

MEASURING JOY AND SORROW.

THE PSYCHO GALVANIC REFLEX AS A DETECTOR OF EMOTION.

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THE psychogalvanic reflex is a peculiar physical manifestation of mental processes, in the form of a change in the electrical properties of the skin. This change occurs whenever the subject feels an emotion and it can be detected and measured with a sensitive galvanometer.

The point of a needle, connected with one pole of a sal-ammoniac battery, is thrust through the skin of the palm of the hand, in a normal person, and, after the smart of the wound has passed, a steel plate, connected with the other pole of the battery, is laid on the skin, near the needle. An electric current now flows through the skin between the needle and the plate. The strength of this current is indicated by a sensitive galvanometer composed of two fixed coils and a suspended coil, which takes the place of a magnet and carries a mirror. If the subject remains at rest and undisturbed by emotion, the galvanometer reading is found to decrease, at first rapidly and then more slowly, indicating a corresponding increase in the resistance of the skin, but any stimulus which produces an emotion also produces a temporary decrease in the resistance of the skin, which is indicated by an increased deflection of the galvanometer.

If the galvanic cell is removed from the circuit the galvanometer again shows a deflection, varying within wide limits, when an emotional stimulus is applied. This effect is due, not to a change in resistance, but to the variation caused by emotion in the electromotive force resident in the skin. These experiments, especially the first one, can be greatly simplified. The skin need not be pierced. It is sufficient to immerse the hands of the subject in two vessels of lukewarm brine connected with the battery and galvanometer, or to press the palms of the hands or the soles of the feet on plates of metal, similarly connected.

In all cases the deflection gradually diminishes during perfect mental calm, and is suddenly increased by emotion. The stimulus may be a flash of light, a sharp whistle, a prick with a needle, or a word, spoken or written. In order to affect the galvanometer, the stimulus must produce an emotion or feeling of some kind. For example, the steady decrease of the deflection is not interrupted by reading uninteresting matter, but a word that awakens interest always increases the deflection. In order to study the action of verbal stimuli I have adopted the method of calling out a series of disconnected words, including a word or two of especial interest to the person under examination. For example, I examined an architect whose plan for a house had been severely criticised by a builder. I read aloud a list of indifferent words, such as tree, sing, yellow, mountain, book, etc., introducing the builder's name and a contemptuous expression which he had used. In these two instances deflections of 24 and 33 scale divisions were produced while none of the other words affected the galvanometer at all. In examining a student of the University of Zürich I used the name of a town in the vicinity and was surprised by the great deflection that followed. The student explained that he had been arrested for dueling in that town.

If the effective words are repeated at short intervals the deflections caused by them gradually diminish. The time required for the effect to disappear entirely varies greatly with the individual and the emotion.

Before I published the needle experiment the objection had often been made, to experiment with metallic electrodes in contact with the hands, that the deflection of the galvanometer indicated nothing but a change in the conditions of contact caused by involuntary movements. But this interpretation is made very improbable by the constancy of the phenomenon with other methods of experiment and also by the fact that an interval, sometimes of more than six seconds, elapses between the application of the verbal or other stimulus and the sudden deflection of the galvanometer. An involuntary movement of the hands would take place more promptly. Imagine an actor waiting six seconds before imitating the involuntary movement of alarm evoked by a terrifying occurrence!

This interval between the stimulus and the movement of the galvanometer is one of the peculiarities of the psychogalvanic reflex that may aid us in discovering its nature. The length of the interval and all other phases can be recorded by well known photographic methods. The curve obtained in this way often shows, before the great deviation, a small deviation in the opposite direction, which considerably shortens the latent interval. Often, also, a strong stimulus is followed by several oscillations, and the

deviations caused by successive stimuli of the same kind gradually diminish. The same peculiarities have been observed in galvanic reflexes of plants, certain animal tissues and, especially, electric fishes. The results which I have already obtained have been confirmed by many other observers, and they suggest many interesting possibilities.

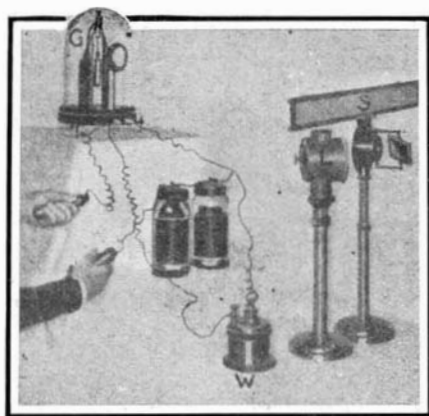


FIG. 1.—APPARATUS FOR MEASURING PSYCHO GALVANIC REFLEX.

G. Galvanometer. L. Lamp. S. Scale. W. Resistance.

In the first place, human psychology possesses in the psychogalvanic reflex an objective indication of emotions which, in contrast to many other forms of expression, is free from ambiguity and apparently from control by the will of the subject. We cannot prevent the electric confession of our skins.

The application of psychogalvanic association experiments to criminal investigations has often been recommended and it is said that this method has been employed in America with brilliant success. I do not advise this course. Let us suppose that a man suspected of crime is examined by this method. A reflex produced by an allusion to the crime would not prove the man's guilt, for it might be caused by the interest

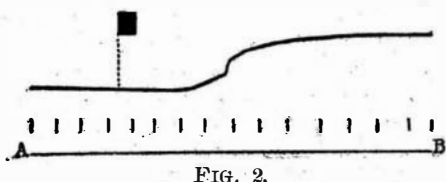


FIG. 2.

