STATES OF HEIGHTENED SUGGESTIBILITY: NARCOSIS.

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(1) *Introduction.*—The present paper reports the results of certain experiments carried out in an attempt to obtain information on the increase in suggestibility which is often said to follow the administration of certain narcotics, in particular sodium amytal and nitrous oxide. The set-up of the experiment, and the results and conclusions reached, may be looked at from two different points of view, viz., (1) with regard to the light that is thrown on the action of the narcotics examined, and (2) with regard to the nature of suggestibility.

The existence of a close correlation between narcosis and heightened suggestibility has been asserted by many writers. Starkey (19) in 1917 found light ether hypnosis valuable in producing relaxation and increased suggestibility; later workers disliked the variability and uncertainty of this and similar methods and turned to the "short-acting" barbiturates. Hauptmann (9) used evipan intravenously in the production of hypnosis, while Horsley (10) preferred pentothal and nembutal. He found that a state of optimum suggestibility could be induced by small doses of these drugs. Stungo (20) used a 10 per cent. solution of evipan intravenously in subanaesthetic doses and found that a heightened state of suggestibility was induced, and a kind of artificial hypnosis could be obtained, in patients otherwise recalcitrant. Dicks (2) reported on the euphoric-suggestible state of patients injected with evipan and pentothal, and considered this state very suitable for psychological treatment. Rogerson (18) used both intravenous barbiturate injections and nitrous oxide inhalation, and found an increase in suggestibility after administration of either narcotic.

The statement that a certain drug increases the suggestibility of the person to whom it is administered lacks proper scientific connotation unless we can define the concept "suggestibility" operationally, and measure the changes which occur consequent upon the administration of the drug. A concept like suggestibility, which belongs to popular rather than to scientific psychology, may cover a multitude of phenomena explicable in terms of diverse mental functions. Simple clinical impression cannot take the place of controlled measurement and experimentation.

Such tests of suggestibility as have been used in psychological work fall clearly into several distinct groups. Allocation of the tests to each group is on the basis of their correlation with other tests in that group; the underlying principle which gives meaning to these groupings can be determined by an examination of the features characterizing all the tests in any one group. Two main types of suggestibility have been delimited hitherto by means of factorial studies, and a third type has been shown to possess a certain amount of functional unity. In the first instance we have what has been called Primary Suggestibility, or suggestibility of the ideo-motor kind (3, 4). The type of test most clearly representative of primary suggestibility is the so-called body-sway test (11), in which the subject stands upright, with his eyes closed, while a gramophone record repeats the suggestion: "You are falling—you are falling forward—you are falling forward now" over and over agin. The amount of body sway induced by the suggestion, in spite of the subject's desire to remain in the upright position, constitutes his suggestibility score.

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Other tests of primary suggestibility are similar in nature: the arm levitation test is based on the movement of the subject's arm, held sideways, either up or down in accordance with the suggestion; the press-release test, described in detail below, is based on the pressing or releasing movement of the subject's hand, in accordance with suggestion; the Chevreul Pendulum test is based on the swinging of a pendulum held by the subject, in accordance with suggestion; and so on and so forth. Of particular interest in this connection is the fact that these tests of primary suggestibility correlate very highly with tests of hypnotizability and post-hypnotic suggestibility; by the use of a suitable battery of tests it has been found possible to predict a subject's hypnotizability with almost complete accuracy (6).

Another interesting point is that primary suggestibility is highly correlated with neuroticism; in a recent report, a correlation of 0·66 was found between neurosis and suggestibility when 110 normal and 110 neurotic men and women were tested by means of the body-sway test (5). Also, contrary to the common view, as voiced by Janet, Babinski, and many modern psychiatrists, hysterics are no more susceptible to primary suggestibility than are other types of neurotics (3). Both the positive correlation between neuroticism and suggestibility, and the lack of correlation between hysteria and suggestibility, have since been confirmed by extensive studies mainly at this hospital, involving altogether some 1,400 subjects, both normal and neurotic.

