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ANOMALOUS REACTION-TIMES IN A CASE OF MANIC-DEPRESSIVE DEPRESSION

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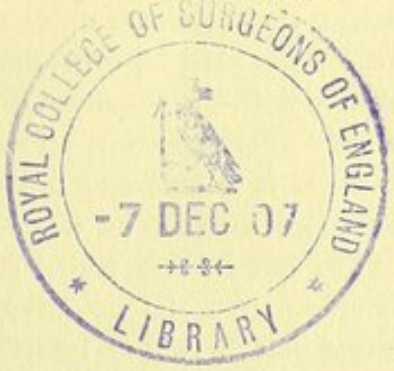

ANOMALOUS REACTION-TIMES IN A CASE OF MANIC-DEPRESSIVE DEPRESSION.[1]

BY SHEPHERD IVORY FRANZ,

McLean Hospital, Waverley, Mass.

In the course of a series of experiments upon the condition of the nervous system in manic-depressive insanity, it was found that the reaction times of a depressed and retarded patient not only were much longer than the normal, but that on certain days there was a tendency for the simple reactions to be greatly prolonged, without a corresponding lengthening of the choice reaction time. Sometimes the time of the simple reactions was found to be equal to, sometimes to be longer than the choice reaction time. These results, so peculiar and at the same time so interesting, warrant a special report apart from the other results which do not show such anomalous results.

The subject of the experiments is a man, sixty-six years old, successful in business and of good education. He was admitted to the hospital greatly depressed and retarded in October, 1903, and the experiments to be reported were made September to December, 1904. Previous to his present illness the patient had had six similar attacks, from each of which he had recovered in a few months. The current attack (the seventh) is the longest, and at the present writing recovery has not yet taken place (June, 1905).

In the depressed phase of manic-depressive insanity there is a lowering of feeling tone and a decrease, often a slowing of voluntary bodily and mental activity, *i. e.*, a psycho-motor retardation. In this condition, in addition to the usual feeling of malaise and to the self-accusation, there is noted a feeling of inadequacy,—a feeling of inability to do what had formerly been easily performed, and, particularly, a feeling of inability to start ordinary acts. A patient may make

[1] This number has been prepared under the editorial care of Dr. Adolf Meyer.

few voluntary movements, and those that are made are very slow. He will sit or stand in one place for hours at a time, and, when compelled to move, will do so apparently with the greatest effort. He will talk little, and slowly, usually very short phrases, affirmative, negative or complaining. Sometimes there is a tendency to stereotypy, a repetition of the same phrase over and over again, whenever a question is asked: 'I don't know,' 'I'm not feeling well,' etc. These stereotyped expressions and the affirmative and negative answers are very often quickly given, indicating that there is no retardation for responses of that character. At times there is a slowing of mental processes which parallels or supercedes the motor difficulty.

When admitted to the hospital, the patient, the subject of the experiments, was almost immobile, kept in his bed, and made only gross movements of his arms and legs. During this time he had to be tube fed. Gradually this immobility passed away, but there remained a lesser amount of retardation. He walked slowly and very little, stood or sat in one place for hours, did not read, and did not take any interest in things about him. At the time the experiments were begun the patient's condition was as described. He said nothing voluntarily, answered slowly and in whispers, walked, dressed and ate accurately but sluggishly. As the experiments proceded improvement was noted in reading, speaking, and walking. This progress, it should be mentioned, was observed only when he was in the laboratory; on the ward there was no appreciable change beyond an occasional improvement in speech. There is no mental deterioration apart from the depression and retardation.

The experiments to be reported are the times of simple and choice reactions to sound. The stimulus for the simple reactions was the sound given by a telegraph sounder operated electrically, and the reacting movement was the lifting of the finger (right hand) from a telegraph key. For the choice reactions, the same sound was reacted to by the same movement, and a finger of the left hand reacted to a low sound. In the choice reactions only the reaction times given for the loud sound (right hand) have been considered. Thus, the choice and simple reactions are directly comparable. The fact that the reactions of the left hand were not being considered was not known by the subject. The time was measured by means of a Hipp chronoscope, regulated by a fall hammer. The experiments were made each day at about the same time. At most of the sessions a number of simple reactions was first made, then an equal number of choice reactions (counting only those from the right hand, of course), and finally an

equal number of simple reactions. Occasionally the number of choice reactions equaled the number of simple ones. In the following tables the average and the average variation are given for the total number of reactions for the period of time considered. No reactions were discarded because they seemed to be too short or too long, but only when there was evidence that the subject had not reacted in a perfectly normal manner.

