Proceedings of the Iowa Academy of Science

Volume 43 | Annual Issue Article 127

1936

The Adaptation and Variability of Response of the Human Brain

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as a non-reversal. If the first hypothesis here presented were true, and a specific word called up a specific conflict situation, thus leading to a disturbance, the percentage of reversal would approximate zero. Chance would be approximately 50 per cent. The average percentage of reversal found in this study was 43 per cent. This approximates chance much more closely than the value expected if this hypothesis were true.

From these data we conclude that the process of association represents a sample of the amount of mental disturbance rather than a specific conflict situation suggested by a specific stimulus word, and that the subject within the reliability of the technique and regardless of the word list used will show a given number of disturbances per 100 words. Thus the word list may be better thought of as a random sample of a process which is easily disorganized rather than a list containing a given number of words "critical" to a given subject.

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THE ADAPTATION AND VARIABILITY OF RESPONSE OF THE HUMAN BRAIN

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Electrical potentials have been recorded from the brain of five normal human subjects by means of needle electrodes inserted about half a centimeter through the scalp, one near the external occipital protuberance and another about three inches forward and an inch to the side from the median line. The high time-constant of the amplifier, which was about a second, made it possible to obtain an almost distortionless recording of the low frequency waves. The amplifier was connected to the oscillograph element. The oscillation of the light beam projected from the element was photographed on sensitized paper.

The subjects lay on a cot in a dark, semi-sound-proof room, about three feet from a loud speaker into which sound stimuli from two oscillators and a phonograph record were presented from the outside of the room. A microphone placed within a foot of the loud speaker activated the signal. The subjects were instructed

to remain neutral, that is, not to attempt to hold either any reactive or negative mental set toward certain sound stimuli which they were told would be presented to them.

The brain rhythm had the most common frequency of about ten per second and an amplitude value ranging from 6 to 63 microvolts. Following the stimulus there was a latent period and then usually a 25 per cent to 70 per cent depression of the brain waves. The adaptation time was the time within which the brain waves regained a part or the whole of their amplitude value after such depression by the sound stimuli.

Preliminary results show that a 500 cycle tone presented continuously gave an adaptation time of less than a second, whereas the same tone repeated every second delayed adaptation from 2 to 8 seconds. In general, an indifferent word like "How" presented every second produced a longer adaptation time than a 500 cycle tone under the same circumstances. Complete adaptation to discrete words each given at an interval of a second may take more than fifteen seconds, within which there may be periods of partial adaptation.

Facilitation in the sense of rise of amplitude from 39 per cent to 158 per cent over the control period was observed in some instances at the occurrence of adaptation or later, and at the beginning or cessation of stimuli.

The brain rhythm which undergoes spontaneous changes in amplitude and frequency was not always depressed under the following circumstances; a ten decibel rise or drop of a continuous or interrupted tone; a change to a lower pitch (from 1000 cycle to 500 cycle); and some stimulus words and tones given at certain intervals. Occasional ineffectiveness of sound stimuli had already been noticed by Berger, Adrian and Travis.

While we have not isolated the effect of sound stimulus upon the brain rhythm from the effect of sudden shifts of attention caused by it or caused endogenously, which may explain some of the above variabilities, we can interpret the occurrence of adaptation as a certain readjustment of the dynamic functioning of the brain following an effective stimulus attack. This *neuro*-physiological happening is what probably underlies our common psychological experience of "getting used to" sound stimuli.

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