Tests of secondary suggestibility, or gullibility as it might very well be called, depend largely on indirection. In the Heat Illusion Test, for instance, the patient is told to note the moment a handle he is asked to hold gets hot; three times running the handle is heated by an electric current; the fourth time the current is switched off without the patient's knowledge, and yet a suggestible subject will again feel the heat. Or odoriferous bottles may be presented, mixed with bottles containing water; suggestible subjects will identify the odour of the bottles containing only water. Suggestible subjects will see certain shapes which are suggested to them in inkblots, or report from memory the presence of certain objects in pictures because their presence was implied in the question put by the examiner. Tests of this kind correlate negatively with intelligence, and show much less functional unity than do tests of primary suggestibility. There is no correlation whatever between primary and secondary suggestibility (3, 6).

Prestige suggestibility may form a tertiary kind of suggestibility (7), but the possibility that such tests as are used to define it may correlate with tests of secondary suggestibility has not been ruled out. In consequence, the existence of this kind of suggestibility must be left open, as well as the existence of still other "suggestibilities."

In the present paper we have used tests of primary suggestibility. This choice was conditioned largely by the fact that the action of the barbiturates and other narcotic drugs is often likened to hypnosis; indeed, the term "hypnotic drugs" has become quite general in recent years. In view of the close affinity between hypnosis and primary suggestibility our choice appears almost inevitable. We do not mean to deny the possibility, of course, that the indefinite statement that "hypnotic drugs increase suggestibility" may refer to secondary suggestibility, or to any other kind; experimentation along these lines would be of great interest and value.

(2) *The experiment.*—The set-up of our experiment was partly determined by certain experimental inadequacies of the only empirical study carried out in the field of suggestibility and drug-administration. Baernstein (1) tested 19 college students by means of the body sway test, under two conditions: (1) after injection of ¾ c.c. of sterile water (control experiment), and (2) after injection of one U.S.P. tablet containing $\frac{1}{100}$ gr. of scopolamine hydrobromide dissolved in ¾ c.c. of sterile water. Under these conditions she found a considerable increase in suggestibility in eight of her subjects from state (1) to state (2); she also found, however, that eleven subjects who in the control experiment had not swayed at all did not sway either after injection of the drug.

The main objection to this experiment derives from the fact that the drug injected might have increased, not the suggestibility of the subjects, but their static ataxia. The experiment does not include a vital control test, viz., a test of their ability to stand after the administration of the drug without any suggestion

at all. If this ability is impaired by the drug, as seems possible, the experiment would prove nothing regarding increased suggestibility under narcosis, but would merely show a selective increase in static ataxia. This criticism is strengthened by the fact that on samples of 60 male and 60 female neurotics we found correlations of 0·6 and upwards between static ataxia and body-sway suggestibility. Clearly, then, this factor of non-suggestion body-sway must be ruled out before we can admit the conclusions as valid.

An attempt was made to do this by means of the following experimental procedure: Two groups of neurotic patients were selected on the basis of their body-sway scores; group A was made up of ten patients who were not in the least suggestible, swaying less than 1 in. during the suggestion period, while group B was made up of ten patients who were markedly suggestible, swaying 3 in. or more during the suggestion period. All twenty patients were then tested on the Press-Release test, which was specially designed for the purpose of this experiment, and their scores recorded. They were then injected with sodium amytal (or made to inhale nitrous oxide, as in our second experiment), and retested on the Press-Release test. Changes in suggestibility scores on the Press-Release test indicated increase in suggestibility due to the injection, or the inhalation, of the narcotic. A special control experiment was performed to safeguard against the influence of the suggestive effects of the procedure of injecting the patient.

The Press-Release test was designed in order to obviate the criticisms of Baernstein's experiment stated above. In this test the patient lies on a bed, with his eyes closed, and holds a rubber ball or bulb in his preferred hand. This bulb is connected through a rubber tube to a tambour. Pressure on the bulb increases the volume of air in the tambour, thus stretching the rubber membrane covering the latter; this movement in turn activates an ink-writer which produces a tracing on a kymograph. Thus we obtain an accurate record of the exact amount of pressure exerted at any one moment of time on the rubber bulb in the subject's hand.

