DRUGS AND PERSONALITY

IV. THE EFFECTS OF STIMULANT AND DEPRESSANT DRUGS ON THE RATE OF FLUCTUATION OF A REVERSIBLE PERSPECTIVE FIGURE

By

H. J. EYSENCK

H. HOLLAND

and

D. S. TROUTON*

Institute of Psychiatry (Maudsley Hospital), University of London

IN the first paper of this series (5), it was pointed out that one of the reasons why McDougall's (13) theory of drug action and personality was not accepted at all widely was connected with the fact that he failed to provide an objective, experimental test which could be used to diagnose extraversion-introversion, and to assess drug effects. This argument is not entirely correct; McDougall did in fact suggest one such test, namely the rate of fluctuation of so-called reversible perspective figures. Many varieties of these are known, and have been used experimentally; the Necker cube, the staircase, the vase-face, and the windmill patterns being probably the best known. In all of these, there is an ambiguity in the drawing which makes it possible to perceive two distinct patterns in the stimulus; on prolonged inspection these patterns alternate, and it is the rate of alternation, signalled verbally or by suitable mechanical arrangement, which constitutes the score on this test. It is known that different types of pattern give reasonably reliable scores, and also that rates of alternation on different patterns correlate quite highly together, thus demonstrating that one and the same tendency is being measured (15). That this tendency is of central rather than peripheral character is indicated by the fact that changes in the rate of reversal due to fatigue and other causes can be transferred from one eye to the other (2).

McDougall (13) put forward two main hypotheses: (1) Introverts are characterized by a fast rate of reversal, extraverts by a slow rate of reversal. (2) Stimulant drugs increase the rate of reversal, depressant drugs decrease the rate of reversal. We shall not go into the details of McDougall's neurological theory on the basis of which he made these predictions; it is highly speculative, and does not accord too well with modern views in the field. Nevertheless, a large body of research has been done in connection with these two predictions. With respect to the first hypothesis, linking personality with rate of reversal, Payne (15) has critically reviewed the literature and reports that results are "variable" where normal subjects are concerned. McDougall identified schizophrenia with introversion, manic depressive insanity with extraversion, and the evidence is on the whole in agreement in finding higher rates of reversal in schizophrenics than in manic depressives. However, even this conclusion

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cannot be regarded as established, and in any case the hypothetical relation between schizophrenia and introversion has never been verified on an experimental basis.

As regards the effects of drugs, McDougall and Smith (14) claimed to have found confirmatory evidence, but it should be remembered that they only used 3 subjects, and that their research was rather unsystematic. Guilford and Braly (10) found a significant increase in the rate of reversal in 10 normal subjects of 2·32 fluctuations after alcohol; this is contrary to prediction. Three subjects tested under strychnine increased their rate of fluctuation, as predicted. Ewen (4) used a variety of drugs on schizophrenics and manic depressives, and claimed that the results were in accordance with McDougall's theory. George (9), working with 24 normal subjects, used sodium amytal and caffeine as his drugs and also reported positive results. On the whole, therefore, the second part of McDougall's hypothesis seems to have some empirical support, and it appeared worth while to repeat these investigations under somewhat more carefully controlled experimental conditions, and with the use of a somewhat more adequate design.

A further reason for repeating the experiment is linked with the fact that the present writers' theory of personality might be thought to give predictions exactly the opposite to those made by McDougall. There is some evidence that reversible perspective alternation is in part determined by satiation (3, 11), and the writer (8) has shown that, as postulated by his theory (7), extraverts (hysterics) show quicker and stronger satiation effects than do introverts (dysthymics). It would seem to follow that extraverts should show a faster rate of fluctuation, as well as a faster rate of change of fluctuation with time. (It is well known that the rate of fluctuation increases with time as the experiment progresses; this is possibly due to the accumulating effects of satiation which are not completely dissipated. Finally, inhibition reaches an asymptote, and no further change in rate of fluctuation takes place.) And it would also seem to follow that stimulant drugs should *decrease* both rate and change of rate, while depressant drugs should have the opposite effect. These predictions are of course contingent on the correctness of the theory linking reversible perspective fluctuation with satiation; the writer is not convinced that this explanation is in fact the correct one.

