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**EDGEWOOD ARSENAL
TECHNICAL REPORT**

EATR 4564

**PERSONALITY AND REACTIVITY
TO STIMULANTS AND DEPRESSANTS**

by

Jack A. Klapper, MD, MAJ, MC
Michael A. McCulloch, MS, CPT, MSC

November 1971



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PERSONALITY AND REACTIVITY TO STIMULANTS AND DEPRESSANTS

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Jack A. Klapper, MD, MAJ, MC
Michael A. McColloch, MS, CPT, MSC
Clinical Medical Sciences Department

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Task 2B662710AD2503

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FOREWORD

The work described in this report was authorized under Task 2B662710AD2503, Prophylaxis and Therapy for Incapacitating Agents. The experimental work was started in January 1971 and completed in May 1971.

The volunteers in these tests are enlisted US Army personnel. These tests are governed by the principles, policies, and rules for medical volunteers as established in AR 70-25.

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DIGEST

Thirty-one nonpatient male volunteers with four distinct Minnesota Multiphasic Personality Inventory (MMPI) patterns [neurotic triad pattern, psychotic tetrad pattern, elevated mania (Ma) and psychopathic deviant (Pd) scales, and normal pattern] were selected in order to investigate the differential effect of stimulants and depressants on different personality types. Two stimulants, caffeine sodium benzoate and methylphenidate hydrochloride, and two depressants, secobarbital sodium and amobarbital sodium, were given to various combinations of the four types of subjects in groups of 7 to 10 men. The subjects' scores on two cognitive tests and one motor test following drug administration were compared.

Several significant intergroup differences are reported. The group with the psychotic tetrad pattern was relatively unresponsive to stimulants and sensitive to depressants. Those subjects with the elevated Ma and Pd pattern were generally very responsive to stimulants and more sensitive to depressants than were the normal group and the group with the neurotic triad pattern. The group with the neurotic triad pattern was relatively responsive to stimulants, but less sensitive to depressants than were subjects with the psychotic tetrad or the elevated Ma and Pd pattern.

The results are discussed in terms of Eysenck's theory of drug response based on an extroversion-introversion dimension. The group of subjects with the elevated Ma and Pd profile had personality scores on the MMPI, the California Psychological Inventory (CPI), and the Maudsley Personality Inventory (MPI) most suggestive of extroversion. The response of this group to both stimulants and depressants was consistent with Eysenck's predictions. No group appeared to have personality scores suggesting introversion; therefore, Eysenck's theory could not be completely confirmed.

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PERSONALITY AND REACTIVITY TO STIMULANTS AND DEPRESSANTS

I. INTRODUCTION.

The anxious patient who responds to tranquilizing or sedative medication paradoxically, with increases in anxiety, has been the subject of reports by both clinicians and research workers.¹ Less frequently, reports of experimental subjects reacting to stimulant drugs with depression appear in the literature.²

Previous work in the area of individual differences in response to drugs suggests that depressants and stimulants have different effects on different personality types. Eysenck³ has proposed that extroverts are more sensitive than introverts to depressants, but more responsive to stimulants. This theory has been supported by others in regard to depressants^{4,5} but has not been confirmed to any great extent with stimulant drugs. Meyer, *et al*⁶ were unable to find a difference in the objective performance of introverted and extroverted sleep-deprived subjects given amphetamine. Idstrom and Schalling⁷ did not report any differences in subjects selected because of extreme scores on a Pt (psychasthenia) scale in response to dextroamphetamine.

In a previous report,* we showed significant correlations between the Minnesota Multiphasic Personality Inventory (MMPI) scale scores and performance on cognitive and motor tests following various tranquilizer drugs. Especially selected subjects (chosen on the basis of two or more MMPI scale scores beyond two standard deviations from the mean of the population used to standardize the MMPI) responded differently from subjects who did not meet this selection criterion, depending on the dose and type of drug.

¹ Sarwer-Foner, G. J. Recognition and Management of Drug-Induced Extra-Pyramidal Reactions and "Paradoxical" Behavioral Reactions in Psychiatry. *Canad. Med. Assoc. J.* 83, 312-318 (1960).

² Lasagna, L. The Relation of Drug-Induced Changes to Personality. In *Specific and Non-Specific Factors in Psychopharmacology*. M. Rinkel (Ed.) pp 114-129. Philosophical Library Inc., New York, New York. 1963.

³ Eysenck, H. J. *Experiments with Drugs. Studies on the Relationship Between Personality, Learning Theory and Drug Action*. The MacMillan Company. New York, New York. 1963.