The subject is told that he is required to exert a certain steady amount of pressure on the bulb; an increase in pressure in indicated by a rise in the curve on the kymograph record, while a decrease is indicated by a fall in the curve. He is then told to keep on holding the bulb exactly like this while a gramophone record is played to him. He is to listen carefully, but to keep on holding the bulb exactly the way he is holding it now. Then the gramophone record is started, which goes on for one minute repeating the suggestion: "You are squeezing the bulb—you are squeezing the bulb—you are squeezing it harder, harder—you are squeezing the bulb . . ." (A gramophone record was used in preference to using personal suggestion because it would appear to rule out the subjective element in the giving of the suggestion more successfully. A comparison of the effects of personal and recorded suggestion is given elsewhere (4).)

The Press-Release test has been shown to measure primary suggestibility by correlating scores obtained from 60 subjects on this test with scores made by the same subjects on eleven other tests of suggestibility, including tests of hypnotizability and post-hypnotic suggestibility (6). It thus measures essentially the same function as does the body-sway test, without being subject to the objection that static ataxia might in any way interfere with the testing. The patients seemed to find little difficulty in doing this test even when in the narcotic state, whereas they would certainly not have been in a position to do the body-sway test.

(3) *Results.*—Fig. 1 shows the records of the Press-Release test of ten suggestible patients in the normal state and after sodium amytal injection. In conjunction with each double record are shown the patient's sex, and the amount of narcotic injected. (10 per cent. sodium amytal solution was injected intravenously at the rate of 1 c.c. per minute. The patient was requested to count backwards from 50, and when the counting became confused, as shown by omitting or repeating numbers, or counting in normal progression, the injection was stopped. While the patient's weight and other factors probably influence the amount of sodium amytal required to produce this state of narcosis, it has been found impossible to predict the exact dosage required beforehand (14), and our rather subjective method appeared the only one practicable in order to obtain comparable depth of narcosis.)

It will be seen that in every case there is a marked increase in suggestibility,

as shown by the fact that the curve (1) begins earlier, (2) rises more steeply, (3) reaches a greater height, or (4) continues longer in the narcotic than it does in the

