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THE EFFECTS OF ECT UPON SIMPLE VISUAL REACTION  
TIME AND SERIAL ANTICIPATION LEARNING

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Submitted in part fulfilment for the degree of

BACHELOR OF PHILOSOPHY

in

PSYCHOLOGY

at

THE UNIVERSITY OF WAIKATO

Hamilton, New Zealand

1970

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A C K N O W L E D G E M E N T S

The author wishes to thank all those people who have contributed to the development of this study. Deserving of special mention are :-

Mr B.S. Parsonson, thesis supervisor, for his attention, constructive criticism and sound advice throughout the study.

Mr P.N. Hamid for his assistance in the handling of the statistical treatment of the data.

The staff and patients at Tokanui Hospital (6/6/70 - 25/7/70) whose assistance and ready co-operation made this study possible, and finally

My wife, Glenda, whose enthusiasm and encouragement has been instrumental to the completion of this work.

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A B S T R A C T

A 2 x 3 analysis of variance design with repeated measures on the second factor (n = 10 in each group) was employed to assess the effects of ECT upon psychomotor speed and serial learning ability.

The results revealed that ECT did not increase either simple reaction time or serial learning scores.

These findings are interpreted to indicate :-

- (a) that ECT does not reduce the psychomotor retardation found in psychiatric patients, and
- (b) that ECT alone does not facilitate learning

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THE EFFECTS OF ECT UPON SIMPLE REACTION  
TIME AND SERIAL LEARNING

A REVIEW OF THE LITERATURE

Electric convulsive therapy (ECT) has, since 1938, become a major therapy in psychiatry. Yet, despite its widespread use, few studies have attempted to establish the viability of ECT as an effective therapeutic agent. The reasons for this apparent omission by researchers have been summarized by Campbell (1960 p.611).

'ECT has rarely been examined in its own right perhaps because it has never appeared as a wholly novel treatment which has to be proved as better than existing treatments or than no treatment at all.'

Those studies which have undertaken to establish the efficacy of ECT (Huston and Locher, 1948; Kalinowsky, 1943; Karagulla, 1950) have generally suffered from many methodological limitations, the most serious of which has been the failure to include adequate untreated or control groups. Consequently there has been difficulty in attributing the findings unequivocally to ECT. To date no study has conclusively demonstrated that ECT is efficacious for any group of psychiatric patients. There is, however, suggestive evidence that ECT may serve to hasten the recovery process in cases of depression (Locher 1948).

The modus operandi of ECT has been the subject of even more conjecture and speculation than has the therapeutic benefits of the treatment. At least 50 theories have been proposed. These have included some providing physiological explanations (Meyerson 1943) others stressing psychological factors (Janis, 1950, Duncan 1949) and yet others emphasizing cognitive aspects of the treatment

situation (Alexander 1953). None of these theories has been able to adequately account for the diversity of phenomena reported by investigators. Since many of the research findings have been either contradictory or inconclusive ECT must be regarded as a pragmatic treatment at the moment.

Psychological investigations of ECT have been relatively uncommon when compared with the numerous psychiatric and physiological studies of the topic. Yet it would appear that psychological methods would have much to contribute in investigations of ECT by estimating the efficacy of the treatment, in testing its hypothesized modes of action, and in quantifying its effects upon specific psychological functions. (Campbell 1960)

Owing the special conditions under which ECT is administered to humans, research into electroconvulsive shock (ECS) with animal subjects can prove a reliable source of comparative information.

A number of ECS researchers have found that the convulsions can lead to a decrement of intellectual performance in rats. Learning, as evidenced by the running of three successive perfect trials on the Stone Multiple T maze, was found (Eriksen, Porter and Stone, 1948) to be slightly but significantly inferior in the experimental (ECS) group to the control group ('pseudoshock'). In a further study, using another sample of young rats, it was found (Porter, Stone and Eriksen, 1948) that when the performances of these groups were compared with those of comparable groups used in earlier experiments, uniform differences were found between the shock and the unshocked, without regard to the amount of time allowed for recovery between the series of convulsions and the period of testing. The authors interpreted the findings to mean

that :-

- i) ECS effects a small permanent decrement in ability to learn a relatively difficult maze
- ii) This decrement is most likely due to brain injury from which partial recovery is rapid
- iii) The degree of defect is relatively uniform in all individuals of a homogeneous group of rats.

Using mature rats, it was found (Brown, Russell and Patton, 1949) that learning ability, as measured by a Lashley III maze modified for swimming, 24 hours and 30 days after the last of 25 convulsions was significantly impaired. The magnitude of the impairment, however, was not as great at 30 days as it was 24 hours after the shock series.

In another study using convulsive and subconvulsive shocks Braun, Pierce and Patton (1950) demonstrated that the convulsion itself, rather than the electrical stimulation or situational factors, was responsible for the small but apparently permanent impairment of learning ability in rats.

Russell (1949) found that a series of ECS did not affect learning and retention, either immediate or delayed, of a habit at the relatively simple level of difficulty of the straightaway or the single choice point maze. However, in another series of experiments, in which an exact duplication of the conditions existed with the exception of the degree of difficulty of the maze (5 choice point), very significant decrements in both learning and retention, both immediate and delayed, were observed. The author concluded that the effects of ECS on learning and retention are, in part, functions of the difficulty of the task or habit involved.

Tattan (1957), in examining the effects of ECS on

learning in rats as a function of age, found that while there was no significant difference between groups with respect to age, all convulsed groups were inferior to their respective controls in their maze swimming performances (Lashley III modified for swimming). No significant recovery was noted after a 30 day rest period.

Tsai and Perez, (1970) report that ECS retards learning of reversal problems by rats to a degree significantly different from non-convulsed and pseudoshock groups.

The evidence, then, from a variety of well run animal studies indicates that ECS does result in a decrement of performance in the learning of complex tasks and that this decrement may be relatively long lasting, if not permanent.

Given that research with animals has certain advantages over research with humans there still exist two problems facing those who interpret the findings. Firstly, decrements in performance on a particular task may be due to some general effect of ECS such as alteration of drive, rather than being attributable to a specific action of ECS upon the functions in question.

Secondly, although animal studies use ECS, there is uncertainty as to how fully the results may be applied in explaining the effects of ECT in humans.

These two possible limitations should not detract from the experimental findings using animals. Rather they illustrate the need for comparative research using both animal and human subjects from which can be extracted a common body or knowledge of the effects of electroshock convulsions.

Whereas many of the animal studies provide a model for exact experimentation, the majority of the studies using human subjects produce findings that are suspect owing to the employment of a poor experimental design. In many studies the control group is either non-existent or is

comprised not of patients but of 'normal' persons. In other studies the results are interpreted without the use of statistical analysis.

Some of the more well conducted studies that bear relevance to the present study are briefly outlined.

Stone (1947) used parallel forms of the Wechsler Memory Scale administered before and after a treatment series of shocks and found that his experimental group (ECT) declined on all but one of the subtests while the control group showed a significant gain on the scale when tested at similar intervals. Since the memory scale correlates highly with tests of intelligence (eg. Army Alpha) this finding appears to reflect a genuine cognitive impairment.

Fisher (1949) used both cognitive tests and a questionnaire to assess mood in a study in which a comparison was made between improved and unimproved patients who received ECT. While the tests did not predict the outcome of the treatment those who improved in clinical status also improved significantly in test performance.