The results of the weekly grouping ot the reactions are given in Table I. The general average of the 1,710 simple reactions is 273.1 σ and of the 990 choice reactions is 334.5 σ.[1] It will be noted that the simple reaction time is very greatly lengthened (although it should be mentioned that the subject's reactions were probably of a 'sensory' type), but that the choice reaction time is not correspondingly increased.[2] The most striking results, however, are that the differences in time between the simple reactions and the choice reactions are very slight during the ninth and thirteenth weeks. The average variations

TABLE I.

WEEKLY AVERAGES OF SIMPLE AND CHOICE REACTIONS TO SOUND.

Serial Weeks.		1	2	3	4	6	9	13
Simple Reactions.	Average.	299.0	209.2	208.3	224.0	282.9	311.5	342.8
	Av. Variation.	79.7	53.3	41.5	48.0	62.6	57.1	73.6
	No. Experiments.	120	100	100	610	100	300	380
Choice Reactions.	Average.	432.0	306.8	338.1	304.5	308.5	313.4	357.6
	Av. Variation.	82.3	71.8	75.2	55.8	47.1	48.5	24.7
	No. Experiments.	60	50	50	330	50	240	210
Choice minus Simple Reaction.		133.0	97.6	129.8	80.5	25.6	1.9	14.8

are mostly comparatively greater than normal. It was to be expected, as is found to be the case, that both simple and choice reactions during the first week should be greater than with practiced subjects, although the patient had been practiced on the reaction movements for some days

[1] Throughout this paper all figures will be given in thousandths of a second, *i. e.*, $\sigma = .001$ sec.

[2] Eight normal observers gave average simple reaction times from 120 σ to 180 σ (Wundt, *Physiol. Psychol.*, III., 416). Tischer, in experiments upon choice reactions, similar to those made on my subject, obtained an average of 316 σ; the individual averages of his nine subjects varied from 293 σ to 357 σ (Wundt, *op. cit.*, III., 461).

before any time measurements were made. The decrease during the next three weeks was expected also. After an intermission of a week we find an increase, and still greater increases after other intermissions of two and three weeks.

The foregoing table gives only an indication of the abnormal reactions. It shows that the average simple reaction time is greatly lengthened during the sixth, ninth, and thirteenth weeks, but by weekly groupings the greatest abnormalities in the simple reactions are not shown. It is necessary, therefore, to consider the daily averages during this period and to examine in detail the results obtained on particular days. The daily averages for the last three weeks are given in Table II. The average variations have been determined for the total number of reactions on the separate days.

TABLE II.

DAILY AVERAGES OF REACTION TIMES, 6TH, 9TH AND 13TH WEEKS.

The days on which the simple reaction time was found greater than the choice reactions are designated by *.

Date.	Simple Reactions.			Choice Reactions.		
	Average.	Average Variations.	No. Experiments.	Average.	Average Variations.	No. Experiments.
Oct. 10*	312.9	94.3	20	266.1	34.5	10
11*	342.5	41.2	20	318.1	44.5	10
12	234.0	23.7	20	273.6	45.4	10
13	269.5	52.9	20	335.6	23.5	10
14	255.8	37.4	20	349.1	57.3	10
Oct. 31	365.3	79.3	60	372.3	38.8	30
Nov. 1	277.5	46.6	60	292.1	43.1	60
2*	321.3	50.6	60	294.4	46.9	60
3	291.9	39.3	60	302.0	36.9	60
4	298.2	48.1	60	358.9	44.8	30
Nov. 28	360.4	96.2	100	361.3	36.0	30
29	340.3	82.1	100	388.5	46.0	30
30	324.9	54.9	60	350.4	46.7	60
Dec. 1*	346.6	62.5	60	345.8	40.4	60
2	331.6	46.2	60	383.6	36.3	30

The average simple reaction exceeds the average choice reaction on four days (October 10 and 11, November 2, and December 1). On only six of the fifteen days was the average simple reaction less than the choice reaction minus its average variation. If from the choice reaction is taken its variation, and to the simple reaction is added its variation, we find the figures overlapping throughout this period. Moreover, we observe that the amount of the average

variation is, as a rule, either absolutely or relatively greater for the simple reactions than for the choice reactions. In some, probably in most cases, the greater variation is due to the fact that there are two different types of simple reaction on the same day. This is brought out more clearly in Table III. in which the reactions have

TABLE III.

