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THE STATUS OF THE PSYCHOGALVANIC REFLEX IN PSYCHOLOGY

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Experimental studies of the emotions are comparatively recent undertakings. Most investigations have been done by means of the "method of expression," on the basis of a physical measurement of characteristic physiological changes, as breathing or pulse. One of the more promising of these measurements is that of the so-called psychogalvanic reflex. This reflex is a change of electrical conduction through the body which can be measured by means of a galvanometer. It occurs under emotional conditions and when an emotion is reported by the subject. This phenomenon was first reported by Féré in 1888 when he found the reflex corresponding with plethysmographic changes in hysterical patients. He attributed it to lowering of body resistance under emotional states. Tarchanov in 1890 reported the reflex in normal subjects, showing it to be a normal reaction. In 1904 Müller reported studies of the psychogalvanic reflex which were followed by those of Veraguth. Some other early investigators are Goldemeister, Waller, Prideaux, Peterson, Jung, and Scripture.

There have been from the first, two main methods of experimentation, resulting in two main theories of the cause of the reflex. The exponents of the one theory use the body in direct connection with the galvanometer, and assume that the reflex phenomenon is due to an increased electromotive force produced in the body under emotional stress. Sidis and Kalmus [7] have endeavored to show that this electromotive force is generated by muscular action. They have inserted the electrodes (hypodermic needles) under the skin, and report that the reflex still occurs, but that it does not occur when the limb is bound so that no muscular response is possible. They worked mostly with rabbits and cats. Their work has not been verified, and has been severely criticised by Dunlap,[2] Prideaux,[6] and others. Aveling and McDowell [1] found deflections occurring when the skin was removed, and so concluded that it was not due to skin resistance. Other workers have attributed the increased e.m.f. to action currents of the heart. These experimenters for the most part have worked with the Einthoven

string galvanometer which in this connection records the heart beat.

A large number of investigators, some of whom are Peterson and Jung, Scripture, Waller and Markbreiter, have used an exsomatic current with a D'Arsonval moving coil galvanometer, and (recently) measured the changes in resistance by means of a Wheatstone bridge. They hold that the reflex is due to a decrease in body resistance, probably at the skin, in emotional states. The theory most frequently advanced by them is that this decrease in skin resistance, is due to the opening of the pores of the sweat glands, bringing about a more complete electrical contact with the electrodes. This theory is supported by the fact that the reflex is most noticeable when the electrodes are attached to the surface where the sweat glands are most abundant, that is the palms of the hands and soles of the feet. Waller [11] and others report that the reflex occurs only when the electrodes are in contact at these points, at least when it is measured in terms of resistance. Waller does not believe, however, that the reflex is occasioned by changes in the sweat glands, but by parallel reactions of other pores which are microscopic. He has no proof of these pores, but assumes them. He measured the amount of perspiration over ten minute periods and found that the greater perspiration was from the skin of higher electrical resistance. In addition to this he found that when the body secretions were dried up with atropine the reflex was not lessened.[10] From these findings he concludes that the change in resistance must be due to something other than perspiration, and posits a reaction of pores which he assumes to be present. He seems to stand alone in this theory.

Much of the lack of agreement is probably due to the lack of standardization of the instruments and technique used. This standardization will not occur until more complete knowledge of the electrical and physiological phenomena involved is attained. Dunlap [2] said in 1910: "The experiments up to date can be explained by showing that mental activity is accompanied by muscular activity and by variations in animal secretions. Perhaps something may be done in the future to establish the usefulness of psychogalvanic experiments, but it will be done by physiologists who are skilled physicists." Advancement has been made since then, but the technique is by no means perfected. The use of this method in a psychological study of the emotions is somewhat limited by the inadequate knowledge of the physiological nature of the reflex.

At the present time a number of psychological facts have been fairly well established with regard to the reflex. The first concern is with the nature of the occasion for the response. When an affective stimulus is presented to a subject who is in series with the galvanometer a deflection occurs indicating an increased amount of current passing through the instrument. This deflection characteristically starts after a latent period of from one to five seconds, makes an abrupt rise and gradually returns to zero. When compared with introspective accounts from the subject, it is found that on the whole the more intense the emotion, the greater the amplitude of the deflection. Prideaux [6] reports that with considerable muscular reaction the deflection is less than when muscular response is inhibited. Waller [9] also says that the more completely an emotion is suppressed the greater is the deflection. This tends to corroborate the theory that the less the emotion is expressed the more it is felt, a position which is contrary to the James-Lange theory, but on the whole Prideaux's and Waller's findings have not been corroborated.