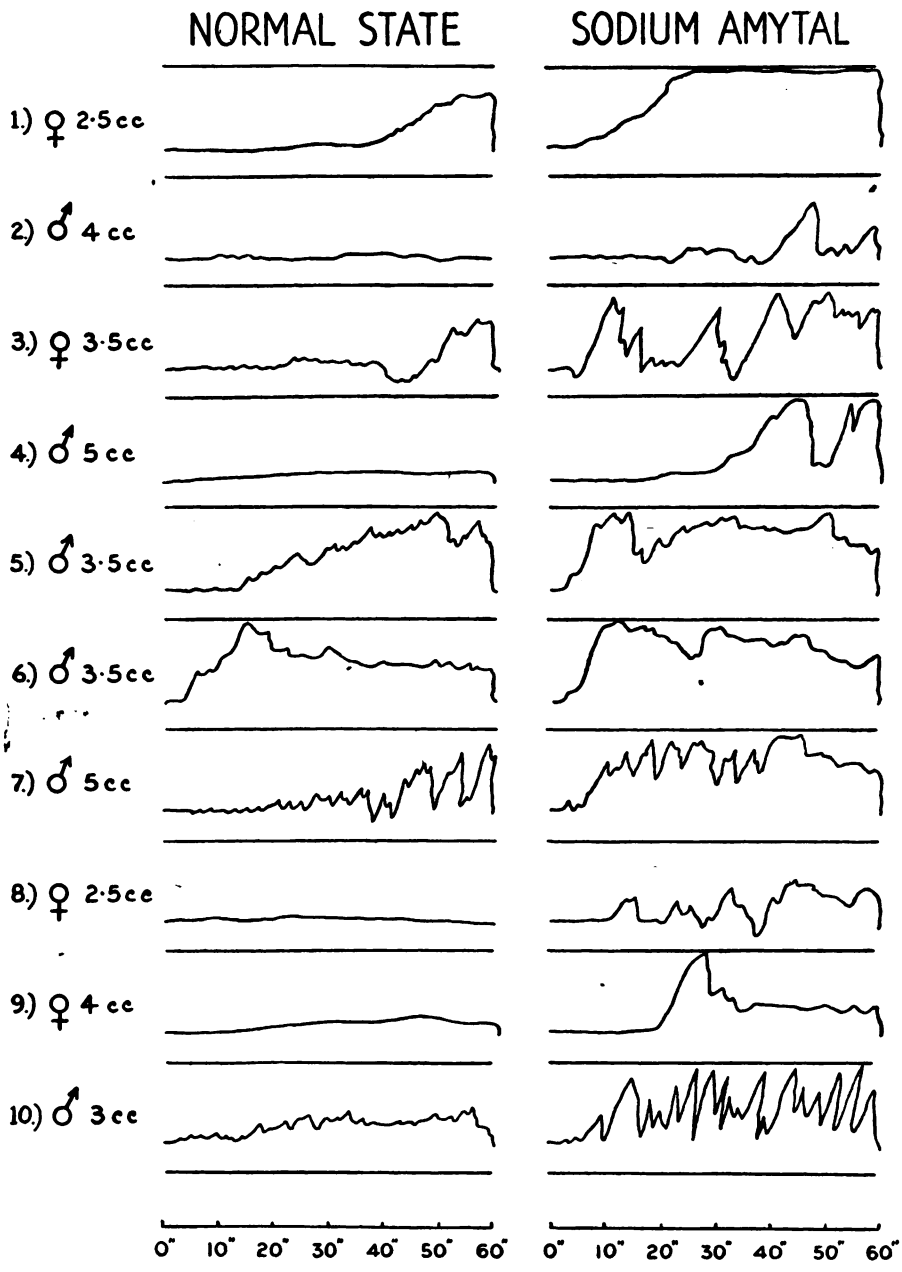

FIG. 1.

normal state. The probability that this increase consequent upon the injection of the drug is a significant phenomenon, and not due to chance, is a thousand to one (P = ·001).

Quite a different picture is given by the records of the non-suggestible patients.

In no case is there an increase in suggestibility in the second record; in some cases the only effect is a slight *relaxation* of pressure. In the majority of cases no

