Explorations in Awareness: Respiration & Relaxation

A Technology For Mind Development And Spiritual Awakening

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"... a fully developed feedback model can do what no behaviorist model has been able to do: It can restore purposes and goals to our concept of human behavior, in a way that does not violate direct experience or scientific methods." William T. Powers (1973)

"What interests us for the design of an anthropological physiology and what has to be investigated explicitly, are the actual functional changes, the altered physiological regulations which occur when the pathically-tuned body is no longer marginally co-present, but becomes a theme of objectifying consciousness." F. J. J. Buytendijk (1974)

We shall now consider some details of these alpha feedback experiences to focus attention on the meanings of physiological and psychological processes which were discovered, and we shall sketch briefly some objective evidence of the relationship of alpha activity to two other physiological systems: **muscle activity (EMG) and respiration**. It is obvious that the extreme sensitivity of feedback enhanced alpha activity to the amount of egoicity in specific thoughts makes it possible to study the structure of thinking processes and thought formation in a new way. Seeking the structure of the thinking aspects of consciousness is an entirely

new area for phenomenological study. Not only will its development enhance the psychology of cognition, but by virtue of the permanent physiological record of the feedback scores, it will also further psychophysiology. A direct subjective and objective understanding is also achieved of the interdependence of multiple physiological systems. The patterning of physiological responses was understood almost effortlessly by noting the interactive effects of changes in muscle tension, breathing activity and alpha activity. A brief formal analysis will serve to increase our confidence in the validity of insights derived from subjective sources during the alpha feedback

McDowall (1950) has suggested that the state of consciousness of an organism is highly dependent upon the amount of oxidation taking place in the brain. This process is facilitated by high concentrations of arterial oxygen so that both the state of consciousness and the brain electrical activity arising from brain cell metabolic processes depend critically upon arterially supplied oxygen. This is not to deny Moruzzi and Magoun's (1949) identification of the brain stem reticular formation's influence on the level of activation and the activity of the EEG, but rather to add that proper functioning of the reticular activating system (RAS) depends on oxygen delivery to the RAS. Kriendler, Poilici, and Marinchuscu (1967) reported that chronic hypoxia of deep central structures, particularly the mesencephalic reticular formation, resulted in a non-alpha EEG record characterized by bilateral delta activity. Soulas and Sternberg (1967) reported that children hospitalized for respiratory disturbances and suffering from hypoxia, which is characterized by abnormal brain electrical activity, has been successfully treated my Flügel (1967) with vaso-active agents which improve blood and thus oxygen supply. This treatment brought increased continuity and definition of the alpha rhythm to hypoxic patients [as well as improvements in intellectual function and psychic drive], which benefits lasted as long as the vasoactive drugs were dilating the blood vessels. However

increasing the blood supply will be effective only if the blood is sufficiently oxygenated. **The breathing process is therefore very important.**

Deep breathing is usually slow breathing and fast breathing is usually shallow. Best and Taylor (1945) have shown that arterial oxygen saturation is higher during slow, deep breathing than during shallow rapid breathing, even though a larger minute-volume is inspired during shallow, rapid breathing. **Slow breathing is important for other reasons. Grim (1971) found that a slowing of breathing decreased muscle tension toward relaxation levels.** This finding has important implications for levels of alpha activity because of Malmo's (1959) report that alpha activity is related to activation level through an inverted "U" shaped function. **Since slower breathing decreased muscle tension, it could also enhance alpha activity by mediating activation level through relaxation of muscles.** We should consider some possible means of this mediation.

Van Slyke (1934) has shown that the pH of the blood fluctuated with the respiratory phase, and Friedell (1948) indicates that the breathing rate can influence these pH fluctuations. Friedell finds that blood acidity, which increases during inhalation, increases more during slow (deep) breathing than it does during rapid (shallow) breathing. The higher blood acidity of longer inhalations is viewed by Friedell as inhibiting the action of cholinesterase, which destroys acetylcholine. In addition to retarding the destruction of acetylcholine, Friedell indicated that a longer inhalation period affords more acetylcholine production by the nerve endings of the parasympathetic system. Acetylcholine is seen to be a smooth muscle relaxant. Since **the effect of muscle relaxation is to increase alpha activity, we have another mechanism whereby the rate and depth of breathing can influence the brain's electrical activity and the state of consciousness.** Slow breathing brings increased acetylcholine

production as well as periodic elevations of blood acidity levels which inhibit cholinesterase, both of which effects lead to relaxation of smooth muscles and presumably an increase in the abundance of alpha activity.

Localized muscle tensions can also play a role in determining alpha activity. Malmo indicated that local muscle tensions could increase an individual's general activation level with subsequent elevation of heart rate and blood pressure and a decrease of EEG alpha activity. Other muscle activities, such as the deep tendon reflexes, are also related to alpha activity. Kennard and Willner (1945) found that six different tendon reflexes, including the knee jerk, were related to alpha activity through ease of elicitation. **If the deep muscles were relaxed and the reflexes hard to elicit, the human subjects showed much alpha activity and only little beta activity.** On the other hand, with tensed muscles, and therefore easily elicited reflexes, there was very little alpha activity but considerable beta activity. Kennard and Willner even reported that the low alpha subjects appeared to be "tense." Relaxation training has been shown to be capable of reducing deep tendon reflexes like the knee jerk (Jacobsen, 1938) and given the findings of Malmo and of Kennard and Willner it would seem that **relaxation training could help increase alpha abundance**. On the other hand **relaxation training was shown by Johnson and Spielberger (1968) to significantly decrease anxiety** as measured by the Multiple Affect Adjective Check List (MAACL), and Stennet (1957) indicated that subjects having little alpha activity were generally "anxious," though he did not test for anxiety. Grim (1969) has pointed out that the assumption that muscle tension will increase anxiety and that relaxation will decrease it is the basis of desensitization therapy and somatic approaches to psychotherapy in general. Since relaxation and alpha activity are positively related, the logical inference is that alpha and anxiety (or fear) are negatively related. Costa, Cox, and Katzman (1965) found this to be the case in a study of the EEG and the Minnesota Multiphasic

Personality Inventory (MMPI). Alpha amplitude was significantly and negatively correlated with the Welsh *A* anxiety scale, which is the first factor of the MMPI's clinical scales. And Hardt (1974, 1976, 1977, 1978) has shown that high Welsh *A* males do more poorly at learning both alpha enhancement and suppression that do low Welsh *A* males.

Coming full circle back to respiration, which was seen capable of influencing muscle tension, we note that Grim (1971) found breathing rate to be positively correlated with MAACL anxiety. This correlation helps explain Pitt's (1969) report that anxiety neurotics increased their breathing rates more than normals in response to pressor stress and actually utilized inspired oxygen less efficiently than normals. Grim has suggested that attention to breathing slows its rate, and he employed the breathing feedback technique of Kuble and Margolin (1944) to insure full attention to breathing by his subjects. This technique involved the presentation of amplified breath sounds to the ears by a system involving a microphone, amplifier, and earphones. And Grim found that feedback of breath sounds slowed the breathing rate significantly more than a control sound of electronic hum.

This technical excursion has shown that the scientific literature of objective experimentation both validates the experientially derived insights regarding the interrelationship of EEG alpha, EMG, and respiration activity, and also supports the discovery of the effect of fear (anxiety) in suppressing alpha activity. With this kind of cross-validation in hand we are emboldened to postulate an **Ecology of Consciousness** and to consider the special significance of the subjective experience of ego disintegration.