier & Carver, 1985). Optimism is associated with positive health outcomes, such as faster recovery from surgery, increased longevity, and enhanced immune system functioning (e.g., Taylor, 2009). With similar effects on the reduction of stress shown between increasing Alpha wave activity and optimistic personality type, this paper examines the following research question: Does optimism enhance your ability to differentiate between different brain states such as high vs. low alpha states?

Methods

Participants

  Participants were chosen through volunteers found within the experimenters' contacts as well as the Psychology Department at the university. Nine participants in total were tested, five men and four women, whose ages ranged from 21 years to about 27 due to most of them being undergraduate students at the university. They were offered either the benefits of money or extra credit for a class for completing the sessions. This study was approved by the university institutional review board.

Materials

  The Life Orientation Test (LOT) survey designed by Scheier and Carver (1985) was used to measure levels of optimism. The LOT survey consisted of 12 questions which the participant could answer with a numerical value that ranged from 4 (strongly agree) to 0 (strongly disagree). The majority of the questions were then used to rate the participant's general level of optimism by adding or subtracting the values that they gave on certain questions (as outlined in assessing a LOT survey). Higher scores indicate higher levels of optimism.

  The program and procedures used in the biofeedback assessment of Alpha wave state were based on the Introspect program created by Dr. John Frederick. The biofeedback program is called Brain Master, and it is designed to register a tone when individuals are high or low in alpha. EEG was measured with electrodes furnished from Thought Technologies (Canada).

<u>Procedures</u>

For the experiment, nine participants were run through a biofeedback training program in which they had to assess their level of Alpha wave activity at random intervals. Participants were asked to come in to perform 10 sessions in total (two had to be limited to five trials total due to time constraints of the study), with three trials in each session, where the subject had to self determine whether they were in a state of 'high' Alpha wave activity, or 'low' Alpha wave activity when prompted by a computer program that worked in conjunction with EEG readings of the individual's brain activity at the alternating sites PZ and F3. A tone issued by the computer gave the participant feedback whether their assessment was correct or not, and participants were encouraged to try and identify their state correctly and learn to recognize what a 'high' Alpha wave state felt like. In addition, all participants completed the LOT during sessions 1, 5, and 10.

Participants were brought in two or three times a week, were prepped by placing leads at either the site PZ or F3 for EEG recording, were told to relax in order to determine their baseline Alpha wave reading, and then were put through the course of three different trials that varied the bandwidth based on the baseline reading measurement obtained (either 1, 3, or 5 difference around the baseline). Participants responded when prompted by simply pressing into a keypad whether they thought they were in a 'high' alpha wave state or a 'low' alpha wave state (pressing 4 if they thought they were in a low state or 6 if they thought they were in a high state).

It is of note to mention that through the course of the experiment, Dr. Frederick updated the introspect program to better facilitate learning and biofeedback. Some of these changes included increasing the number of prompts per trial and decreasing or increasing the duration between prompts in the trial. The results presented in this paper serve to try and average the changing trials to keep each participant's scores similar.

Results:

The data collected in this report and presented shows what was recorded for the different trials. Note that some scores are missing due to a computer error that deleted some of the data towards the end of the experiment.

Participant	1	2	3	4	5	6	7	8	9	10
i041	47.00%	50.67%	49.50%	51.67%	43.33%	52.00%	52.67%			52.67%
i042	46.33%	47.33%	40.67%	43.67%	49.67%	51.00%				53.33%
i043	50.00%	51.67%	45.00%	62.00%	50.00%	48.33%				
i044	56.67%	54.33%	47.33%	55.67%	62.00%	47.00%	54.67%	60.33%		52.67%
i045	51.67%	48.33%	53.00%	57.33%	52.33%					
i046	51.67%	35.50%	49.00%	47.50%	47.67%					
i047	52.67%	36.67%	45.67%		55.00%			56.33%	60.00%	50.67%
i048	45.33%	44.33%	48.62%		46.00%	48.00%	39.33%	59.33%	47.33%	62.00%
i049	57.33%	56.33%			52.67%	50.67%	52.33%	55.00%	51.33%	56.67%