Brower and Oppenheim (1951, p.186) quote the results of their study of the effects of ECT on mental functions as indicating that ECT ...' served to restore intellectual efficiency and orientation as well as rendering the patient more susceptible to external stimuli ...' However, as details of tests of significance of the testing interval, or of a control group are not given these findings are difficult to assess.

Scherer (1951) studied the effects of Brief Stimulus Therapy (BST) upon a variety of psychological test performances (including tests of abstraction, motor ability, attention span and vocabulary.) An experimental group of forty one patients who received between 10 and 31 treatments and a control group of 17 patients, who were originally chosen to receive shock treatment but because of complicating factors were unable to receive treatment, were

used. Both the experimental and control groups showed improvement on tests given three weeks prior to treatment and two to six weeks after the final treatment but the degree of improvement from the first to the second testing was not greater for one group than the other.

Hetherington (1953) produced results which he interpreted as indicating that ECT produces two effects working in opposite directions, namely, an increase in the rate of motor response coupled with a decrease in the rate of accurate mental work. The same author confirmed these findings in another study (1956) but in both cases an experimental weakness existed in his use of normal subjects as controls. However, since the initial scores of the treated group were poorer than those of the normal controls, they were allowed more room for improvement with practice effects.

Using a word naming test, Michael (1954) was able to show that patients word naming scores decreased significantly after five or more treatments but an upward trend in scores occurred one week after the last treatment. A comparable control group of patients showed a moderate increase in scores when administered the same test over a three week period.

Zirkle (1956) using pictorial, verbal and numerical materials found that electric shock profoundly interfered with learning ability in the immediate post shock period. Learning performance was shown to have returned to preshock levels  $2\frac{3}{4}$  hours after shock.

Brengelmann (1959) examined the effects of single and repeated electroshocks upon usual learning. Impairment of learning ability was noted after five and seven shocks. In a further experiment Brengelmann, (1959) was able to show that impairment had existed from the first shock.

Mistos (1960) applied the savings method to test the hypothesis of learning interference in the immediate post shock period. These subjects that received

practise on the verbal associate learning tasks immediately following ECT did not show any appreciable savings when tested 6 hours later. Furthermore, Mistos found that at even six hours post-shock learning ability still fell significantly below preshock levels.

Finally Miller (1970) observed that verbal learning disturbances depended upon the cumulative effect of several ECTs. In this study the during treatment testing session took place  $2\frac{1}{2}$  hours after the previous shock.

Most researchers agree during the course of an ECT series, some cognitive impairment is present and that this impairment is of a temporary and reversible nature only. The finding from animal research that ECS produces relatively permanent intellectual impairment has not been paralleled in human research.

Changes in motor performance have also been noted following ECT. A reduction in the speed of verbal response was reported by Janis and Astrachan, (1951). Callagan (1952), using tests of motor speed with depressed patients, found that the group which had received ECT did not differ significantly from the controls. Landis and Clausen, (1955) found, as did Hetherington (1952), that ECT increases the rate of muscular work. In this study also it is noted that the improvement recorded may have been the consequence of greater initial retardation of the experimental group.

Landis, Dillon and Leopold (1956) found that flicker-fusion threshold decreased and choice reaction time increased during and after a course of ECT. Two weeks after treatment the adverse effects were no longer apparent.

Shapiro, Campbell, Harris and Dewsbery (1958) found that ECT did not lead directly to a relative improvement in the psychomotor speed of depressed patients but rather to a relative (but not absolute) reduction.

Dillon (1961) found that ECT lead to a significant increase of choice reaction time (CRT). He noted, too, that CRT measures obtained during the course of psychiatric

treatment were influenced significantly by age, sex and diagnosis.

Since in many cases the findings of investigations into the effects of ECT upon psychomotor performance are at variance with one another, no one generally accepted conclusion as to the actual effects is available. An important prerequisite to study in this area is the employment of adequate untreated control groups for the assessment of situational and practice effects. Those studies which have utilized psychiatric patients as controls seem to all agree that ECT does not increase psychomotor speed (Landis, Dillon and Leopold, 1956, Shapiro, Campbell, Harris and Dewsbury 1958, Dillon 1961). Some studies have indicated that a decrement in performance occurs (Shapiro et al 1958) but this appears to be related to the difficulty of the task involved. As was found in the case of learning, performance measured by simpler psychomotor tasks are less affected by ECT than are the more complex tasks (eg. multiple choice reaction time).

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SOME METHODOLOGICAL IMPLICATIONS FOR ECT RESEARCH

Although many of the investigations of the effects of ECT upon psychomotor and cognitive functions, mentioned so far, have yielded apparently contradictory findings it becomes evident, upon closer examination, that a large number of the studies are not directly comparable owing to great variations in the treatment-test time interval.

Studies in which testing has taken place within an hour or two of the convulsion have all found that ECT does seriously impair cognitive and motor performances. (Stone 1947, Janis 1950, Zirkle 1956, Mistos 1960). The clinician can observe this post-shock confusion without the aid of psychological tests. There is, however, disagreement concerning the permanency of the post shock impairment. While Zirkle (1956) noted that learning ability returned to the preshock level within three hours of the previous treatment, several other authors (Stone 1947, Michael 1954, Brengelmann 1959, Miller 1970) have found that there is a small residual decrement in learning performance which becomes cumulative over a series of treatments. That is, partial recovery from the effects of the convulsion is rapid but with each successive convulsion recovery is thought to be a little less complete. Brengelmann (1959) attributed this impairment resulting from repeated shock to the creation of an organic syndrome. Generally these cumulating adverse effects have not been detected until at least five treatments have been administered (Michael 1954 Miller 1970). Brengelmann (1959) has been the only researcher able to detect any detrimental effects of ECT after one treatment.

When compared with the immediate post shock period the debilitating effects of ECT measured twenty four hours or more following treatment are not particularly severe.

In fact so slight as to frequently miss detection. The findings to date have not indicated any lasting impairment of motor or cognitive abilities following ECT. All the adverse effects of ECT are assumed to be reversible and total recovery is thought to have taken place no later than three months following a series of treatments. Scherer (1951), testing subjects between two and six weeks following a course of treatment commented 'The present study provides no striking or consistent evidence in support of the hypothesis that electroconvulsive therapy affects psychological performance adversely' p.(433). This conclusion seems valid as far as most studies are concerned. In summary then, the present evidence indicates that;

- (a) The detrimental effects of ECT upon motor and cognitive abilities are of a transitory nature only
- (b) Partial recovery from the shock is rapid and within twenty four hours is almost completed
- (c) No permanent ill effects result from ECT.

The failure to find any long lasting ill effects resulting from ECT runs contrary to the consistent observation that the ill effects attributable to ECS in animals are of a comparatively permanent nature. If the analogy between ECT and ECS holds then it would appear that the observed discrepancy is related to the different conditions under which ECT and ECS are administered. Since ECT is administered only as a treatment to persons diagnosed as having some psychiatric complaint research into the effects of ECT could hardly be unequivocal as at all times there is more than one variable influencing the findings. That is, changes in the scores of the psychological tests used to assess the various effects of ECT may not only reflect the changes resulting from the treatment per se but may also reflect those changed in the patient's clinical condition. The difficulty of separating the two effects was observed by Stone (1947 p.208) 'In the run-of-the-mine patients the

part to be ascribed to cortical injury from shock is so inextricably bound up with that which stems from the patient's illness that present methods of separating the two are highly unreliable if at all effective'. This comment would hold true to the present.

