

A TECHNIQUE FOR TRAINING STUDENTS IN AN EDUCATIONAL SETTING TO INCREASE THE PERCENTAGE OF ALPHA WAVES

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In a group of eight subjects some showed a marked increase in the proportion of time for which they could produce Alpha waves, when they received audio feedback of their brain patterns.

The reported study was part of a larger study investigating the effects of Alpha feedback and control as a reinforcer in a Behaviour Modification study in an academic learning situation. A number of researchers—Kamiya (1968, 1969), Hart (1968) Green, Green and Walters (1970), Nowlis and Kamiya (1970), Engstrom, London and Hart (1970), Brown (1970 a, b) and Strayer (1971)—have reported that when subjects are given audio and/or visual feedback signals of their Alpha rhythms, they can decrease and increase the production of Alpha waves. Peper and Mulholland (1971) however found that only four out of twenty-one subjects could increase production.

In the present study, subjects were given audio signals corresponding to Alpha, Beta and Theta waves and asked to maintain the Alpha tone. One of the intentions was to devise a simple procedure for training subjects to increase Alpha wave production, so that with the minimum of trouble, educational and clinical applications would be feasible.

METHOD

Subjects. Subjects were recruited from a Primary Teachers' College. They were from a population of 24 volunteers for a statistics course. Eight second year students, six female, two male, were randomly assigned to the Experimental group, with which this paper is concerned. The Alpha control learning took place at the College during their free time.

Instrumentation. Figure I is a block diagram of the especially developed portable, battery operated equipment. (The Department of Radio Research, University of Auckland developed the equipment for the School of Medicine in Auckland).

The equipment was calibrated against an Elma Shonander, a clinical EEG machine. The unit is a high gain operational amplifier complex using high input impedance scalp electrodes. Glued on to the leather and elastic headband were three silver electrodes of approximately one square inch, to avoid critical placement requirements. They were glued in such a position as to be able to have one electrode,