ANALYSES OF CERTAIN DAILY AVERAGES.

The averages are given in large type, the average variations of the averages of groups of ten are given in smaller type and the total numbers of reactions are in parentheses.

Sequence of Tests.	Simple Reactions.	Choice Reactions.	Simple Reactions.	Choice Reactions.	Simple Reactions.
Sept. 28.	255.3 27.7 (50)	251.9 11.9 (60)	174.6 13.3 (60)	—	—
Oct. 10.	222.1 — (10)	266.1 — (10)	403.7 — (10)	—	—
Oct. 31.	330.0 42.9 (30)	372.3 1.2 (30)	400.7 49.9 (30)	—	—
Nov. 2.	—	303.7 31 0 (30)	331.7 27.1 (30)	281.8 8.8 (30)	310.9 11.0 (30)
Nov. 28.	245.2 23.2 (30)	361.3 22.8 (30)	409.7 31.3 (70)	—	—
Dec. 1.	300.6 14.7 (30)	337.5 8.1 (30)	392.5 30.8 (30)	352.0 24.8 (30)	—

been grouped according to the sequence of the tests. A glance at the table will indicate what is meant. For example, September 28 — fifty simple reactions were first taken, averaging 255.8 σ, then sixty choice reactions were made, average 251.9 σ, and finally sixty simple reactions, average 174.6 σ; and October 10 — ten reactions each, in order (1) simple, (2) choice, and (3) simple, averaged respectively 222.1 σ, 266.1 σ, and 403.7 σ. On other days as well as on these two days the simple reactions first made differed greatly from those made after the choice reactions, thus indicating that there are two types or methods of reaction. Further comparison of the two tables shows that the lengthened average simple reaction on any day is often due to one greatly varied set.

Before attempting to account for the anomalous condition which has been found, it is well to summarize the main results thus far given. It has been found that in a retarded subject (manic-depressive depression):

1. The average time of simple reaction to sound is greatly increased.

2. The time of the choice reactions is sometimes increased, but proportionately not so much as the time of the simple reaction.

3. From day to day great variations in the time of both simple and choice reactions are found. The simple reactions show the greater variation.

4. There is a great variation in the simple reaction time on the same day, both when all such reactions are combined and particularly when they are grouped in accordance with the experimental grouping.

5. Occasionally the daily average simple reaction time is greater than the average choice reaction time.

6. More often the average of the group of simple reactions taken before or the average of the group taken after the choice reactions alone shows this peculiar condition.

Two possible explanations of the foregoing phenomena which immediately suggested themselves are (1) that the attitude of the subject, as shown by the greater or less number of premature reactions, had caused the great time difference, and (2) that during the second series of simple reactions fatigue had taken place and caused a lengthening of the simple reaction time. If the number of premature and wrong reactions in the choice experiments had been increased on certain days, and if on those days there had been a shortening of the choice reaction time, we should need to seek no further for an explanation of the condition. Such, however, is not the case. Table IV. gives the number of the premature and wrong reactions for each week

TABLE IV.

PREMATURE AND WRONG REACTIONS.

p = premature. *w* = wrong. Number of experiments in parentheses.

Serial Weeks.	Simple Reactions.		Choice Reactions.	
1	12 *p*	(120)	3 *p*, 3 *w*	(60)
2	6 *p*	(100)	1 *p*, 4 *w*	(50)
3	2 *p*	(100)	3 *w*	(50)
4	20 *p*	(610)	5 *w*	(330)
6	2 *p*	(100)	3 *w*	(50)
9	—	(300)	1 *w*	(240)
13	1 *p*	(380)	1 *p*, 4 *w*	(210)

of the series for both simple and choice experiments. After the first week, the number of premature reactions is no greater than is found with normal subjects. It is evident, therefore, that the attitude of expectation (as shown by the premature reactions) with its easily liberated motor response cannot be considered the cause of the shortened choice reactions, and the absence of this mood cannot be thought to be the reason for the lengthened simple reactions.