It appears that two different effects result from ECT, namely, ill effects which would tend to impair test performance and, (possibly), therapeutic gains which could improve motivation and test performance in general. It is probable that these two effects work in opposite directions so as to negate one another. That is, cognitive impairment is more or less offset by the gain of clinical improvement. This interpretation would account for the observed discrepancy between ECT and ECS findings. However, the assumption that ECT is the sole cause of improvement is not wholly justified. Although there is suggestive evidence that ECT does hasten recovery from depression (Locher 1948) other clinical factors may play an equally important part in the recovery process.

Generally ECT is more frequently administered to, and is considered more successful for, acute rather than for chronic cases of an illness (Kalinowsky 1943). The success rate is also considered higher for patients who are treated for the first attack of an illness which is of short duration (Gralnick 1946, Herzberg 1954). However, it has also been noted (Batt 1943) that for the first acute illness of short duration, the rate of spontaneous recovery is particularly high. It appears as though ECT is given to the type of patient who is likely to recover rapidly without any form of treatment. Thus, the efficacy of ECT must be evaluated with respect to an adequate control group and not simply on the basis of crude recovery rate alone. It has been found (Karagulla 1950) that where an untreated control group is used a much more conservative estimate of the efficacy of ECT results.

In this connection it must be noted that it is

virtually impossible to obtain two identical groups of patients only one of which is receiving ECT, since if they were both identical, they would be both receiving ECT. Most studies claiming to have used a control group of 'identical' or 'very similar' patients are in fact using a group of patients which is in some aspects of diagnosis quite different from that group which is receiving ECT. The possibility that the natural recovery rates differ between the ECT groups and the 'identical' or 'very similar' control groups further complicates the task of attributing any changes in the patients clinical condition solely to the action of ECT. Similarly this variable may differentially effect psychological test performance where the two groups of psychiatric patients are used.

Psychological research into the effects of ECT is then presently faced with at least three major obstacles :-

- (1) There are no available instruments for differentiating the separate debilitating and therapeutic (if any) effects of ECT. At present the notion that ECT does result in brain damage is in part inferential relying on the evidence made available from ECS research.
- (2) The high rate of natural recovery with ECT patients can spuriously inflate psychological test scores and may well conceal any other adverse effects resulting from the use of ECT.
- (3) Owing to ethical considerations it is not normally possible to utilise identical experimental and control groups in ECT research. Current psychiatric hospital doctrine does not permit the withholding of ECT from any patient considered suitable for such treatment for the purposes of research. Also, related to this point, there is the difficulty of assessing the expectancy and situational effects created in the

administration of the treatment. Since only the experimental group receives the treatment, it is normally not possible to equate the experimental and control groups with respect to such factors as the amount of hospital staff attention received or the degree of motivation for improvement.

It is obvious, then, that the scope of ECT research is restricted by methodological complications. Unfortunately many of the conclusions of earlier research have been reached with apparent disregard for the difficulties inherent in any study of ECT. For this reason, even thirty two years after the introduction of ECT, there is still room for much well controlled study in the field.

By well-controlled is meant study that is undertaken with the objective of overcoming the problems associated with ECT research in so far as this is possible under the prevailing hospital conditions. Of course the conclusions of even 'well controlled' studies have to be supplemented with comparative data from ECS research. Improvements could be effected in at least two cases of ECT research :-

- (1) Careful matching of the control group to the experimental group over a whole range of factors, eg. diagnosis age, sex, education level, length of hospitalization, would result in a closer correspondence between the groups and would therefore lend greater strength to the findings, and
- (2) Wherever possible use should be made of 'psuedo-shock' to eliminate some aspects of the treatment variable. Owing to such factors as staff non-availability, it is often not possible to employ 'pseudoshock'. An awareness of these

problems was instrumental in shaping the present research.

### THE PRESENT STUDY

In the present study objective measures of the effects of ECT upon simple reaction time and serial learning are obtained. In view of the previously mentioned difficulties inherent in ECT research the present study should be viewed only as an attempt to obtain the above measures within the psychiatric hospital environment. The findings are discussed with reference to current psychiatric hospital ideology.

The simple visual reaction time test was employed in the present study to assess the effects of ECT upon psychomotor speed. Since it has been found that psychiatric patients, particularly depressives, display a degree of psychomotor retardation, one could predict, on the basis that ECT were efficacious in the remission of psychiatric symptoms, that a reduction in psychomotor slowness should occur during a course of ECT.

The serial anticipation learning task was used to measure the effects of ECT upon verbal learning ability. The findings are then related to the suitability of using psychotherapy with patients receiving ECT. It is assumed that the serial learning situation, involving similar components to those in psychotherapy, would provide an indication as to the likely effects of ECT upon psychotherapy. It has been claimed that one of the beneficial effects of ECT is that it facilitates psychotherapy (Linn and Rosen 1950, Hill and Patton 1956). Zirkle (1956) observed that psychotherapy was used in the immediate post shock period when learning ability was well below pre-shock levels. Learning ability in the present study was

assessed no sooner than twenty four hours following the previous shock; a time when the seriously disrupting effects of ECT may have passed and when the presumed beneficial effects have had time to become apparent.

If ECT were to facilitate psychotherapy then it could be expected that during and following a course of ECT learning ability should improve.

The hypotheses then adopted for the present study can be formally stated as:-

Hypothesis I : that ECT improves simple visual reaction time

Hypothesis II: that ECT improves serial anticipation learning.

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## M E T H O D

SUBJECTS: The subjects (S's) for the study were twenty patients selected, over a four week period, from the new admissions to the male and female reception wards at Tokanui Psychiatric Hospital. S's were initially chosen on the basis that they would either be undergoing a course of ECT or that they were thought to be suitable controls. Severely disturbed patients for whom a testing session (duration twenty minutes) may have been distressing were not considered for the study. Testing of all S's began within five days of admission. None of the S's in the study had been admitted to a psychiatric hospital for at least six months prior to their current admissions.

There were two groups of subjects; Group E (patients receiving ECT) and Group C (a similar group of patients not receiving ECT).

The groups were equated with respect to age, sex, diagnosis, admission status and W.A.I.S. vocabulary subscale scores (Refer table 1).

The groups were fairly well equated with respect to age. The mean age of group E was 41.6 years with the S.D. being 14.6, while the figures for group C were 45.0 and 8.7 respectively. There was no significant difference in the ages of the two groups ( $t = 0.64$ ).

With regard to sex, there was some difference between the groups. Group E contained an equal number of males and females while in group C there were three male and seven female S's.

There were no marked differences in the diagnoses of the two groups. Owing to the vagaries of current differential diagnosis S's were classed as belonging to one of the two broad categories of depression and schizophrenia. Included in the 'depression' category

were all those S's whose diagnoses contained depression as a principal symptom. Similarly the schizophrenia label included all those S's for whom schizophrenic behaviours were the principal determinants of their diagnoses.

Using the above criteria, seven S's in group E were depressed and the remaining three schizophrenic. In group C six S's were depressed and three were schizophrenic. There was one S in group C whose diagnosis given as 'probably a catatonic episode' did not permit simple classification. All of the diagnoses, as abstracted from hospital records, are given in Table 1 of the appendix.