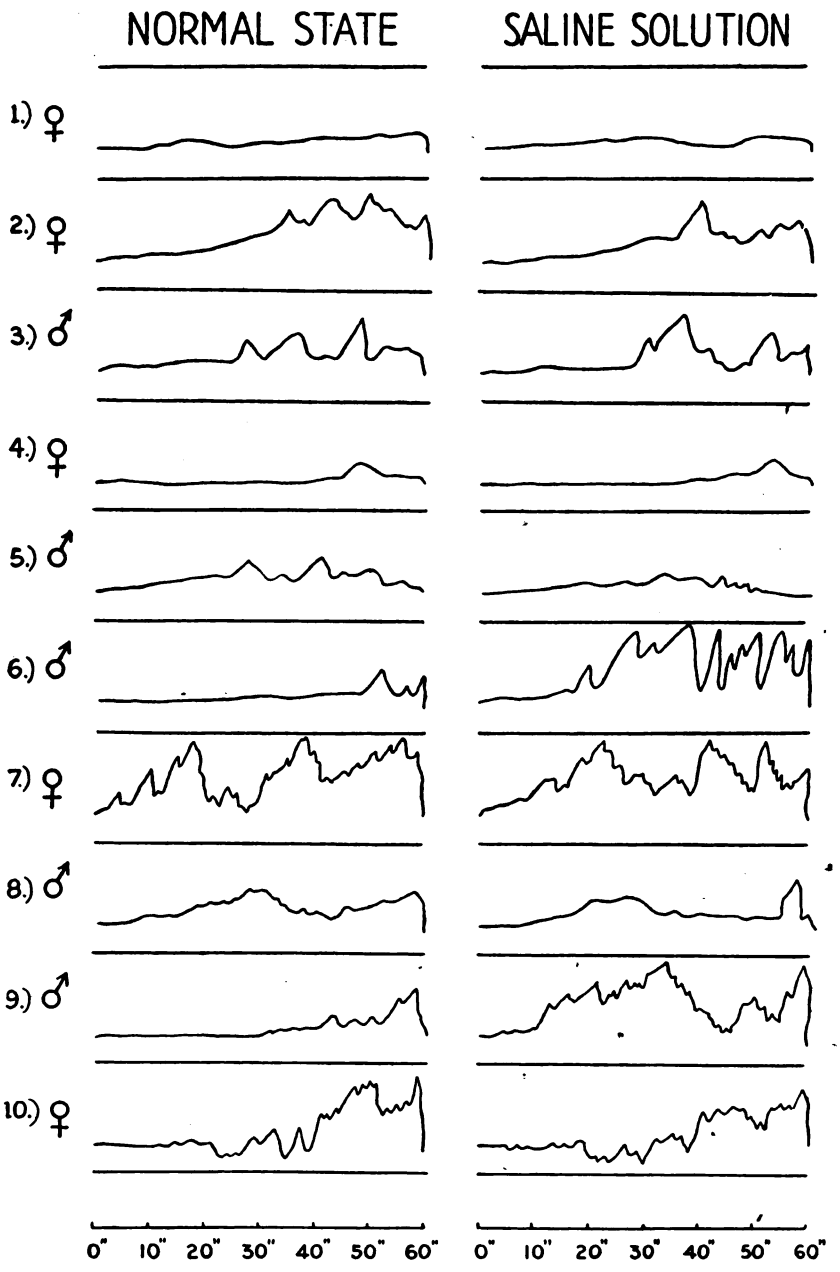

FIG. 2.

difference whatever is observed between the original record and the record obtained during narcosis. The average amount of sodium amytal injected was identical for the two groups.

It is reasonable to conclude that *suggestible subjects are made more suggestible by*

sodium amytal injection, while non-suggestible subjects remain completely unaffected by the drug. The possibility of achieving such complete concordance in the experi-