The Experiment

The apparatus consisted of a viewing box and recording system. The distance from the subject to the figure was 48 inches. The cube outline was drawn on perspex, one-sixteenth of an inch thick and ground on both sides with fine lapping powder. It had a total size of 4½ cm., thus subtending an angle of 2° 6′. The lines were drawn with India ink approximately 1 mm. thick. Illumination came from a 15-watt Pigmy lamp 10 inches behind the screen on which the cube was drawn. A fixation point was provided in the centre of the cube outline. Recording was done by a telegraph key activating an event marker on an Evershed & Vignoles Recording Meter travelling at 12 inches per minute.

The subject was seated on a hardwood chair drawn up to a high table (36½ inches high). In front of him was the viewing tube of the apparatus, which was adjustable in height. On the table and directly in front of the subject was a telegraph key, located below the viewing tube. Before testing proper began the subject was asked to observe a large-sized Necker cube drawn in white on dark grey cardboard and the reversal phenomenon was explained to him. He

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was then instructed that each time such a reversal took place he was to depress the key in front of him.

When the subject had taken position the illumination behind the Necker cube was switched on simultaneously with the recording mechanism. Testing continued for a period of two minutes and at the end of this both recorder and illumination were switched off. There followed a rest period of approximately 10–11 minutes, and there was finally another Necker cube trial identical to the one described above.

Two scores were taken from each record, these being the average number of reversals per ten-second period and the change in rate which was found by subtracting the first three periods from the last three periods.

The subjects tested were the same as served in the experiment reported in a previous paper in this series (6). Drug treatments were also identical, so that we have six subjects each carrying out the experiment under three types of drug treatment—stimulant, depressant, and placebo. In fact, the experiment reported in a previous paper (6) was interpolated between the two runs of the present one. This point is important because in case of failure to verify McDougall's hypothesis it is useful to know that identical experimental arrangements (same subjects, same dosage, same drugs, same time elapsed since treatment) can produce highly significant effects in relation to another after-effect phenomena.

Results are shown in Table I. It will be seen that on the first administration, both stimulant and depressant drugs give rise to higher rates of reversal than

TABLE I

Subjects	1st Administration Treatments			2nd Administration Treatments			Combined Scores Treatments		
	Placebo	Amytal	Dexedrine	Placebo	Amytal	Dexedrine	Placebo	Amytal	Dexedrine
1	2·16	1·91	1·83	2·26	2·16	2·83	2·208	2·041	2·330
2	3·66	2·91	4·60	3·50	3·41	4·75	3·583	3·166	4·708
3	2·58	1·50	1·91	3·58	4·91	2·18	3·083	3·208	2·041
4	2·66	1·33	3·58	3·75	2·25	4·58	3·208	1·791	4·583
5	2·08	2·50	1·91	2·50	2·08	1·91	2·291	2·291	1·916
6	5·08	10·92	7·08	7·58	10·83	9·25	6·333	10·875	8·166
Average ..	3·04	3·51	3·50	3·86	4·28	4·25	3·45	3·90	3·97

does the placebo.* The same is true of the second administration; all three treatments give a greater number of reversals during the second period than during the first, but the amount of increase is approximately the same for all three treatments. This general increase is possibly due to satiation effects not entirely dissipated during the rest pause; it emerges in the analysis under the heading of "replication".

An analysis of variance was performed on the total scores; the results are reported in Table II. Two significant sources of variance appear, relating to people and days. In other words, there are consistent differences between people, and there is a consistent tendency for all people, and under all conditions of treatment, for number of reversals to increase from the first to the second, and from the second to the third occasion of testing. On the first day of testing, the

* If it were to be established that both amylobarbitone sodium and dextro-amphetamine sulphate increased the rate of reversal, this would not necessarily be incompatible with the satiation theory. It is possible that peripheral factors such as eye movements may precipitate a reversal if a certain degree of satiation has already been built up, so that the phenomenon occurs sooner than it would have done if the gaze had remained fixed. Subjects under the influence of amytal find it more difficult to maintain their gaze (1), but there is only indirect evidence that dextro-amphetamine affects eye movements; however, the amphetamines usually increase motor activities (16, 17), and presumably the eye is similarly affected, although the only observation which may be relevant is that amphetamine increases reading speed (12).