Very similar Wechsler Adult Intelligence scale Vocabulary subtest standard scores were obtained by the two groups. The mean vocabulary subtest standard score for group E was 10.3, S.D. 2.7, and for group C the figures were 10.0 and 2.3 respectively ( $t = 0.27$ )

The groups were also similar with regard to status upon admission. Eight S's in group E were informal (voluntary patients), while two were committed. (Sections 19 and 21 Mental Health Act 1969). In group C six S's were informal patients and four were committed. (Four patients in Section 21). The significance of admission status and its relationship to treatment is noted later.

A record was taken of all S's medication over the testing period. (Refer Table II Appendix) but as the variation was great, both between S's and within S's from day to day, no attempt was made to equate the groups for drug effects.

It emerges from the data presented that groups E and C are relatively similar. However, at least some clinical difference must exist since the patients in group E were considered suitable to undergo ECT while those in group C were not. As was pointed out earlier care

must be taken in the interpretation of results where two different groups of patients are used. It was encouraging to find, however, that after the termination of the testing programme three of the S's who had been in Group C were given ECT. This seems to indicate that the clinical difference between the groups was not very great.

.....

Table 1  
COMPARATIVE SUMMARY OF GROUPS E AND C

SUBJECTS		AGE	SEX	DIAGNOSIS	STATUS	W.A.I.S.
GROUP E	1	50	M	D	I	14
	2	41	M	S	C	11
	3	51	F	D	I	8
	4	41	M	D	I	12
	5	69	F	S	I	12
	6	29	M	D	I	13
	7	31	F	D	I	11
	8	29	F	D	I	6
	9	21	M	S	C	9
	10	54	F	D	I	7
	$\bar{X}$	41.6				$\bar{X}$ 10.3
	$\sigma$	14.6				$\sigma$ 2.7

GROUP C	1	27	M	D	I	6
	2	33	F	D	C	6
	3	55	F	S	I	12
	4	51	F	D	I	10
	5	43	M	D	I	11
	6	46	M	D	C	12
	7	45	F	S	I	11
	8	49	F	S	I	10
	9	51	F	D	C	12
	10	50	F	C	C	10
	$\bar{X}$	45.0				$\bar{X}$ = 10.0
	$\sigma$	8.7				$\sigma$ = 2.3
	$t$	0.64				$t$ = 0.27

M : Male

D : Depression

I : Informal

F : Female

S : Schizophrenia

C : Committed

C : Catatonia

## APPARATUS AND MATERIALS

A Stoelting choice reaction timer (Model 23307) was used to assess simple visual reaction times. The timer had an amber light attached which showed simultaneously with the starting of the timing mechanism. By pressing a small key as soon as the light showed S's were able to extinguish the light and also indicate their reaction time which was measured in 100dths of a second.

For the presentation of the nonsense syllables of Lafayette memory drum (Model 303) with an adjustable exposure was used. The recommended (Hilgard, 1965) two second exposure time was employed. Three lists of six syllables were constructed according to the conditions outlined by Hilgard, one list was used during each testing session. The three letter nonsense syllables had association values of either 93% or 100%. In all lists there were equal numbers of 93% and 100% association value syllables. The lists used in the experiment are presented in the appendix (See table III).

In order to achieve a high degree of equivalence between the groups with regard to intellectual ability the W.A.I.S. vocabulary subtest was administered to all S's before testing proper. The subtest also functioned as a screening device, eliminating the very dull and the exceptionally bright from the study i.e. patients who obtained a scaled score outside of the range of six to fourteen were excluded.

## DESIGN AND PROCEDURE

The data for the study was collected in the mornings of Tuesdays, Thursdays and Sundays between 6th June and 24th July, 1970 at Tokanui Hospital. Group E received ECT on Monday, Wednesday and Friday mornings.

Thus, by testing on alternate days to ECT, in no cases was testing of any S undertaken sooner than 24 hours after the previous treatment. Similarly, no S was tested sooner than 20 hours before the next treatment.

In all, three testing sessions for each subject were employed. Ideally, the testing programme worked so that Group ECT was tested 24 hours prior to the First ECT, at least 24 hours after the third ECT (Sometimes 48 hours after, depending on which day of the week ECT was started) and finally, at least 24 hours after the final ECT. Since S's received, at a maximum, six ECT's, the testing programme for any one S did not cover more than two weeks. The testing plan adopted is expressed diagrammatically (refer figure 1 below)

TEST ADMINISTRATION PLAN

FIG. 1

<u>No. of Day</u>	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<u>GROUP ECT</u>	Test	ECT			ECT		ECT	Test	ECT			ECT		Test
<u>CON</u>	Test						Test							Test

In practice the test spacing was not always as given above. In some cases S's imminent departure from the hospital necessarily meant that Test III had to be advanced somewhat in order that this data be obtained. In other cases S's leave away from the hospital caused disruption of the testing plan. However, as can be seen from the appendix (Table III) the above outline was reasonably well adhered to in the majority of cases. As indicated above (fig. 1) the tests were administered to Group C over the same time span as for to Group E.

The S's in Group E received their ECT in the mornings, thrice weekly, on their respective wards. The shock was delivered with either an 'ECTRON' or a 'CATLON' ECT apparatus. 'Brevidal' muscular relaxant was employed in conjunction with 'epenual' anaesthetic prior to the

treatment; the shock being administered when these drugs were seen to have taken effect. A saturated salt solution was applied to the skin to ensure efficient transmission of the current which was delivered via metal electrodes. Generally bilateral placing of the electrodes was used but in two cases (S's 5 & 10) unilateral placing of the electrodes occurred. The reasons for this variation were not made clear. The voltage varied between 150 volts to a maximum of 200 volts with the duration of the shock in all cases being 1 second.

The number of ECTs ranged from two to six with the mean being 4.2. At this point it should be noted that the author found that (personal communications) the doctors at Tokanui consider ECT to be a supplementary treatment to the various medications given, rather than being a substitute for drug treatment. Examination of Table II of the Appendix seems to support this contention. Thus, it should be assumed that the treatment variable between groups E & C differs only with respect to ECT administration.

With all prospective Ss the author was introduced, by the ward staff, as a psychologist who required a little of their (the patients) time for 'some testing'. Many of those patients approached were familiar with the notion of being 'tested' and most were willing to co-operate. It became apparent, during the course of the study, that S's closely associated the writer's (E's) activities with those of the resident psychologist.

Testing took place in a quiet room, adjacent to the Psychology Unit some distance from the wards, making it necessary for E to convey Ss to and from the wards in his own vehicle. S's generally appeared enthusiastic about the testing programme when advised by E 'that their involvement and co-operation in the testing would help both

E and S's respective doctors find out more about the treatment they were receiving.'

At the testing room standardized instructions were given. Those patients who 'failed' on the W.A.I.S. Vocabulary subtest, which was administered according to the standard manual instructions (Manual for the Wechsler Adult Intelligence Scale Wechsler, D 1955) were returned to their wards without any further testing. The 'successful' patients (now S's) remained at the testing room and were firstly given the reaction time (RT) task. The standard instructions, as given to S's, on this (RT) task and the learning task are given in Table IV of the Appendix.