⁴ Heninger, G., DiMascio, A., and Klerman, G. Personality Factors in Variability of Response to Phenothiazines. *Amer. J. Psychiat.* 121, 1091-1094 (1965).

⁵ Shagass, C., and Naiman, J. The Sedation Threshold as an Objective Index of Manifest Anxiety in Psychoneurosis. *J. Psychosom. Res.* 1, 49 (1956).

⁶ Meyer, R. E., DiMascio, A., and Stifler, L. Personality Differences in the Response to Stimulant Drugs Administered During a Sleep-Deprived State. *J. Nerv. Ment. Dis.* 150, 91-99 (1970).

⁷ Idstrom, C. M., and Schalling, D. Objective Effects of Dexamphetamine and Amobarbital and Their Relations to Psychasthenia Personality Traits. *Psychopharmacologia*, 17, 399-413 (1970).

* Klapper, J. A., and McColloch, M. A. EATR 4553. Personality and Response to Tranquillizers. (In press.) 1971.

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Because this criterion was rather nonspecific about distinct personality types, additional selection criteria were introduced to further delineate personality factors which might account for the individual variation in drug response. Three commonly recognized MMPI patterns⁸ were sought among volunteer subjects:

The neurotic triad: subjects with elevated Hs (hypochondriasis), D (depression), and Hy (conversion hysteria) scales.

The psychotic tetrad: subjects with elevated Pa (paranoia), Pt, Sc (schizophrenia), and Ma (mania) scales.

The psychopathic profile: subjects with elevated Pd (psychopathic deviant) and Ma scales.

Their responses to depressant and stimulant drugs were compared using two tests of cognitive performance and one motor test.

The data in this report give some support to the idea that extroverts respond differently to depressant and stimulant drugs, but suggest that other personality dimensions are important. In addition, the type of drug and its dosage must be taken into account in order to explain an individual's response to a drug.

II. METHODS.

Subjects selected for this study had MMPI scale scores that met one of the following criteria:

Group I: No clinical or validity scale scores above 70. (n=8)

Group II: High two points of the profile either Hs, D, or Hy (neurotic triad pattern). (n=5)

Group III: High two scales F and Sc and both greater than 65 (psychotic tetrad pattern). (n=10)

Group IV: High two scales Pd and Ma, both greater than 60 (psychopathic pattern). (n=8)

The MMPI score sheets were screened to exclude response sets that approached all true or all false responses.

The subjects were tested in a hospital setting in groups of 7 to 10 with various mixtures of the four personality types making up each group. All subjects were given a thorough physical and laboratory examination to exclude those with physical disease. The California Psychological Inventory (CPI)⁹ and the Maudsley Personality Inventory (MPI)¹⁰ were administered to the subjects after they were selected for the study.

⁸ Dahlstrom, W. G., and Welsh, E. S. *An MMPI Handbook*. University of Minnesota Press, Minneapolis, Minnesota, 1960.

⁹ Gough, H. G. *Manual for the California Psychological Inventory*. Consulting Psychologists Press, Palo Alto, California, 1957.

¹⁰ Eysenck, H. J. *The Maudsley Personality Inventory*. Educational and Industrial Testing Service, San Diego, California, 1962.

Three tests of performance after drug administration were used. The Number Facility (NF) test¹¹ is a series of simple one- and two-digit addition problems. Twenty practice trials were given and the mean of the five highest scores was used as a baseline. This test was administered every half hour for 4 hours following drug administration. Scores on this test were recorded as the mean of the high three scores following stimulant drugs or the mean of the low three scores following depressant drugs, as a percentage of the baseline score.

A simple pegboard (PB) test was given 10 times prior to drug testing, and the mean of the five highest scores was used as the baseline score. Nine equally difficult forms of the Wechsler Adult Intelligence Scale digit symbol substitution test (DSST) were given, and the mean of the three highest scores was used as a baseline. Postdrug scores for both the DSST and the PB tests, which were administered hourly for 4 hours after dosing, are reported as the mean of the two highest scores following stimulant drugs, or the mean of the two lowest scores following depressant drugs, both converted to a percentage of the baseline score. This method of data analysis was chosen to accentuate intergroup differences.

The drugs used were caffeine sodium benzoate, 500 mg, im; methylphenidate hydrochloride, 20 mg, iv; sodium secobarbital, 200 mg, PO; and sodium amobarbital, 250 mg, iv. Caffeine was selected as a mild stimulant, whereas methylphenidate was chosen as a more potent stimulant. Secobarbital was given orally as a mild depressant, whereas amobarbital was given intravenously in order to study a more potent depressant effect. Since the time course of the effects of these compounds varied in different individuals and performance on the tests varied in the undrugged condition, mean scores were felt to be more informative than single peak effect scores.