A few individuals have maintained that the reflex is not a measure of the emotions. H. M. Wells [14] from the introspective reports of her observers concludes that the reflex is not due to emotion but to a quality of action. Her observers reported no emotion but feelings of action accompanying the situation, which was a choice between two possible responses. Her situations were of a kind that would bring about only slight affective feelings. In a reply to her statement Wechsler points out that an examination of her protocol reveals introspections of affective states. Aside from one or two objections such as this the reflex is considered to be an index of an affective situation.

Another generally noted fact is that anticipation of an emotional stimulus will cause a deflection in most observers but not in all. On the basis of this some investigators have divided the observers into two groups, the imaginative and the non-imaginative. This 'expectancy curve' is sometimes evidenced in a gradual rise, and is sometimes more abrupt. It may even be as great as or greater than the deflection caused by the actual stimulus when it occurs. Observers usually report in this case a relief when the stimulus is given, even though it be quite painful, as it means a termination of the period of suspense.

There are a few characteristic differences in deflections. The duration of the deflection depends in part on its initial amplitude, that is, a comparatively intense emotion seems to die out rather

slowly. It depends also on the duration of the emotional situation while its affective value for the observer lasts. However, a stimulus such as a sudden loud bang, which is affectively described as a 'startle' may give a fairly large deflection which returns to zero relatively rapidly. Unpleasant emotions give larger deflections than pleasant. This may be explained by the scarcity of intense, real, pleasant emotions, and the difficulty of arousing them in the laboratory situations. So far no characteristic deflections have been noted as peculiar to any one emotion or type of emotion. Whether or not this is possible is an open question. The method will probably have to be limited to the discovery of the presence of an emotional state, its intensity and duration.

Comparative studies of emotivity of individuals on the basis of the amplitude of the swings is made difficult by the fact that individuals vary greatly in bodily resistance, and the same individual varies on different days and at different times of the day. In order to make any comparison between results obtained with different subjects, it is necessary to employ currents of constant and equal intensity. To do this, since individuals differ greatly in skin resistance, it is necessary to use a potentiometer for regulating the amount of current passing through the individual, and a Wheatstone bridge of which the subject forms the unknown resistance of the fourth arm. When the bridge is then balanced, deflections of the galvanometer mirror will indicate the amount of change in resistance resulting from an affective stimulus. These can be compared in magnitude.

There is, however, no absolute standard by which the amplitude of a deflection could be compared in terms of emotion. General emotivity might be determined by the range and variety of stimuli to which a subject responds. Emotivity is specific rather than general. Wechsler [12] finds this to be true of emotions as measured by the galvanometer. One person responds to certain stimuli which are not found to be affective by another, and fails to respond to other stimuli which might greatly affect the other. This difference is probably a matter of difference in experience and associations.

A number of experimenters have studied the occurrence of the reflex under abnormal conditions. Such drugs as atropine, pilocarpine, and alcohol have been used on subjects in order to learn more about the nature of the reflex. Waller [10] found no significant change in deflections with the use of any of these. Wells and Forbes [13] found a decided reduction of reflex deflections with

atropine, but Markbreiter's [3] findings agree with Waller's. Since atropine would dry up the sweat secretion, Waller's results would agree with his theory that the change in resistance is not caused by the pores of the sudorific glands.

Some suggestions of practical applications of the phenomenon have been made. Measurements of the reflex in different kinds of mental disorders point out the possibility of its use in diagnosis. Some types of insanity give normal curves while others give very large deflections and still others none at all. The latter happens quite generally in advanced stages of the diseases. Another possible application has been suggested in detecting emotions of which the patient is not conscious, by means of word association tests, for curing emotional complexes. The same method could be used in detecting crime, and would be more accurate than measuring reaction time to crucial words. But to attempt any kind of practical application with the present knowledge of the phenomenon is unwise. There is not close enough agreement among investigators nor has the method been sufficiently perfected for this.

As for the use of the psychogalvanic reflex in a purely psychological study of the nature of emotions, it serves as a delicate and fairly accurate measurement of the presence of bodily changes corresponding with an emotional consciousness. It is probably more accurate than any of the other objective measures of the emotions which have been used. It is also sensitive to very slight affective changes. This method used in conjunction with subjective reports of affective consciousness should give further insight into the nature of emotions.

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