The RT task required a total of twenty trials, five from each of the intervals of two, four, six and eight seconds. The interval was measured, by stopwatch, as the time between E's instruction of 'ready' and the pressing of the main switch which, both illuminated the light and initiated the timing device. The intervals were presented in a random fashion. There were no pauses between the twenty trials. After a brief rest period S's were presented with the verbal instructions for the serial anticipation learning task. In reporting the nonsense syllables S's were advised to say the syllables as words rather than as three individual letters. Each syllable was exposed for the two second interval most commonly used (Woodworth, 1954). The interval between each trial was 10 seconds (as long as it took E to reset the drum) S's were not advised as to the number of trials they were to be given but if the criterion (two successive correct trials) had not been reached the series was terminated at the twentieth trial. At times it was necessary to give some form of verbal reassurance to S's who might otherwise have refused to continue the task.

The three lists of nonsense syllables were presented in a random order so that any possible differences in the difficulty of the lists, albeit unlikely, would not affect the results.

After the first testing session which took S's about 35 minutes, each session was normally no longer than 20 minutes. The actual length of the session depended on the number of trials taken to complete the learning task.

The design of the present research was aimed toward isolating ECT, in so far as this was possible, as the only variable between two otherwise essentially similar groups of patients.

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## RESULTS

As both experiments consisted of a control condition (Group C, non-ECT) and an experimental condition (Group E, ECT) and were measured over three trials, a 2 X 3 factorial design with ten subjects in each cell was used and subjected to analysis of variance with repeated measures on the second factor. The 0.05 level was chosen as the acceptable level of statistical significance.

Simple Visual Reaction Time An overall trend towards improvement in reaction times is indicated by the data as presented in Graph 1. While, by inspection Group E would appear to have shown the greater improvement in reaction time the statistical analysis failed to reveal the existence of any significant differences between the two groups. The largest F values obtained were 0.003 (subjects within groups) and 0.005 (trial number). Such low F values argue against the existence of any differential trends or patterns in the reaction times of the two groups. (refer Table III). None of the observed differences between the two groups (Graph 1) were found to be significant (t-test). Thus, it can be concluded that ECT does not increase simple visual reaction time.

TABLE II

RAW REACTION TIME DATA FOR GROUPS E & C

<u>SUBJECTS</u>	<u>TEST NO.</u>		
GROUP E	1	2	3
1	.19	.24	.24
2	.32	.23	.24
3	.36	.22	.21
4	.29	.25	.24
5	.26	.21	.22
6	.27	.23	.23
7	.22	.25	.25
8	.24	.25	.24
9	.18	.19	.17
10	.27	.21	.18
$\bar{X}$	.260	.228	.222
=====			
GROUP C			
1	.20	.20	.23
2	.32	.29	.26
3	.25	.24	.22
4	.22	.21	.21
5	.23	.21	.20
6	.22	.24	.25
7	.34	.28	.31
8	.22	.20	.24
9	.27	.25	.24
10	.21	.23	.23
$\bar{X}$	.248	.235	.239
=====			

# MEAN VISUAL REACTION TIME

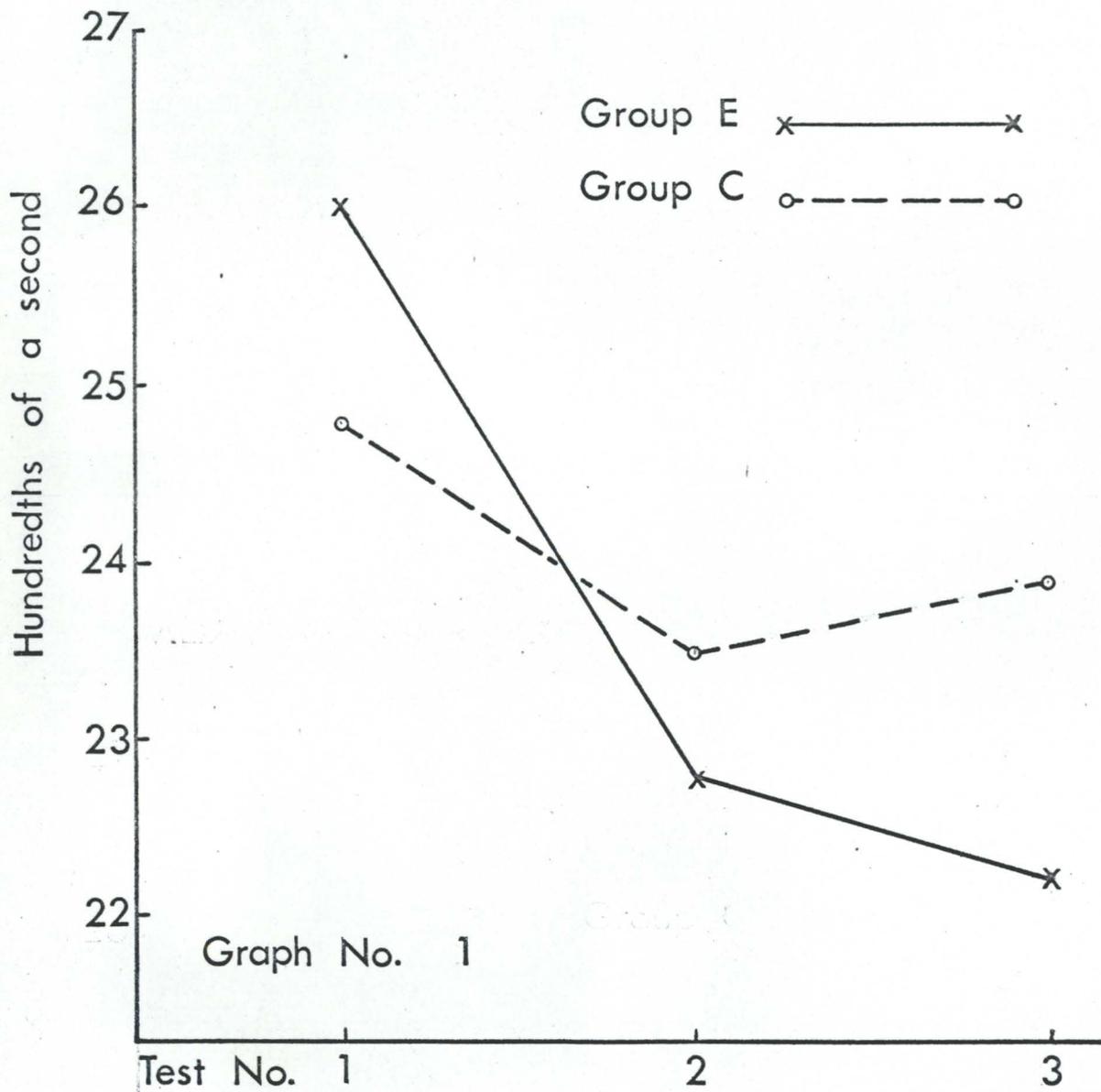


TABLE III

ANALYSIS OF VARIANCE OF SIMPLE VISUAL REACTION TIME  
PERFORMANCES AND SERIAL ANTICIPATION LEARNING SCORES:

<u>SOURCE OF VARIATION</u>	<u>Degrees of Freedom</u>	<u>Reaction Time</u>		<u>Serial Learning (a)</u>		<u>Serial Learning (b)</u>	
		MS	F	MS	F	MS	F
Between Subjects	19						
Treatment Conditions	1	0.0003	<1	0.40	<1	0.90	<1
Subjects within groups	18	0.029	<1	6.17		14.5	
Within Subjects	40						
Trial number	2	0.0036	<1	7.23	3.58*	19.06	4.72*
Treatment X trial	2	0.0011	<1	2.03	1.00	.78	<1
Trial X subjects within groups	36	0.0238		2.02		4.04	

\*  $p < 0.05$

(a) Mean number of responses correct at Fourth Trial.