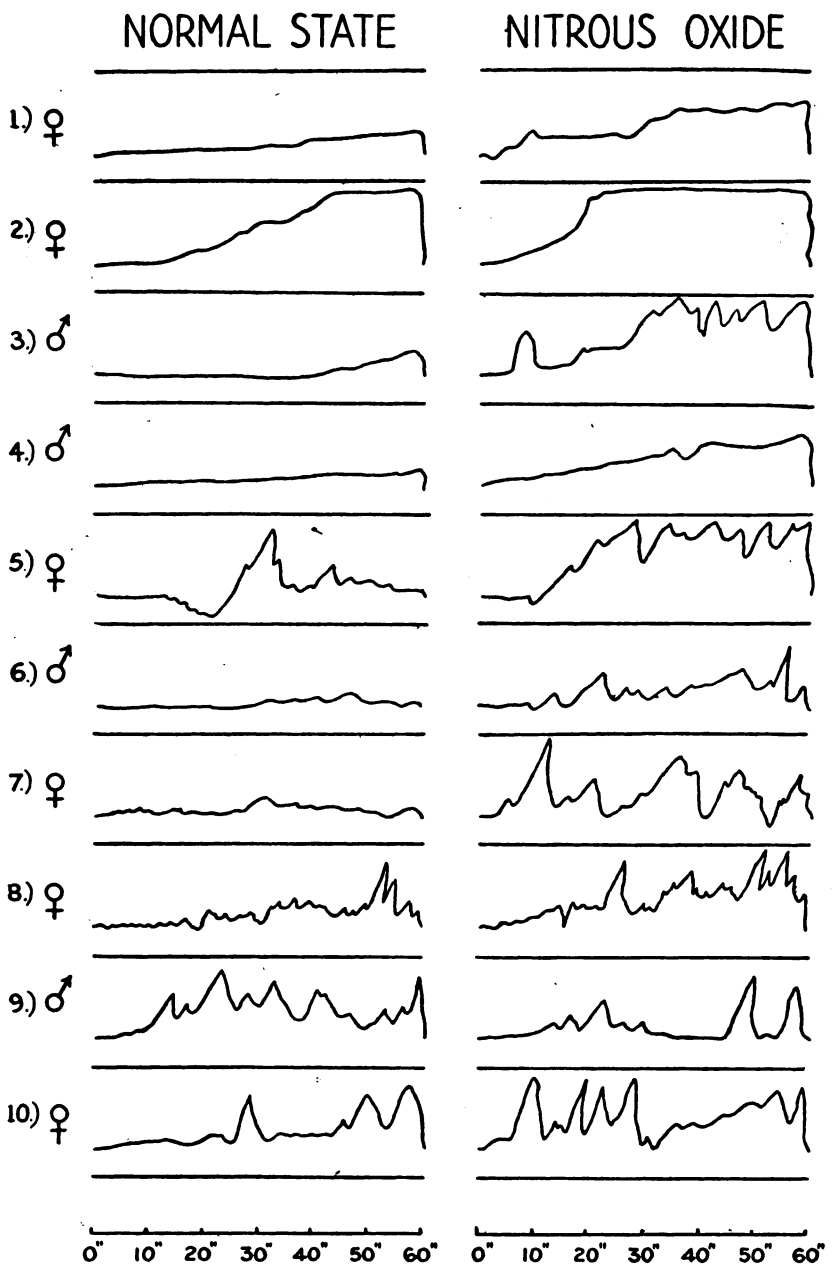

FIG. 3.

mental results by chance is less than one in a million (P = ·000001), and we may therefore consider the above conclusion amply justified on statistical grounds.

The obvious explanation of the results obtained would ascribe the observed increase in suggestibility to the direct action of the drug. Two alternative explana-

tions, however, must be considered. The first of these is that *practice effects* might be responsible for the increase in suggestibility of the suggestible group during the second test. The second possibility is that the *suggestive effect* of the whole procedure of injection and retesting might be responsible for the increase. The two hypotheses just mentioned can both be tested by injecting ten suggestible subjects with saline solution, and retesting them in exactly the same manner in which the subjects injected with sodium amytal were retested. The results of this experiment are shown in Fig. 2. In eight cases there is no increase on retesting; in two cases (Nos. 6 and 9) there is a marked increase after injection with saline solution. These results show that while in isolated cases practice effects and/or indirect suggestion effects may be responsible for increases in the suggestibility of suggestible subjects, this effect is very much weaker on the whole than is the effect of sodium amytal.

In Fig. 3 are shown the results of testing ten suggestible subjects before and after the inhalation of nitrous oxide.* The gas was self-administered, and administration was automatically stopped when the pressure of the patient's hand on the mask was relaxed following onset of narcosis. It will be seen that in nine cases out of ten there is a marked increase in suggestibility following the administration of the gas; in the case of No. 9 there is a lessening in suggestibility. A group of ten non-suggestible patients shows exactly the same picture as did the comparable cases in the previous experiment; in a few instances there is a slight *relaxation* of pressure, but in the majority of cases there is no change at all. These results are statistically significant beyond any possible doubt. Thus this experiment results in a conclusion very similar to that given above: *Suggestible subjects are made more suggestible by nitrous oxide inhalation, while non-suggestible subjects remain completely unaffected by the gas.*

(4) *Discussion.*—The results of our experiments, then, are more definite than is usual in psychological work; their interpretation, however, presents certain difficulties. No definite explanation, in fact, can be given until far more is known both about the action of narcotic drugs and gases on the central nervous system, and about the nature of suggestibility. In these circumstances we can only present an heuristic theory which, while not strictly speaking enforced by the data, is yet capable of accounting for them satisfactorily, and which, furthermore, is open to confirmation or disproof by further experimentation.

