Technical Papers

Theoretical Foundations of Audio-Visual-Tactile Rhythm Induction Therapy Experiments

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An instrument has been assembled in a college electronic laboratory (*1*) that is designed to emit audible clicks in rhythmic acoustic patterns, light flickers that are variable in speed and intensity and are adapted with a color selector, and tap hammers that make distinct but painless cutaneous rhythmic contacts. The clicks, light flickers, and taps have rhythmic patterns that are separately variable. The subject controls this variability by manipulating dials. The range of the audio, visual, and tactile impulses vary from 1 impulse/3 sec to the critical frequency at the threshold of incapacity to distinguish pulsation. The latter differs for each of the three types of sensory stimuli.

Three revolving drums are electrically attached to the instrument, making it possible to obtain continuous recordings of the various frequencies selected by the subject for each element.

Experiments to be conducted with this device are of two kinds. The possibility that the instrument may be diagnostic will be explored. The optimum rhythm patterns (most pleasant to listen to, look at, and feel) will be determined for neurotics, various categories of psychotics, psychopathic deviates, and nonpsychotics. A variety of rhythm patterns will be investigated using these populations. Psychogalvanometric and other physiological data will be recorded simultaneously by means of a multichannel polygraph.

The other research will be concerned with a possible psychiatric and somatic therapeutic effect of exposure over a period of time to a variety of rhythms and the achievement of conditioned tolerances to irritating frequencies.

Electroencephalographic responses of psychic states during rhythmic acoustic patterns produced by variations of metronome clicks have already been investigated in experiments at Tohoku, Japan (*2*), and a highly positive relationship was found to exist between subjective and EEG responses to the several experimental situations. Gengerelli (*3*), using remote-control electric stimulation of the cortex of rats, found that variations in rhythms caused characteristically differentiating behavior when strength and direction of charge remained constant.

O'Flanagan, Smith, and Taylor (*4*) used 20 subjects in a photic rhythm stimulation experiment; with the aid of a stroboscope, they were able to obtain powerful reactions of sympathetic neural centers short of full photogenic seizures. Libet and Gerard (*5*) have demonstrated the rhythmical character of neuromuscular activity by using action potential records from an isolated mass of cortical tissue. Freeman (*6*) states that the "rhythmical character of excitability suggests a primordial basis for neuromuscular homeostasis."

These and other studies suggest that neuromuscular activity may be stimulated and behavioral modifications accomplished through rhythmic sensory stimulations. The present theory postulates the therapeutic implications through controlled conditioning by multiple-sensory stimulation. It is predicated on the possibility, as yet unexplored, that the interaction of specific frequencies (to be determined) may leave residuals beneficial to the somatic and psychological integrative processes of an individual.

Music, dancing, and rhythmic manual work have been used therapeutically with varying success. The physiological rhythm responses to tissue impairment, the dysrhythmia of the neural electric field that characterizes cortical damage, and the diastolic, systolic, respiratory, and circulatory rhythms are seen as having integrative neuromuscular counterparts of a Gestalt nature apart from organ function and neural reinforcement of the learning theory. Rhythm induction therapy would modify this configurational field by exposing the patient over a period of time to the interplay of specific series of audio, visual, and tactile frequencies. It has already been demonstrated by Gengerelli (*7*) that variations of rhythm patterns stimulate differential behavior in mice and that these rhythms can be emitted and regulated by remote control. The research of Miller *et al.* (*8*) indicates the compelling nature of subliminal clues in behavioral modfications.

The hypothesis that behavioral and personality changes may be accomplished subliminally by electronic, remote-control methods is a valid one. The two recent articles by Faukhauser (*9*) give the theory of emotional alterations of masses of population by subliminal, rhythmic remote-control techniques added plausibility. This is particularly interesting inasmuch as the instrument described here has already demonstrated its capacity for stimulating, in a relatively short time, a hypnotic-type stupor in several experimentally tested subjects.

A paranoid schizophrenic patient was asked to describe his feelings while being subjected to the rhythm pattern he had selected. He stated: "I can find a definite rhythm here that does not seem to be disturbing to thought continuity. I find myself thinking of driving across a level terrain watching a beacon of light. Also it suggests flying the beam by radio control. I find no hostility in this rhythm." He asked for a piece of paper, saying, "I just want to chart the thing to see whether the content is the same." Three other patients reacted to the number of selected rhythms by showing considerably greater likes and dislikes of certain frequencies than a group of five nonpatients. Two

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obsessive-compulsives showed characteristic behavior in spending a considerably longer time in the selection of "pleasing" rhythms than members of other groups. These experiments were not intended to demonstrate that this method is capable of discriminating between clinical groups. However, the indications are that further research is justified on the basis of the interesting responses to audio-visual-tactile stimulation.