(b) Mean number of trials for three correct responses.

.....

SERIAL ANTICIPATION LEARNING (a) While the attainment of two consecutively correct trials was taken as the criterion of learning during the actual testing, it was subsequently found that two different criteria had to be adopted before these data were rendered amenable to statistical analysis. The complicating factor was the failure of several S's to obtain the set criterion of learning before the twentieth trial (at which point the test was terminated). Consequently these S's received an open-ended score of twenty plus with a note of the number of correct items they had attained on their two best (consecutive) trials. Thus, the score in some cases is given as 20+ (3) i.e. three correct items attained by the twentieth trial. Obviously raw scores of 20+(0) and 20+(5) are not comparable and are not, therefore, suited to statistical evaluation in that form. (Refer Table IV).

From Table IV, it can be seen that the test criterion was attained by the two most proficient S's at the fourth trial. For the purposes of analysis then the first measure of learning ability was taken to be the number of items in the nonsense syllable lists correctly anticipated by each S at the fourth trial. In this way, no data is lost or is left open-ended. S's scores ranged from 0 to 6 with the higher scores indicating a better performance.

Inspection of the data, as presented in Table IV and Graph 2, reveals a tendency of initial retardation in Group E followed by rapid improvement.

However, statistical analysis - refer to the analysis of variance (Table III) - failed to indicate the presence of any significant differences in learning ability between Groups E and C. ( $F = 0.06$ ) The different treatments administered to Groups E and C then, in this analysis, are of relatively minor importance; ECT

TABLE IV

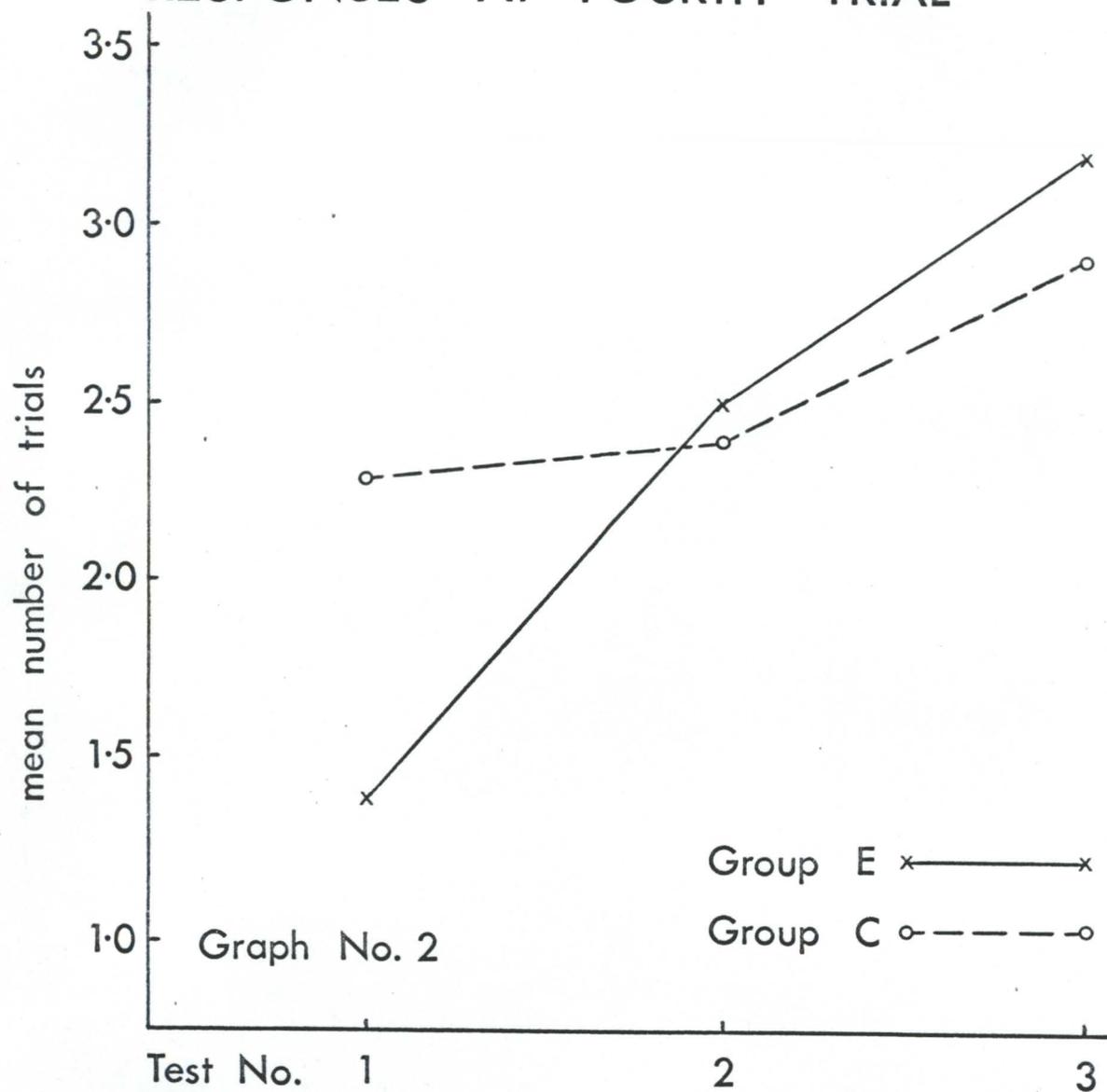
NO OF TRIALS TAKEN TO LEARN EACH LIST OF  
NONSENSE SYLLABLES\*

	<u>TEST NO.</u>		
GROUP E	1	2	3
1	10	20+(5)	10
2	*20+(0)	19	12
3	20+(5)	20+(3)	18
4	20+(5)	17	18
5	20+(3)	7	15
6	13	20+(5)	20+(5)
7	20+(3)	20+(3)	6
8	*20+(2)	*20+(0)	20+(5)
9	12	4	11
10	20	20+(5)	20
GROUP C			
1	20+(5)	20+(5)	16
2	19	20+(5)	20+(5)
3	20+(5)	20+(4)	20+(4)
4	9	11	7
5	5	18	4
6	13	13	15
7	5	6	5
8	20+(3)	20+(4)	16
9	20+(4)	20+(5)	18
10	14	7	20+(5)

Scores of 20+ indicate that the criterion of learning had not been reached by the twentieth test. The figures in brackets indicate the number of items of any list given correctly by the twentieth test.

\* These scores were omitted from the second analysis and were replaced with the column means.

# MEAN NUMBER OF CORRECT RESPONSES AT FOURTH TRIAL



Graph No. 2

Group E x ——— x

Group C o - - - - o

Upward trend denotes improvement

has no significant effect on learning ability. At no testing session were the differences between Groups E and C significant (t-tests).