III. RESULTS.

The figure (appendix A) shows the mean MMPI profiles for the four groups selected. No claim is made that Group I represents normal subjects although it is apparent from table B-I* that their mean scores on the MMPI scales are less deviant than those of any of the other three groups. The incidence of this MMPI pattern in a random group of 158 volunteers was 36%. Additional MMPI scale scores, the CPI scores and the MPI scores, are given in tables B-II through B-IV.

Group II subjects were selected to represent the neurotic triad pattern of the MMPI. In addition, these subjects differed from the Group I subjects on the Mf (masculine-female), Sc, R (repression), and Lb (functional low-back pain) scales. The incidence of this pattern was 3% in the 158 profiles examined.

Group III subjects were selected on the basis of elevated F and Sc scales to represent the psychotic tetrad pattern. From tables B-II through B-IV, it can be seen that this group was markedly deviant on the three personality inventories. The incidence of the psychotic tetrad pattern in the volunteer population was 18%.

Group IV was selected to demonstrate the psychopathic subject. In addition to high scores on the Pd and Ma scales, these subjects, when compared with the other three groups, had significantly lower Si (social introversion), R, and Re (responsibility) scores, and higher Do (dominance) and St (social status) scale scores on the MMPI. The incidence of this pattern was 18%.

* All tables are in appendix B.

¹¹ Moran, L. J., and Mefferd, R. B. Repetitive Psychometric Measures. *Psychol. Rep.* 5, 269-275 (1959).

Table B-V shows the results for the four groups on the three performance tests following stimulant drugs. Table B-VI shows the results following depressant drugs.

IV. DISCUSSION.

Although descriptive labels have been applied to the four groups for presentation purposes, they are not meant to imply diagnostic accuracy. In fact, examination of the mean profiles for the four groups suggests that the labels may be somewhat misleading.

Group I subjects were labeled "normal" to distinguish them from the other three groups. They do not represent a random sample of the overall population because they volunteered for a drug testing study.

Group II subjects were selected as examples of the neurotic profile pattern. Their scores on various measures of anxiety such as the Pt and A (anxiety) scales indicate that these subjects did not respond to the MMPI questions with high manifest anxiety. Their scores on scales indicating repression and denial of psychopathology, such as the K, Hy, and R scales, suggest that these subjects responded to the MMPI like patients with conversion hysteria and psychosomatic complaints. Their neuroticism scores on the MPI were not significantly different from those of either group I or IV.

Group III subjects were labeled as having the psychotic tetrad pattern. These subjects were not overtly psychotic but they demonstrated the most deviant patterns on both the MMPI and CPI tests, and the highest neuroticism scores on the MPI. In addition to showing more psychopathology on the various scales of the personality tests, they showed lower intelligence as measured by the Ai (achievement via independence), Ac (achievement via conformity), and Ie (intellectual efficiency) scales of the CPI; and their scores on the General Intelligence Test of the Army Classification Battery were significantly lower than those of the other three groups.

Group IV subjects were selected to represent psychopathic individuals. Their scores on the Si scale were lower than those of the other three groups, a fact which suggests greater extroversion. In addition, they scored lower on the R and Re scales of the MMPI and higher on the Do scale. Their extroversion scores on the MPI were higher than those of the other three groups and their neuroticism score was the lowest of the four groups although these were not all statistically significant differences.

V. CONCLUSIONS.

Based on personality inventory scores, it can be concluded that the subjects with the most psychopathology (Group III) were the least responsive to stimulant drugs and were relatively sensitive to the depressant effects of the two barbiturates. Subjects whose MMPI's were similar to the neurotic profile pattern (Group II) showed some response to stimulant drugs, but were relatively unaffected by the depressants. The subjects whose MMPI's suggested a psychopathic pattern (Group IV) were very responsive to the stimulant drugs and also sensitive to the depressant drugs when compared with both the normal group and the neurotic profile group.

Significant differences between subjects' responses to depressant and stimulant drugs are demonstrated when these subjects are preselected on the basis of personality inventory scores.

A complete comparison of these data with the predictions of Eysenck³ could not be made because none of the groups represented an introverted pattern on the MPI. However, the response of the Group IV subjects did conform to the prediction that the extroverts are more responsive to stimulants and more sensitive to depressants. Subjects with neurotic profiles and psychotic profiles responded quite differently from one another to both stimulants and depressants.