The other suggested explanation, viz., fatigue, is not more tenable. Some of the results point in that direction, while others give opposite indications. On October 10 the first set of ten simple reactions averaged 222.1 σ, the ten choice reactions 266.1 σ, and the final ten simple reactions 403.7 σ (see Table III.). Similar averages were found on October 31 and November 28, which suggest a fatigue effect, but the reactions on other days give strikingly opposite results. This is notably the case on September 28 and November 2. Another example of this is not given in Table III., the results on November 1. On that day the first thirty simple reactions averaged 288 σ, then an equal number of choice reactions 307.3 σ, and the same numbers of simple and choice reactions respectively 266.9 σ and 275.8 σ. With as many, if not more, cases against as for the hypothesis of fatigue, it cannot be seriously considered.

It is possible that in this case we have simple reactions similar to the antagonistic reactions noted by Smith[1] and later studied by Judd, McAllister and Steele.[2] Smith has recorded the fact that 'the reaction movement may be complicated by a preliminary antagonistic movement and that the time taken up in this movement is on the average probably between four and five hundredths of a second.' A psychophysical explanation for this is suggested by Smith,[3] viz., that the attention is directed to holding down the key before the stimulus is given, and the shock of the sound or light, as the case may be, causes an intensification of the muscular contractions, 'an increase in the innervation of the muscles which are already in a state of tension.' Smith has observed such a condition in patients suffering with general paralysis. "It is, further, possible that the phenomena of antagonism have certain relations, in some individuals, to the alternation of impulses of which we are conscious in deliberation, hesitation and doubt." If elaborated more, this hypothesis would account for all the facts

[1] W. H. Smith, 'Antagonistic Reactions,' *Mind*, N. S., XII., 1903, 47–58.

[2] C. H. Judd, C. N. McAllister and W. M. Steele, 'Analysis of Reaction Movements,' *Yale Psychological Studies*, N. S., Vol. I., 1905, 141–184. PSYCHOLOGICAL REVIEW Monograph Supplement, No. 29.

[3] *Op. cit.*, p. 58.

which have been recorded by me. To begin with, it should be stated that I have observed in my subject actions similar to those of a general paralytic recorded by Smith, but the extra pressure of the reaction key before the reacting movement was not a constant phenomenon. However, great variability was noted in the experiments made at the Yale laboratory and also in those made by Smith. Assuming for the present Smith's interpretation of the simple reaction increase, we need to account for the more normal character of the choice reaction. This may be explained, though rather weakly, perhaps, as an inability to concentrate on the four factors present in the choice experiments, two sounds and two movements. Thus, the scattering of the attention would prevent any increased muscular innervation in these tests, whereas on the other hand when only one sensory-motor set of things had to be considered, the concentration of the attention permitted, and, possibly, caused the intensification of the muscular contraction preceding the reaction movement.

This explanation is not very satisfactory because it must consider these facts apart from others, which are of the same character, in this class of patients. A few of these facts are here given. It has been mentioned that these patients answer slowly (*i. e.*, slow association reaction), but will say 'yes' or 'no' quickly (more rapid association reaction). These simple affirmative and negative answers are, however, normally paths of very little resistance, although they are associative responses. To pin pricks there is often little or no response, but they are usually perceived and appreciated. It seems to me that in all these conditions we have to deal most probably with some sort of decrease in irritability of the body. Whether this lowered irritability be central or peripheral or general, I cannot at present say. The feelings of lassitude and of initiative inability are easily understood from this standpoint, and the so-called sensory complex, a condition in which the patient has a feeling of unreality, particularly of the body or its parts, is also intelligible.

At present, more than this we cannot say. It is possible that further consideration of the other experiments made upon this subject and upon similarly retarded patients may bring to light new facts that will help toward a clearer understanding of the general subject of retardation as well as of this particular condition.