Table 1. Average Correct Responses Data of Participants in the course of 10 Sessions.
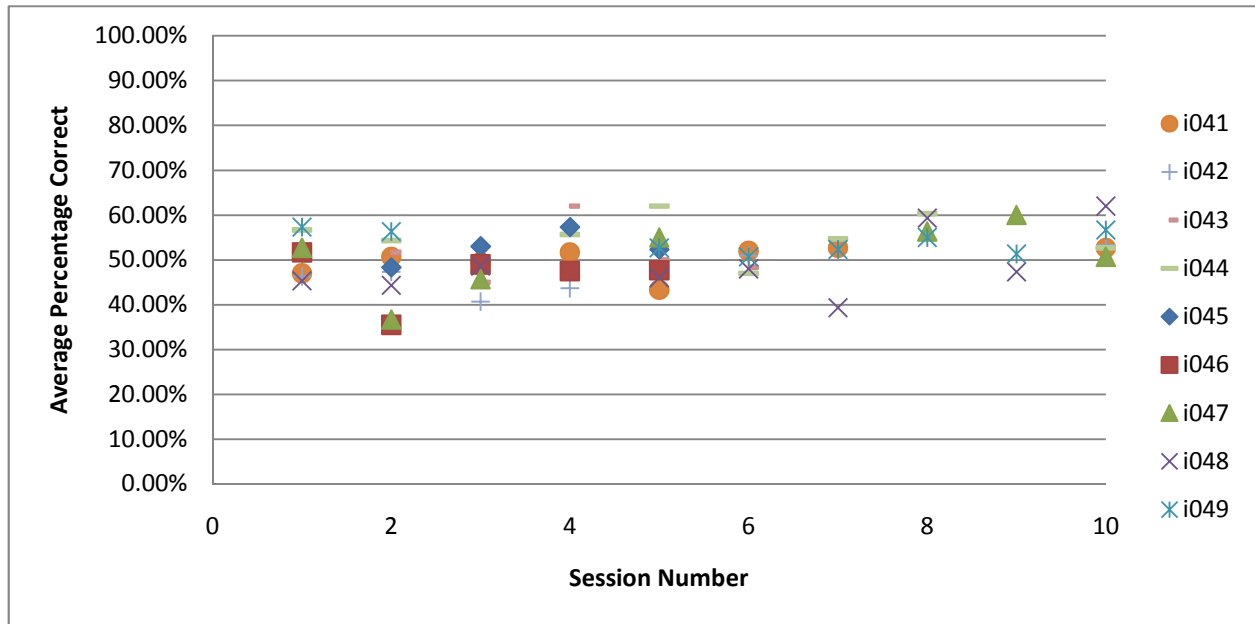
Fig. 1. Average Percent Correct vs. Session Number for Participants i041-i049

Table 1. shows the average percent correct the participants answered with through the course of the ten different sessions (missing data points were either lost due to computer error or missing due to time constraints). To calculate the average percent correct, the participants' percentage of correct responses when prompted to identify their Alpha wave state was averaged among the three trials that each individual session of testing included. Fig. 1. represents this data in a graphical format, with session number along the x-axis while the average percentage correct is the y-axis. The purpose of these two figures is to determine if any learning of Alpha wave state occurred among the participants through the course of the 10 trials.

Participant	Percent right Session 1	LOT Score Session 1	Percent right Session 5	LOT Score Session 5	Percent right Session 10	LOT Score Session 10
i041	50.67%	-3	43.33%	1	52.67%	-7
i042	47.33%	7	49.67%	4	53.33%	4
i043	51.67%	11	50.00%	10		
i044	54.33%	7	62.00%	8	52.67%	7
i045	51.67%	6	52.33%	8		
i046	51.67%	-2	47.67%	1		
i047	52.67%	-5	55.00%	-3	50.67%	2
i048	45.33%	6	46.00%	5	62.00%	4
i049	57.33%	7	52.67%	7	56.67%	7