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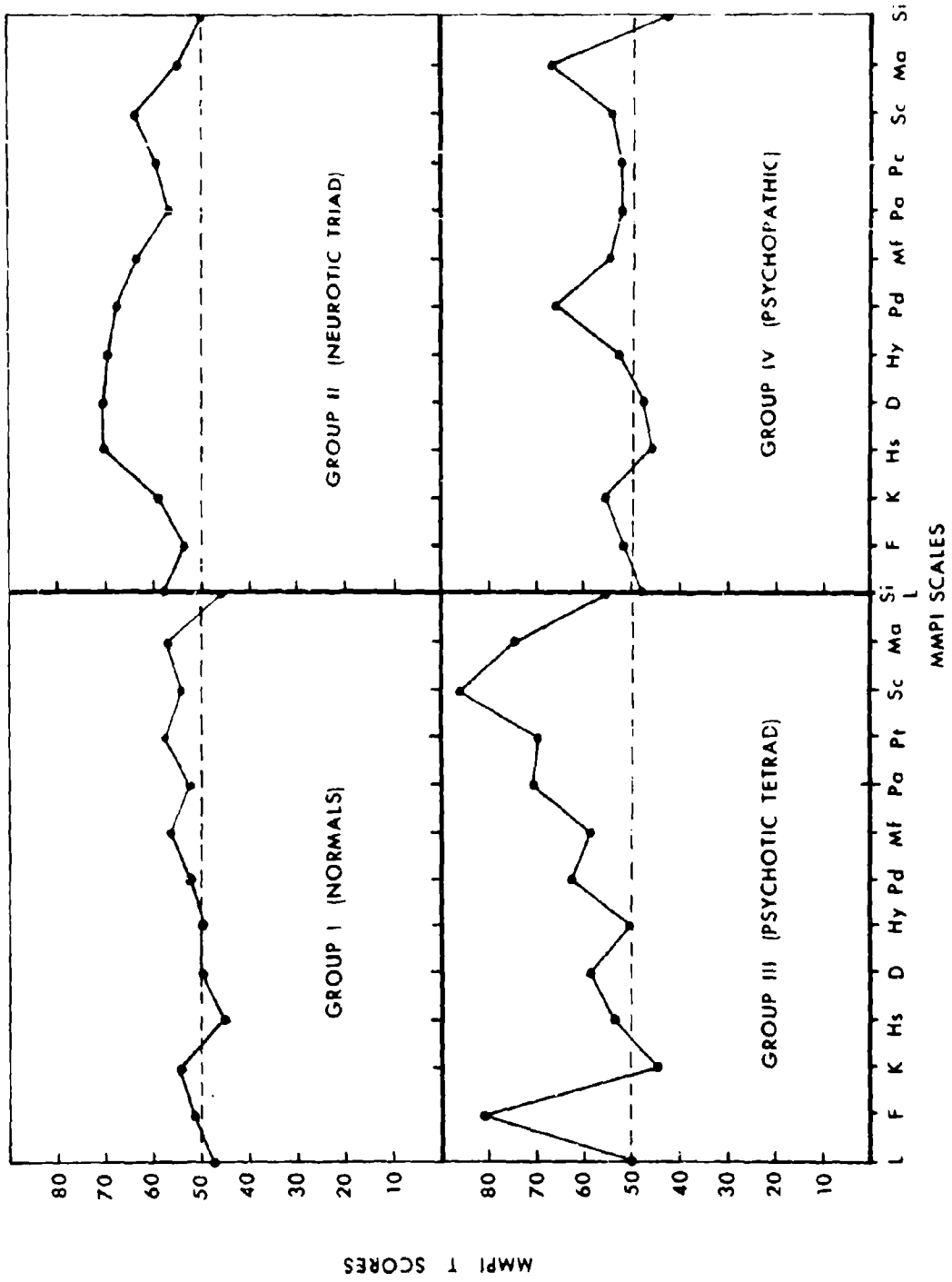


Figure. Mean MMPI Profiles of Four Groups of Subjects

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APPENDIX B

TABLES

Table B-I. Mean T Score on MMPI Clinical and Validity Scales

Scale	I (Normals) n=8	II (Neurotic triad) n=5	III (Psychotic tetrad) n=10	IV (Psychopathic) n=8
L	48	58 ^a	47	49
F	52	54	81 ^a	52
K	55	59	44 ^a	56
Hs	46	71 ^a	54 ^a	46
D	51	71 ^a	59 ^a	48
Hy	50	70 ^a	51	53
Pd	53 ^a	68	63	67
Mf	57	64 ^b	59	55
Pa	53	57	71 ^a	52
Pt	58	60 ^b	71 ^a	52
Sc	55	64 ^a	86 ^a	54
Ma	58	55	75 ^a	67 ^a
Si	47	50	56 ^a	43 ^b

^a Significantly different from three other groups ($P < .05$) by t test.