In earlier work it has been shown that primary suggestibility is determined by two main factors, called *aptitude* and *attitude* (3, 4). Aptitude is conceived of as a neuro-muscular tendency for the idea of a movement to be followed by an incipient form of that movement (ideo-motor tendency); that such a tendency does definitely exist in the majority of normal subjects, if not in all, is shown by the work of Jacobson (12,13), Max (16) and others, who recorded the action-currents in the muscles whose movement the subject was asked to imagine. They also showed that this tendency existed to varying extent in the people tested, some persons showing strong reactions, others very weak reactions. Introspective evidence from normal and neurotic subjects who were given the body-sway test shows that their " susceptibility " to the suggestion is equally varied; some subjects are quite unaffected by the suggestion, while others feel an irresistible pull forward.

Superimposed on this aptitude is the attitude of the subject. This concept covers the willingness or unwillingness of the subject to carry out the suggestion, and his ability to overcome such ideo-motor tendencies as may be present. In our experiments we tried to insure that the subjects should have a maximum negative attitude to the suggestion, i.e., that they should try as hard as they could to overcome the suggestion. That this attempt was relatively successful is shown by the fact that many subjects gave visible signs of their resistance to the suggestion, shaking their heads vigorously, clenching their teeth, and even saying " No, no " quite audibly. We may conclude, then, that we have more or less eliminated individual differences in approach to the test procedure, so that what remains is the *ability of the subjects to overcome the ideo-motor tendencies aroused by the record through an effort of their will.* Results of testing neurotics and normals indicate that this effort of the will is far less successful in the case of neurotic subjects than in the case of normals; this is not surprising if we regard the " will " simply as an expression of the integrated personality (8, 17). Clearly, on the average, neurotics

* Proportion of gas to air = 45%. The apparatus was similar to Minnitt's obstetrical gas-air-analgesia apparatus.

show much less integration than do normal subjects; indeed, this statement may almost be said to be tautological.

In selecting our two groups of patients, we chose one group on the basis of their lack of suggestibility, i.e., presumably on the basis of their comparative lack of ideo-motor tendencies. It might be said that possibly this group consisted of subjects of great will-power, who were able to overcome strong ideo-motor tendencies. This interpretation does not seem likely to us; the patients selected reported introspectively that they felt little or no tendency to react to the suggestion, and did not exert any great effort in resisting it. Our other group, i.e., the suggestible patients, presumably showed both high ideo-motor activity and low will-power; again, their instrospections bear out this view.

We may reasonably suppose that the administration of sodium amytal or nitrous oxide leads to a lessening of conscious control; indeed, this effect would seem to be the most obvious reaction induced by these narcotics. Using the terms introduced in our discussion above, we should then expect that the narcotic would lead to a lessening of will-power in the subject to whom it was administered. This would lead to certain predictable consequences in the case of the two groups tested. Clearly it would leave the non-suggestible group relatively unaffected. In their case there is no ideo-motor tendency which needs to be kept in check by a controlling mechanism; consequently the partial immobilization of this controlling mechanism would not affect the result of the experiment. Quite differently in the case of the suggestible subject; here a strong ideo-motor tendency is only partially kept in check by the controlling mechanism; once this mechanism is weakened the ideo-motor tendencies emerge more strongly than ever. Thus the consequences of our theory are exactly in line with the results actually obtained in the experiment.

The theory presented here in brief was expounded at greater length elsewhere before the present experiment was concluded; indeed, this experiment was set up partially with a view to obtaining evidence on the value of the theory (6). It should be noted also that there is a certain amount of corroborative experimental evidence in favour of the theory here presented; we might point, for instance, to the well-known work of Luria (15) on motor manifestations in emotional states, which led him to postulate a " functional barrier " very similar in nature to our concept of " will-power."