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TABLE II

Source	Degree of Freedom	Sum of Squares	Mean Square	F	P
Replication	1	4·7749	4·7749	4·3818	N.S.
Days	2	17·0446	8·5223	7·8208	1%
People	5	170·1645	34·0329	31·2314	1%
Drugs	2	1·8099	·9049	—	N.S.
Replication/Drugs ..	2	·0824	·0412	—	N.S.
Replication/People	5	3·3928	·6786	—	N.S.
Residual	18	19·6138	1·0897	—	—
Total	35	216·8829			

mean number of reversals was 2·91 per 10-second period; this rose to 3·80 and 4·59 during the second and third days. There thus appears to be a considerable and rather permanent practice effect which it would be difficult to account for in terms of undissipated satiation.

Drug and replication effects are not significant. The figures suggest that if a larger number of subjects had been used, the replication effect would have been significant; this indeed would be in good agreement with previous findings. It does not appear likely that the drug treatment would have emerged as significant even with such an increase in the number of subjects; the failure of the results to bear out McDougall's theory is in fact rather spectacular. A separate analysis was carried out on the "change of rate" figures, i.e. those derived from subtracting the scores during the first 3 ten-second periods from those during the last 3 ten-second periods. Again no drug effects were noted which could even be described as suggestive.

SUMMARY

McDougall's theory of the influence of stimulant and depressant drug action on the rate of fluctuation of a reversible perspective figure (the Necker cube) was submitted to an experimental test. No significant drug effects were found, and it was concluded that the results fairly decisively confirmed the original hypothesis.

REFERENCES

1. BERGMAN, P. S., NATHANSON, M., and BENDER, M. B., "Electrical recordings of normal and abnormal eye movements modified by drugs", *A.M.A. Arch. Neurol. Psychiat.*, 1952, **67**, 357–374.
2. BROWN, K. J., "Studies of apparent change as a function of observation time, using a new type of dynamic ambiguous figure", *WADC Technical Rep.*, 1954, 54–139.
3. CARLSON, V. R., "Satiation in a reversible perspective figure", *J. exp. Psychol.*, 1953, **45**, 442–448.
4. EWEN, J. H., "The psychological estimation of the effects of certain drugs upon the syntonic and schizophrenic psychoses", *J. Ment. Sci.*, 1931, **77**, 742–766.
5. EYSENCK, H. J., "Drugs and personality: I. Theory and methodology", *J. Ment. Sci.*, 1957, **103**, 119–131.
6. *Idem*, HOLLAND, H., and TROUTON, D. S., "Drugs and personality: III. The effects of stimulant and depressant drugs on visual after-effects", *J. Ment. Sci.*, 1957, **103**, 650.
7. EYSENCK, H. J., "A dynamic theory of anxiety and hysteria", *J. Ment. Sci.*, 1955, **101**, 28–51.
8. *Idem*, "Cortical inhibition, figural after-effect, and the theory of personality", *J. abn. soc. Psychol.*, 1955, **51**, 94–106.
9. GEORGE, R. W., "The significance of the fluctuations experienced in observing ambiguous figures and in binocular rivalry", *J. gen. Psychol.*, 1936, **15**, 39–61.
10. GUILFORD, J. G., and BRALY, K. W., "An experimental test of extraversion-introversion", *J. abn. soc. Psychol.*, 1930, **25**, 382–389.
11. HOCHBERG, J. E., "Figure-ground reversal as a function of visual satiation", *J. exp. Psychol.*, 1950, **40**, 682–686.
12. LEBENSOHN, J. E., and SULLIVAN, R. R., "Temporary stimulation of emmetropic visual acuity", *U.S. Naval med. Bull.*, 1944, **43**, 90–95.
13. MCDOUGALL, W., "The chemical theory of temperament applied to introversion and extraversion", *J. abn. soc. Psychol.*, 1929, **24**, 293–309.

https://doi.org/10.1192/bjp.103.432.656 Published online by Cambridge University Press

14. McDOUGALL, W., and SMITH, M., *The effects of alcohol and some other drugs during normal and fatigued conditions*, 1920. London: H.M.S.O.
15. PAYNE, R. W., *An investigation into the possibility of defining "dissociation" as a personality trait by means of adjective tests*, 1957. London: Ph.D. Thesis.
16. REIFENSTEIN, E. C., JR., and DAVIDOFF, E., "The psychological effects of benzedrine sulfate", *Amer. J. Psychol.*, 1939, **52**, 56–64.
17. TAINTER, M. L., "Effects of certain analeptic drugs on spontaneous running activity of the white rat", *J. comp. physiol. Psychol.*, 1943, **36**, 143–155.

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