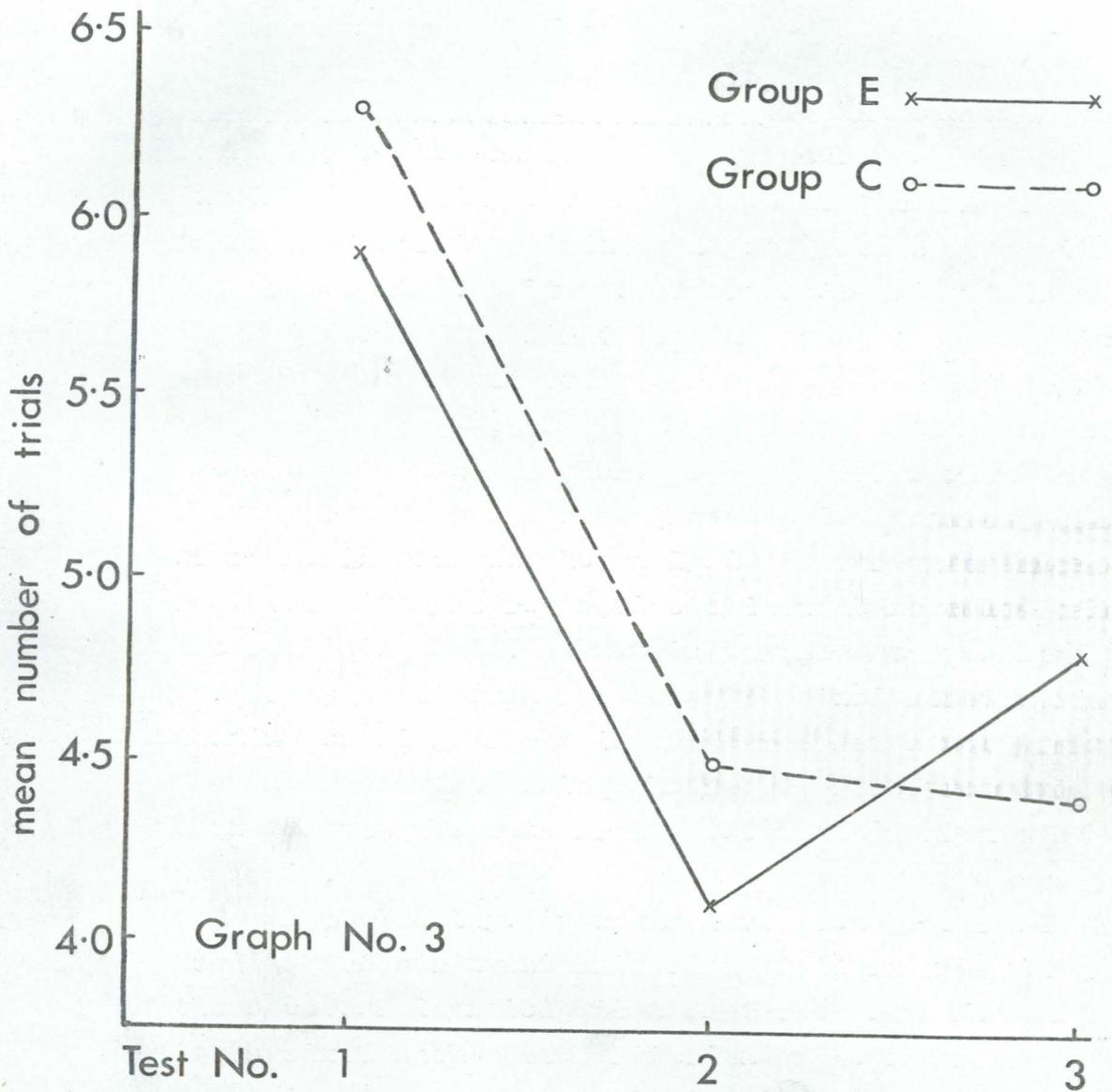
SERIAL ANTICIPATION LEARNING (b) The second approach adopted for the presentation of the raw data for analysis involved recording each S's score as the number of trials taken in order to attain at least three correct items in any one list. It was unfortunate using this method in that during the first testing session two S's in group E did not get even three items correct (raw scores 20+(0) and 20+(2)) and in the second testing one of these two S's obtained the score of 20+(0) (Refer Table VI). These three very low scores were omitted from the columns of raw data used in the analysis of variance and were replaced with the respective column means calculated from the remaining data. In this way no data was lost for Group E although the means obtained for the first two testing sessions for this group are not strictly correct. The alternative to using the above procedure would have been to omit the data from these two S's from the analysis.

Ideally, it would have been preferable to have used a more stringent criterion of learning ability than the successful anticipation of three of a list of six items since such a low criterion of learning would stand to capitalize on chance fluctuations in the direction of high scores.

The mean scores for the two groups are presented in Graph 3 and Table V of the appendix. By inspection both groups display a similar tendency for improvement in score with successive trials.

The analysis of variance Table III indicates that the observable improvement (Graph 3) with successive trials is statistically significant ( $F = 4.75$  d.f. 2/40  $p < 0.05$ ). As was the case in the preceding analysis the

# MEAN NUMBER OF TRIALS FOR THREE CORRECT RESPONSES



Graph No. 3

Downward trend denotes improvement

different treatment effects contributed little to the overall variance and did not approach significance ( $F = 0.06$ ).

Thus while there is no indication in the above analyses of any beneficial effects of ECT upon learning ability, there is a marked tendency for both groups to improve their scores with successive test sessions.

From Table III it can be seen that the trial number accounted for most of the within subject variance ( $F = 3.58$  d.f. 2/40  $p. < 0.05$ ). Thus both Groups E and C displayed a statistically significant improvement in learning ability from the first testing. At no level of testing were there any significant differences between the groups (t-tests.)

.....

DISCUSSION

The results have indicated that ECT does not increase either simple visual reaction time or serial learning scores. These findings are now related to the general aims of the study.

Simple visual reaction time: This was investigated in the present study largely in an attempt to obtain an objective measure of the effects of ECT upon the psychomotor slowness reportedly associated with psychiatric disturbances, particularly depression. Shapiro et al. (1958) pointed out that depressed patients complained persistently about their motor retardation. Further, Shapiro and Nelson (1955) found that psychomotor slowness correlated with subjective estimates of degree of illness. On the basis of the above research findings and on the basis of the assumption that ECT is efficacious - attested to by the widespread use of ECT and by some experimental studies - one would have expected, in the present study, that psychomotor speed, as measured by the simple visual reaction time, would have increased as a consequence of receiving ECT. However, the results failed to confirm this expectation; there was no significant increase in visual reaction time RT either during or following a course of ECT.

The failure to observe an increase in psychomotor speed following ECT is consistent with several of the research findings to date. In a study of the effects of ECT upon psychomotor speed Shapiro et. al. (1958) remarked;

'It appears that ECT has an ameliorative effect only upon the mood of the patient and does not have a similar effect upon slowness. (p.693).'

Callagan (1952) also found that ECT did not have

a significant effect upon motor speed.

Those studies in which an increase in motor speed following ECT has been reported have generally relied upon a control group of 'Normal' subjects. In such cases the group receiving ECT has had an initially retarded score and has, therefore, had more room for improvement with practice (eg. Hetherington 1952, 1956, Landis and Clausen 1955). It will be recalled that in the present study that groups E and C were found to be very similar with respect to RT scores at the initial testing, thus the effects of practice should have been essentially the same for both groups.