The clinical usefulness of our findings cannot be determined without a special experiment directed to that end. It is well known, for instance, that some patients fail to respond to therapeutical suggestions made by the psychiatrist while they are in the narcotic state (14), and it seems possible that in these cases we are dealing with patients who are non-suggestible in the normal state. If this were so, the physician could save himself much unnecessary work by having a test like the body-sway test given routinely to all incoming patients; the results of this test then would assist in determining the advisability of hypnotic or narcotic methods of treatment depending for their success on suggestion. The relevance of this possibility to actual clinical work would, of course, depend on the complex question of the kind of suggestibility used in the clinical situation; the physician may rely mainly on prestige rather than on primary suggestibility, for instance, or he may use a combination of different types of suggestibility. Experimental work along these lines would seem to offer fascinating prospects, both for theoretical advance and for practical use.

(5) *Summary and conclusions.*—Ten neurotic patients who had been shown to be non-suggestible on the body-sway test, and ten neurotic patients who had been shown to be suggestible on this test, were given the Press-Release test of Primary Suggestibility (*a*) in the normal state, and (*b*) after intravenous injection of sodium amytal. Two further groups of ten suggestible and ten non-suggestible patients were given the Press-Release test (*a*) in the normal state, and (*b*) after inhalation of nitrous oxide. Another group of ten suggestible patients was given the Press-Release test (*a*) in the normal state, and (*b*) after intravenous injection of saline solution. Comparison of the scores on the test of patients before and after the administration of the narcotic led to the following conclusions:

1. Suggestible patients become more suggestible after injection of sodium amytal in subanaesthetic doses.

2. Suggestible patients become more suggestible after inhalation of nitrous oxide in subanaesthetic doses.

3. Non-suggestible patients remain non-suggestible after the administration of these two narcotics.

4. A small part of the increase in suggestibility consequent upon the administration of the narcotics is due to practice effects and/or the suggestive effects of the procedure of administration.

5. These results may be of clinical importance in explaining the failures occasionally experienced with narco-analysis, and suggest the advisability of using routine suggestibility tests as aids in decisions regarding treatment by suggestion methods.

6. These results support an heuristic theory of suggestibility which emphasizes the importance of the two factors of (1) *aptitude* or ideo-motor tendency, and (2) *attitude* or conscious control.

We wish to thank Dr. W. S. Maclay, Medical Superintendent of Mill Hill Emergency Hospital, for permission to test the patients.

APPENDIX: *Illustrative Case History.*

The theory developed in the preceding pages would appear to be applicable not only to the limited field of experimental psychology, but also to an understanding of certain abnormal modes of behaviour. The case history given below may therefore be of interest in suggesting certain applications of our findings which may be of some value psychiatrically, although to date such application would be based on reasoning by analogy, rather than on strict scientific proof.

The case discussed is that of a young woman, in her early twenties, suffering from psychopathic personality with antisocial trends. She was referred to the hospital on account of attacks of depression and uncontrollable impulses. Her mother committed suicide, and a brother had a nervous illness, probably schizophrenia. She has always been emotionally unstable, irritable, and intolerant. From an early age her behaviour tended to be impulsive, and this tendency has become more marked in the last eighteen months, manifesting itself in stealing, excessive drinking, sexual indulgence, and aggressive outbursts. She had impulses to get out of enclosed spaces, jump out of windows, go off on train journeys, enter stationary vehicles, and spend all her money. About a year before admission she attempted to commit suicide. Electro-encephalogram was markedly abnormal.

Her experimental record on the Press-Release test is shown in Fig. 3, No. 8. (She had fallen outright when given the body-sway test.) It will be seen that in the normal state she squeezed the bulb from the very beginning of the suggestion, squeezing and relaxing at regular intervals. After 20 seconds her squeezes became stronger, though still showing the alternation with short periods of relaxation. Towards the end there were two very strong, almost convulsive squeezes. After nitrous oxide inhalation it will be seen that the same main features are preserved in the record, except that this time the rise in the curve comes earlier, and that the convulsive squeeze at the end is even harder than before—in fact, she almost burst the rubber diaphragm, and the bulb had to be taken from her, as she clung to it even after the suggestion had ceased. The interplay between ideo-motor tendency and conscious control is quite obvious in the record, and the patient herself drew attention to the similarity between suggestion in the experimental situation and the impulses which she found it so difficult to govern in her life.

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