Table 2. Chart comparing Average Percent Correct responses of each Subject in Sessions 1, 5, and 10 with their corresponding LOT Scores
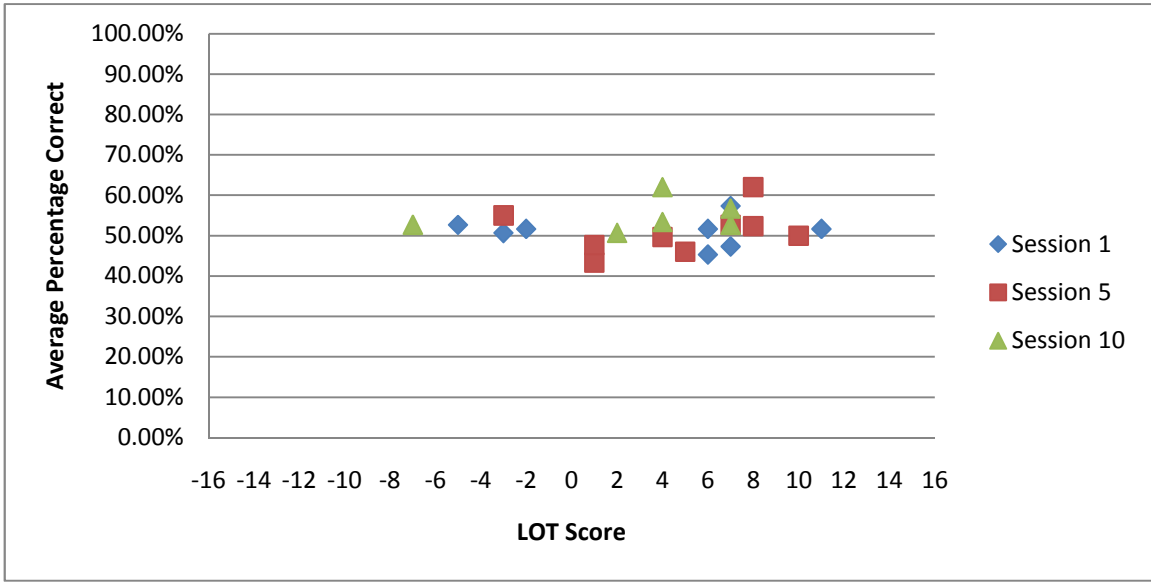

Fig. 2. Average Percentage Correct vs. LOT Score Result for Sessions 1, 5, and 10

Table 2   compares the average percent correct each participant got on sessions 1, 5, and 10

when identifying their Alpha wave state with their calculated LOT value scores, determined by adding up

the values given on the LOT survey. Fig. 2 then shows this data in graphical format, with LOT scores

ranging from 16 (highly optimistic) to -16 (highly pessimistic) as the x-axis and the average percent

correct as the y-axis (the average percent correct was drawn from the scores shown in Fig. 1.). The

purpose of this graph is to see if there is any correlation between overall optimism scores and

performance on identifying Alpha wave state when prompted (expressed in average percent correct of

the three trials in a session).

Conclusions

The results show that towards the latter half of the experiment, no participant scored higher

than 63% correct in the Alpha wave biofeedback trials. Most participants scored about 50% correct on

high alpha states. This calls into question the amount learned within the trials, as in a trial where there

are only two choices (right or wrong) it would be expected by chance to get around a 50% correct

identification rate. However, with this said, some of the participants who ran the full 10 sessions showed

at least a marginal increase in the average amount of correct responses (specifically i041, i042, and i048

in Table 1) and those that decreased through the 10 trials remained around the low to mid 50% range

relatively consistently.

Of course, in looking at the LOT scores versus average percentage correct, it appears there no

correlation between a high percentage of average correct and a high optimism score, as can be seen in

Fig. 2. In fact, some people with lower optimism scores (ones with scores below 0, indicating pessimism)

actually answered more correct averagely than other participants with higher optimism scores

(specifically look at subjects i041 and i047 in Table 2). Furthermore, looking at Table 2, it can be seen

that the average percentage correct scores would go both up and down independent of increasing/decreasing self reports of the level of optimism within the participants for that given session. These results determine that, in the context of the findings of this study at least, that there is no correlation with increasing optimism versus better identification of Alpha wave state and that the two variables appear to have no consistent effect on the other.

Limitations

Of course, these findings could be skewed by a number of facts. First, there was a computer problem which caused the loss of certain points of data. Secondly, the sample size was small. The fact that the test only included a sample size of 9 people, pulled from the University of Tennessee's campus and contacts of the experimenters, makes it harder to generalize the findings in this study to a broad spectrum. Finally, the length of the experiment could have affected the results as well. Due to time constraints of the experiment, later participants (particularly i045 and i046) could not run the full 10 sessions. This led to less time for learning in these participants than the other participants who volunteered earlier. The fact that volunteers were asked to participate leads to the participants' personalities as being similar, evident in the fact that the majority of the participants had a positive LOT score (indicating optimism).

In the end, while this study did not find any correlation between optimism and better capacity to learn and identify Alpha wave state through biofeedback training, this could be due to equipment error and the effect of a small sample size. Performing this experiment again with more funding to increase the sample size and obtain better equipment is strongly suggested, as it might lead to more conclusive evidence between optimism and recognition of Alpha wave state. Meanwhile, the results of this study show that optimism does not necessarily relate to how well an individual can recognize his or her Alpha wave state, and possibly a different variable is the underlying cause.

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