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Personality Variables and Alpha Enhancement: A Correlative Study

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Introduction

Investigations into possible relationships between EEG and personality traits began in 1935 (Lemere, 1935), and have continued sporadically (Saul *et al.*, 1937; Gottlober, 1938; Lindsley, 1938; Henry and Knott, 1941). More recently there has been a controversial British exchange (Savage, 1964; Fenton and Scotton, 1967; Broadhurst and Glass, 1969; Young *et al.*, 1971).

Several investigators (Mulholland, 1968; Kamiya, 1969; Nowlis and Kamiya, 1970; Brown, 1970; Travis *et al.*, 1973) have claimed that "control" of alpha (measured as increases in per cent time alpha) can be "learned" through biofeedback techniques. Kamiya (1969) stated his belief that "certain kinds of individuals" are better at "learning" alpha enhancement. This suggested to us the necessity for a structured investigation into such a relationship.

The Eysenck Personality Inventory, which has been used by others to investigate *resting* alpha and personality variables (*op cit*), was chosen to define the independent personality variables of Extraversion and Neuroticism. These were then related to the following dependent measures of alpha: (1) alpha emitted with *eyes-closed* during rest sessions (EC alpha index); (2) alpha generated with *eyes-open* during training (biofeedback) trials (EO alpha index).

Eyes-open alpha was used as a measure in the biofeedback situation because "eyes open" normally leads to alpha attenuation, and enhancement should therefore be more readily detectable. "Eyes-closed" alpha tends to be quite constant for any individual (Davis and Davis, 1936), thus decreasing the possibility of demonstrating enhancement.

Method

Subjects were 45 students and employees (24 male; 21 females), all unpaid volunteers. They were seated in a dimly lit, sound-attenuated room.

Silver-silver-chloride electrodes were applied with collodion soaked strips of gauze: (1) 2 cm. above the inion (O_z); (2) on the right ear or mastoid; (3) at the vertex (C_z); (4) above and below the right eye; (5) on the forehead (ground).

The following leads were recorded, using a Grass Model 78 polygraph: (1) O_z-ear/mastoid (alpha abundance); (2) C_z-ear/mastoid (to detect drowsiness); (3) eye electrodes (to detect eye movement). Impedance was kept below 5 Kilohms. Occipital EEG was recorded by a Model 7P5 amplifier, then filtered for alpha, RC integrated (Grass 7P3) and fed to level detectors which controlled a blue light serving as the feedback signal.

The subjects were instructed to sit quietly with their eyes open until the beginning of the practice sessions. *Criterion alpha* was defined as follows: 0·07 to 0·13 seconds or more of 8–13 Hz. activity which was 50 per cent or more of the amplitude of the maximum eyes-closed alpha observed during an initial calibration period. Subjects received the blue light feedback only when alpha equalled or exceeded this criterion. Subjects were instructed, identically, that the appearance of the blue light indicated the occurrence of alpha and that they should find a method which would keep the light on as much as possible. They received 5 eyes-open training sessions, each 10 minutes in length. After each eyes-open practice session, there was a 2-minute relaxation period with eyes closed.

Forms A and B of the Eysenck Personality Inventory (EPI) (Eysenck and Eysenck, 1963) were used. About half of the males and half of the females each received forms A and B of this test, administered before any experience in alpha enhancement, and later graded by a person not involved in the study. All scores were converted into percentiles.

Data analysis: The mean number of seconds of criterion alpha was recorded for both eyes-open training and eyes-closed rest periods, and scores during training and rest periods of the subjects with the 15 highest and 15 lowest percentile scores on the Extraversion and Neuroticism scales were then compared.

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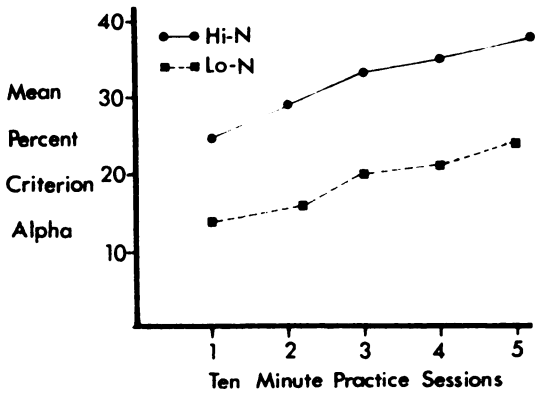
Results

Eyes-closed (resting) alpha

Eyes-closed alpha data for high and low Neuroticism and Extraversion scales yielded no significant differences (type I ANOVA).

Eyes-open criterion alpha

High and low subjects on the Extraversion scale did not differ significantly overall in amount of eyes-open criterion alpha produced during training ($F = 1{\cdot}1519$; d.f. = 1,28; $p < 0{\cdot}1$). However, a significant trials effect was seen ($F = 19{\cdot}8327$; d.f. = 4,112; $p < 0{\cdot}01$). Subjects who had high Neuroticism scores produced significantly more eyes-open alpha during feedback than subjects who scored low on the Neuroticism scale ($F = 7{\cdot}8187$; d.f. = 1,28; $p < 0{\cdot}05$) (Fig. 1). A significant change over trials was found ($F = 15{\cdot}2996$; d.f. = 4,112; $p < 0{\cdot}01$.



Discussion and Summary

In the present study, the amount of eyes-closed alpha produced during rest period did not show significant change over trials, and it can be presumed that this provides a "baseline" measure of alpha abundance. There was no consistent relationship between personality characteristics and amount of spontaneous alpha between trials.

The primary purpose of the present study was to examine relationships between a subject's personality and his ability to modify his occipital alpha abundance by biofeedback techniques. This presents a new approach to the examination of relationships between EEG and personality traits. It was observed that subjects who score high on the Neuroticism scale of the EPI exhibit more eyes-open alpha in the feedback setting than subjects with low scores on those scales. No differences were found relative to the Extraversion scale.

The results suggest the possibility that biofeedback control of alpha abundance may provide a physiological measure of certain personality traits.

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