Curves of deflection produced by pricking the scalp at the instant indicated by the black square. The vertical marks denote seconds.

in the crime which would naturally be felt even by an innocent suspect. Close study of the phenomenon has shown the danger of jumping at psychological conclusions. The irritability of the human mind is a very complex function, the galvanometer deflection a very simple movement.

The psychogalvanic reflex will undoubtedly be of service in animal psychology. It has already been discovered that the reflex can be produced in normal cats and dogs, but not in cats under the influence of narcotics.

In medicine, the reflex affords a trustworthy and indeed the only objective indication of changes in sensibility, but many precautions must be observed in its employment and interpretation. One result of

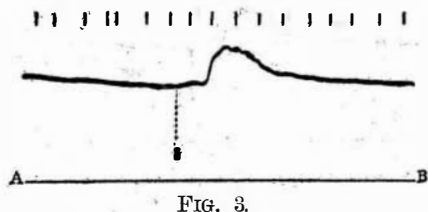


FIG. 3.

Curve of reflex produced by a sound emitted at the instant indicated by the ordinate below. The vertical marks denote seconds.

great theoretical interest has already been obtained. A stimulus applied to a part of the body which has lost its sensitiveness through the severance of a nerve trunk produces no effect on the galvanometer. But there is an insensibility due to hysteria. Some hysterical patients, when certain parts of the skin are cut or burned, show no symptom of pain and assert that they feel nothing. But the stimulation of these same parts produces the same effect on the galvanometer that is observed in the case of normal persons.

In these cases, as in all others, the electrodes should

be applied to the palms of the hands or the soles of the feet, which give far stronger reflexes than any other part of the body, probably because they are more abundantly supplied with sweat glands. In the palm the reflex can be almost destroyed by the local application of belladonna, which arrests the secretion of sweat, but it is little affected by stopping the circulation of blood, freezing, or paralyzing the sensory nerves.

The history of the psychogalvanic reflex is very curious. The phenomenon appears to have been first observed by the French physiologist Féré, in 1888. In 1890 it was rediscovered by the Russian Tarchanow, but his work, like Féré's, attracted little attention, although his results were confirmed by a few other observers. In 1904, the writer, ignorant of the work of his predecessors, undertook the investigation of an electrical phenomenon observed by E. R. Mueller, of Zürich, and was thus led to the researches which are here briefly described. My results have been confirmed by many others, and especially by psychologists. The escape of the third discovery of the phenomenon from the fate of the first and second is due to the astonishing progress which has been made in this branch of science in the last ten years.—Umschau.

A HANDY SACK-HOLDER.

THOSE who have to dispatch their produce in sacks, especially millers, lime-burners, and so forth, readily realize the difficulties attending the charging of the bags. One man or boy has to be deputed to hold the mouth of the sack open while it is being filled. An ingenious means of overcoming this difficulty has been effected by an engineer attached to one of our large gasworks, where the uneconomical labor conditions attending the prevailing system were recognized, and caused him to devise a highly efficient and simple mechanical holder. It comprises a small stand, upon which is mounted an upright pillar. Upon this pillar slides a collar carrying a lever. The longer end of the lever serves as the handle, and the shorter length the sack-holder. The bag is held in the distended position by two rings hinged together. The sack is placed through the lower ring and the mouth pressed over the rim all round. The upper ring is then lowered, and by means of a series of short spikes which pierce the sacking and pass through holes in the lower ring when it is pressed down the bag is held wide open. When the bag is filled the upper ring is simply swung back and the mouth of the sack left free for tying or sewing up. The apparatus is strongly made, is inexpensive, and easily operated, while it can be adjusted to handle any capacity of sack.—Chambers's Journal.

It will be remembered that the French biologist Yves Delage succeeded over a year ago in producing artificial fertilization of sea urchins' eggs by means of chemical reagents, after the manner of Jacques Loeb. He concluded that the fertilization of an egg and its transformation into larva was a series of successive coagulations and re-resolutions of the nucleus membrane and other parts of the egg. Thus he obtained the phenomenon of parthenogenesis in the case of the sea urchins' eggs, using acids for the dissolving and tannin for the coagulating effect. The larvæ which he obtained were transformed into minute sea urchins, and two of them developed normally. Since the time of these experiments the specimens have kept alive and showed a steady growth. One of them now has a diameter of about half an inch, counting the spines, while the second and larger one has at present 0.7 inch without counting the spines. Should they reach the adult stage, M. Delage intends to make some very interesting experiments upon the second generation of such specimens. Without leaving these researches, he is seeking for other means of producing the artificial fecundation, and now succeeds in accomplishing this by an electrical method. In a condenser formed by a sheet of mica he places as electrolyte a liquid composed of sea water to which is added a sugar solution of the same density. The condenser has the form of a trough, and the eggs placed in it are made to receive a series of electric charges. It was found that such eggs were fecundated by this means. Eggs used for a check test which were placed in a similar apparatus but without receiving an electric charge were not fecundated, and it is thus proved that the larvæ are obtained by means of the electric charge. He has secured several larvæ by this method.