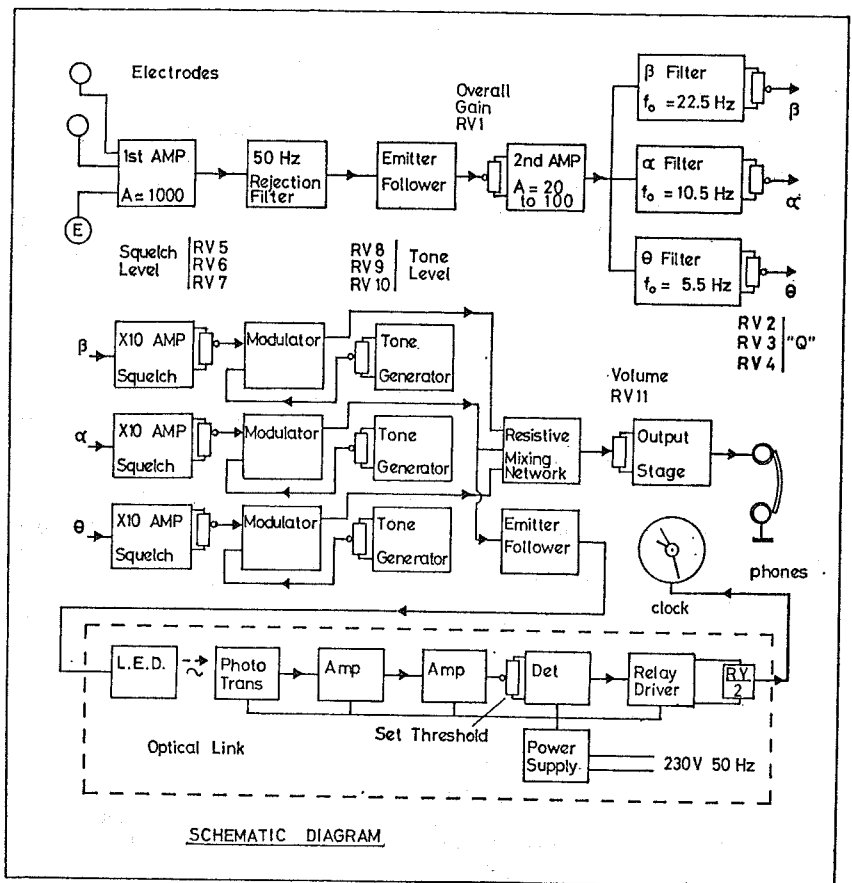


FIG. 1. Schematic diagram of component operations.

for earth, above the left eye, at FpI, one on O_2 and one on Fp2 (10-20 system—Cooper, Osselson and Shaw, 1969). They were positioned on the head with simple finger application of ECG electrode gell. From the headband a three core lead carried signals to the amplifier, which, after selective filtering into Alpha, Beta and Theta tones, returned an audible signal to the subject's headphones. In addition, the signal was passed to a relay with a presetable threshold, in this case 12.5 microvolts peak to peak, within the bandwidth 8-13 hertz, which activated an electric clock with those signals exceeding its threshold. By comparing 'clock time' with elapsed time, an estimate of the proportion of time for which the subject produced the Alpha waves could be obtained.

Procedure: Subjects listened, in a group, to two introductory tapes, nine minutes all told, which described brain patterns, the functioning of the equipment, examples of the different tones, and suggestions for

control—to relax, keep eyes closed and mind blank, whilst using the equipment. They were asked to try and maintain the tone which corresponded to Alpha.

On the second day, after the second tape, subjects were given five minutes with the equipment. Baseline percentages were obtained. On the following two days, each subject had one individual thirty minute session. This consisted of five to seven (mean 6.2) trials with a two minute pause between each trial. Trials were discontinued when each subject appeared to have reached a plateau.

RESULTS

The following graph, Figure 2, shows the percentages of Alpha for each subject. Where subjects had fewer than seven trials, due to plateauing, the last figure for that individual has been continued.

In later parts of the experiment it was found that although the results were inconsistent, even higher individual trial percentages than in the initial Alpha learning session were obtained—see Table 1. Although one of the six subjects was later unable to maintain as much control, a seventh subject's mean percentage was higher, (from 7.07 to 35.26%).

TABLE 1
HIGHEST INDIVIDUAL TRIAL PERCENTAGES

Subject	Highest trial % in initial session over 2 mins.	Highest trial % in later sessions over 2 mins.
V.W.	36.5	92.0
J.T.	35.0	99.0
B.M.	56.8	83.0
J.B.	26.7	50.8
C.M.	86.4	99.0
M.S.	15.0	99.0
P.B.	20.0	9.5
S.K.	99.0	48.3

DISCUSSION

The hypothesis—that subjects can voluntarily increase the production of Alpha waves, given some feedback—was confirmed. The graph of the initial learning session shows that six subjects produced an increase in the percentage of Alpha waves from baseline over the two minute trials.

It was not expected that all subjects would gain control, for as Bandura (1969) suggests, people often display differential susceptibility to autonomic conditioning, which suggests that other variables—possibly genetic, physiological or psychological—are contributing factors. Kamiya (1968) found that eight out of ten subjects could increase