References and Notes

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Ionic Permeability and Osmotic Swelling of Cells

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Many mammalian tissues when studied under unnatural conditions outside the body have been observed to swell in salt solutions isosmotic with blood and tissue fluids. One suggested explanation of this behavior is that the contents of the cells of these tissues *in vivo* are hypertonic to the surrounding media and the water that tends to enter them by osmosis is normally removed by a process of active water secretion (*1*). When this process fails because of anaerobic conditions, the action of metabolic poisons, or low temperature, the cell swells.

Little is definitely known at present about mechanisms, other than contractile vacuoles, for primary active transport of water, but much information has recently been gained concerning processes of active ionic transport in a great variety of cells. Such processes are known to be frequently accompanied by passive osmotic movement of water—for example, the movement of water associated with secretion of NaCl by a frog's skin (*2*).

The influence of colloid osmotic pressure on the movements of ions and water is well accepted in the case of capillary walls, but it is not generally recognized in the case of most tissue cells. A known instance in which this is involved is the type of hemolysis that Wilbrandt (*3*) calls "colloid-osmotic." Jacobs and Stewart (*4*) have discussed in some detail

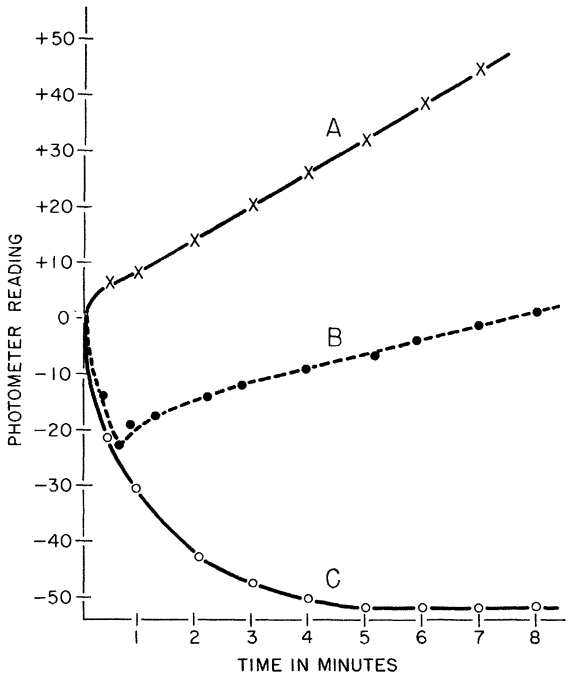

Fig. 1. Volume changes of butyl alcohol-treated beef lymphocytes in various isosmotic solutions. Beef lymphocytes were placed in a mixture of 1 part 0.3*M* sucrose and 5 parts 0.15*M* NaCl (*p*H adjusted to 7.4 with phosphate buffer) containing 5 vol percent n-butyl alcohol. After exposure for 5 min, the cells were diluted five fold with the same sucrose-NaCl mixture without butyl alcohol. One milliliter of the treated cell suspension was added to 10 ml of the following solutions: (A) 0.15*M* NaCl; (B) 1 part 0.3*M* sucrose and 5 parts 0.15*M* NaCl; at zero time 3 drops of saturated NaCl solution was added; (C) 0.3*M* sucrose. Similar results were obtained with polymorphonuclear leucocytes from rabbits.

the osmotic consequences of a variety of types of ionic and molecular permeability, including the abnormally high cation permeability of the erythrocyte that gives rise to hemolysis by swelling. A very convenient agent for producing different easily controlled degrees of cation permeability and of swelling in salt solution is n-butyl alcohol (*5, 6*).

The erythrocyte is a highly specialized cell whose behavior may or may not throw light on the mechanism of volume changes in typical mammalian tissue cells. Experiments were, therefore, made with leucocytes, whose general properties are more closely related to other animal cells. Polymorphonuclear leucocytes were prepared from rabbits by lavage of the peritoneal cavity with saline. A mixture of lymphocytes, monocytes, macrophages, and erythrocytes was also prepared from spleen by mincing the tissue suspended in isosmotic NH_4Cl. Erythrocytes were hemolyzed in this solution, leaving intact the leucocytes, which were then centrifuged and resuspended in buffered saline. Volume changes of these cells were measured by changes in optical density in a sensitive photometer.