^b Significantly different from three other groups ($P < .05$) by t test.

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Table B-II. Mean T Scores on MMPI Experimental Scales

Scale	I (Normals) n=8	II (Neurotic triad) n=5	III (Psychotic tetrad) n=10	IV (Psychopathic) n=8
A	49	46	62 ^a	44
R	51	65 ^a	46	44 ^b
Es	54	56	41 ^a	60
Lb	52	66 ^a	50	51
Ca	51	52	69 ^a	46
Dy	51	46	62 ^a	48
Do	56	53	42 ^a	59
Re	51	52	37 ^a	45 ^b
Pr	52	50	65 ^a	48
St	57	58	50 ^b	66 ^a
Cn	55	53	53	57

^a Significantly different from three other groups (P .05) by t test.

^b Significantly different from two other groups (P .05) by t test.

Table B-III. Mean Standard Scores on CPI Scales

Scale	I (Normals) n=8	II (Neurotic triad) n=5	III (Psychotic tetrad) n=10	IV (Psychopathic) n=8
Do	44	42	42	55 ^a
Cs	45	48	38 ^a	49
Sy	50	49	50	56
Sp	53	55	53	59
Sa	51	48	54	59 ^c
Wb	43	47	19 ^a	43
Re	42	41	28 ^a	39
So	47	45	33 ^a	42
Sc	49	55 ^b	32 ^a	45
To	43	46	25 ^a	46
Gi	47	53	37 ^a	49
Cm	46	38	32 ^b	39
Ac	48	48	29 ^a	47
Ai	46	53	34 ^a	51
Ie	43	45	29 ^a	47
Py	50	54	43 ^b	56
Fx	49	57	46 ^c	52
Fe	53	50	54	44 ^b

a Significantly different from three groups (P .05) by t test.

b Significantly different from two groups (P .05) by t test.

c Significantly different from one group (P .05) by t test.

Table B-IV. Mean Extroversion (E) and Neuroticism (N) Scores from the Maudsley Personality Inventory

Scale	I (Normals) n=8	II (Neurotic triad) n=5	III (Psychotic tetrad) n=10	IV (Psychopathic) n=8
E	28	25	29	33
N	16	14	30*	12

* Significantly different from the three other groups (P .05) by t test.

Table B-V. The Effect of Stimulant Drugs on Mean Performance Scores

Methylphenidate HCl				
Scale	I (Normals) n=8	II (Neurotic triad) n=5	III (Psychotic tetrad) n=10	IV (Psychopathic) n=8
NF	117	125 ^a	113	126 ^a
PB	110	108	110	116 ^b
DSST	111	113 ^c	102	114 ^c
^a Higher than Groups I and III (t test significant beyond .05 level). ^b Higher than Groups I, II, and III (t test significant beyond .05 level). ^c Higher than Group III (t test significant beyond .05 level).				
Caffeine				
Scale	I (Normals) n=8	II (Neurotic triad) n=5	III (Psychotic tetrad) n=10	IV (Psychopathic) n=8
NF	113	115 ^a	111	110
PB	108 ^b	101	105	108 ^b
DSST	106	110 ^c	100	109

^a Higher than Group IV (t test significant beyond .05 level).
^b Higher than Group II (t test significant beyond .05 level).
^c Higher than Group III (t test significant beyond .05 level).

Table B-VI. The Effect of Depressant Drugs on Mean Performance Scores

Secobarbital				
Scale	I (Normals) n=8	II (Neurotic triad) n=5	III (Psychotic tetrad) n=10	IV (Psychopathic) n=8
NF	88 ^a	96	82 ^a	82 ^a
PB	89	85	89	86
DSST	93	87	80 ^b	81 ^b

a Lower than Group II (t test significant beyond .05 level).

b Lower than Group I (t test significant beyond .05 level).

Amobarbital				
Scale	I (Normals) n=8	II (Neurotic triad) n=5	III (Psychotic tetrad) n=10	IV (Psychopathic) n=8
NF	93	95	84 ^a	76 ^a
PB	98	92	91 ^b	88 ^b
DSST	98	98	97	84 ^c

a Lower than Groups I and II (t test significant beyond .05 level).

b Lower than Group I (t test significant beyond .05 level).

c Lower than Groups I and III (t test significant beyond .05 level).