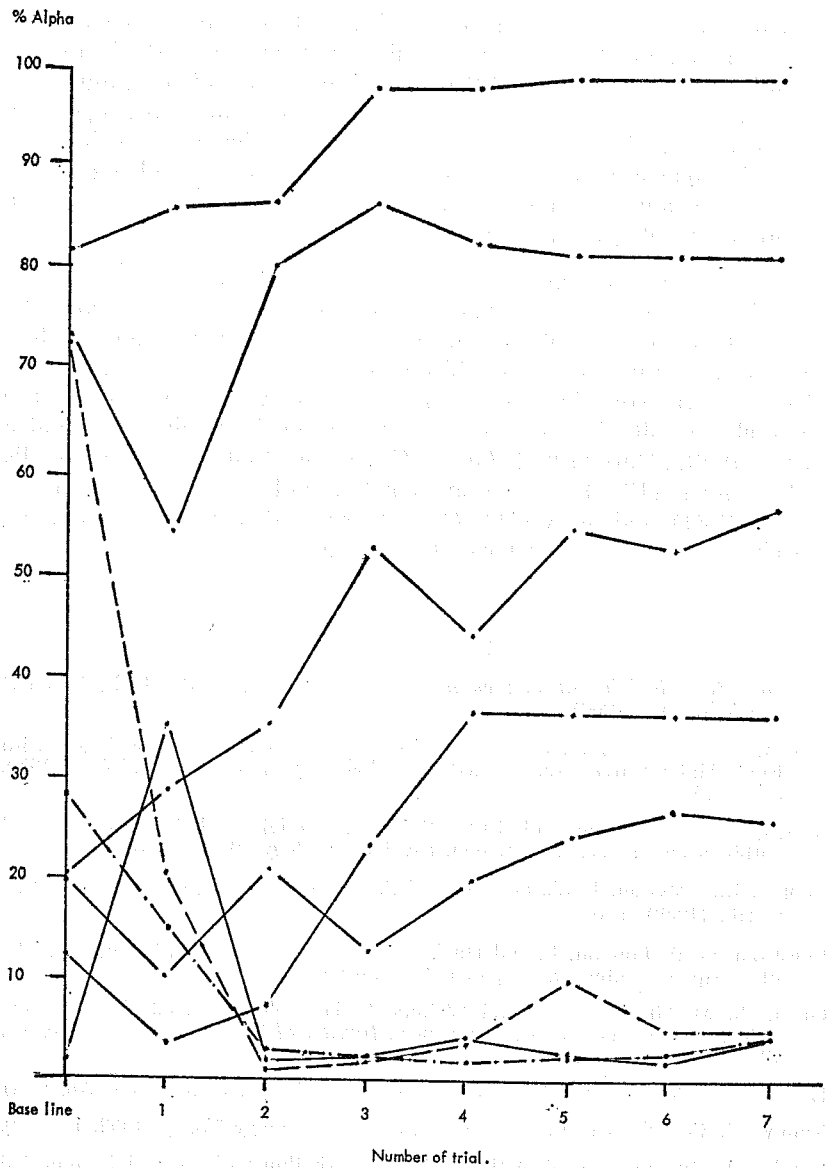


FIG. 2. Individual Alpha learning percentages.

production. Furthermore, Strayer (1971) found that 'right eye movers' (those whose eyes moved to the right when the left cerebral hemisphere was activated) were unable to increase the production of Alpha waves.

The portability of the equipment and the ease of electrode placement meant that feedback could be given easily within a classroom.

Although some studies, such as Kamiya's (1968), have taken up to twenty hours, the time taken for this study was comparable to that taken by Strayer (1971), and Peper and Mulholland (1970), thus making feasible educational and clinical applications. Subjective reports in Brown (1970, b) and by other researchers, indicate that being in a state of Alpha is relaxing and pleasant. There are a number of situations, for example anxious children in a learning situation, where it would be advantageous to relax subjects.

The higher trial percentages found in later parts of the experiment indicate that Alpha control learning continued after both the first trial and the initial learning session, despite Peper and Mulholland's results. Although their subjects too had their eyes closed, Brown's (1970 a, b,) work has indicated that even eyes open can produce favourable results. The present results confirm the findings of Kamiya (1968, 1969), Hart (1968), Green, Green and Walters (1970), Nowlis and Kamiya (1970), Engstrom, London and Hart (1970), Brown (1970, 1971) and Strayer (1971), and show that it is feasible to use portable equipment in an educational setting.

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