The decreases in motor speed during ECT and following the course of treatment found by Campbell (1957) and Foulds (1952) were not expected in the present study for two reasons. Firstly, the ECT-Test interval in the present study was in the order of 24 hours, an interval of sufficient duration for the seriously debilitating effects of ECT to have passed. Both Campbell and Foulds employed their tests in closer proximity to the previous ECT. Secondly, in the present study a very simple indicator of motor speed was used whereas Campbell and Foulds used some relatively complex instruments e.g. Porteus mazes, choice reaction time. Since it has been found that the extent of the adverse effects of ECT is related to the difficulty of the task involved (Pascal and Zeaman 1951) in the present study the influence of adverse effects was expected to be minimal.

On the basis of past research at least two explanations can be offered for the present findings.

It is quite possible, as was outlined in the introduction that there are two opposing effects produced by ECT which operate in such a manner as to negate one another. Evidence from animal research points fairly conclusively to the deleterious effects of

ECS. Similarly, there is suggestive evidence at least, that ECT is effective in hastening the recovery from depressive and some schizophrenic disorders (Huston and Locher 1948). The finding in the present study, that motor speed, as measured prior to and following a course of ECT does not change significantly could be construed as evidence supporting the possibility of opposing effects as suggested above.

Conversely, it may be, as indicated by the Shapiro et al. (1958) study, that the effects of ECT upon motor speed and upon mood are quite independent of one another. If this view is accepted, however, we are left to explain the diminution of the retardation of a successfully treated patient.

For reasons to be elaborated, neither of the above two interpretations of the present findings can be accepted with any degree of confidence; rather, they should be regarded as tentative solutions only.

Serial anticipation learning: This was investigated in the present study in an attempt to investigate the commonly held notion (Hill and Patton 1956, Linn and Rosen 1950) that ECT 'facilitates psychotherapy.' The need for research in this area was observed by Zirkle (1956) who remarked .. 'relatively little research attention has been given to one of the crucial factors in the ability to profit from psychotherapy - namely, learning (p.399).' If it is taken that the success of psychotherapy is dependent largely upon the patient's ability to acquire and retain verbally presented materials then it is considered that the serial anticipation learning situation, also involving the presentation of verbal materials and requiring their retention, should serve as an indicator of the likely effectiveness of psychotherapy.

Although there is some disagreement as to the specific utility of ECT it seems that a large number of clinicians

of clinicians agree that at least part of the therapeutic value of ECT is that it renders the patient more 'amenable' to psychotherapy (Zirkle 1956). Zirkle states... 'the therapeutic effect of ECT is that it temporarily disrupts or disorganizes abnormal mental patterns and permits the substitution of different patterns of a more normal or healthy character (p.399)'.

The medical staff at Tokanui Hospital generally acknowledged the facilitative effects of ECT with respect to psychotherapy and normally instituted psychotherapy more or less concurrently with ECT. The most frequently used type of psychotherapy - a form of group discussion - took place during the week on alternate days to ECT. Patients receiving ECT were encouraged to attend these discussions while they were undergoing their course of treatment.

If ECT were effective in facilitating psychotherapy (as is believed) and were the analogy between psychotherapy and serial learning valid, then during a course of ECT we would expect to find an improvement in serial learning scores.

The results revealed a marked and statistically significant trend of improvement in serial learning in both Groups E and C. At no stage of the testing programme, however, did these groups display any significant differences in serial learning ability. Since the degree of improvement observed was essentially the same for both groups we can conclude that the present study shows that ECT alone does not enhance the ability to learn in a serial learning situation. Assuming that within psychotherapy learning is the major agent of change, then it would appear that ECT does not enhance the ability of the patient to profit from psychotherapy over and above the gains accruing from the more conservative methods of treatment (eg. psychotropic drugs).

There are no studies with which the findings of the present investigation of the effects of ECT upon serial learning are directly comparable. The findings of two studies are partially relevant: Zirkle (1956) and Mistos (1960) in assessing learning ability immediately following ECT produced results which were interpreted to contraindicate the use of psychotherapy in immediate conjunction with ECT. However, both Zirkle and Mistos agreed that the recovery of learning ability following ECT was relatively rapid. Since no clearly adverse effects of ECT upon learning ability (measured 24 hours post-ECT) were observed the findings of the present study provide further support for the above finding that recovery of learning ability is relatively rapid following ECT. The findings of the present study are not consistent with the finding (Brenghelmann 1959) that (visual) learning ability is impaired following a single ECT. The differences between the present findings and those of Brenghelmann's study may be at least partly due to the different modes of learning investigated - verbal learning in the present study as compared with visual learning (involving the reproduction of designs) in Brenghelmann's study.

In view of the widespread clinical conviction that ECT facilitates psychotherapy it is rather surprising that, to date, no experimental study has been able to quantitatively express these gains.

The present serial learning findings can be explained a number of ways.

Firstly, the significant overall improvement in the serial learning scores: Since the degree of improvement found was almost identical in both groups it is considered likely that the improvement is reflective largely of the effects of practice. This interpretation is supported by the observation that in the testing situation

several of the S's in both groups were uncertain as to the requirements of the serial learning task despite repetitions of the instructions. However, of greater interest is the failure of ECT to produce the predicted improvement in serial learning scores.

Again it is possible that there are two opposing effects of ECT which serve to negate one another. Indeed, Scherer (1951) in commenting upon the findings of a study involving the administration of a battery of tests prior to and following a course of ECT offers a similar explanation to the above.

'If the experimental group enjoys a general beneficial result from the shock treatment, a more reality-bound, less labile emotional level, and if the generally facilitating effect upon intellectual performance of such therapeutic progress is acknowledged, then, in view of the absence of improved ... test results on the post shock batteries, we may hypothesize the possible deleterious effects of BST <sup>(1)</sup> (p.433)'.

It may also be as was suggested earlier, that the beneficial effects of ECT are independent of the effects of ECT upon serial learning. If this interpretation is valid then the serial learning task used in the present study was clearly not measuring the facilitative effect of ECT with respect to psychotherapy.

#### GENERAL DISCUSSION

On the basis of past research evidence a large number of quite different explanations could have legitimately been offered for each of the present findings. The existence of large numbers of widely divergent and even contradictory claims as to the effects of ECT point to the difficulties associated with ECT research. Campbell, (1960) in reviewing the ECT literature remarked 'At present

largely because of methodological weakness, the psychological findings do not lend themselves to any exact specification of the changes wrought by ECT. (p.627)'.

Some of the more general difficulties inherent in ECT research were outlined in the introduction. The present study was geared toward overcoming these difficulties in-so-far as this was possible within the research environment. The result was that two relatively similar groups of patients were obtained - the degree of similarity actually being much greater than that achieved between experimental and control conditions by many other ECT researchers. However, the control group employed in the present study was inadequate for several reasons.

Firstly, there must have been some subtle differences between the diagnoses of the S's in groups E and C for only the S's in Group E to be administered ECT.

Secondly, and probably more importantly, there is much more involved in ECT than a simple electrically induced convulsion. Some of the more significant effects stemming from the administration of ECT are as follows:-

(a) The patients expectation of improvement which is fostered both by the rather involved procedure of receiving ECT (abolishment of meals prior to and following ECT, the application of salt solution, anaesthetics, etc.) and by the psychiatric insistence that the treatment is effective.

(b) The attention factor: Patients receiving ECT command more staff attention than those not receiving ECT. Further, it is likely that the increased staff attention following ECT would consist mainly of selective positive reinforcement for the behaviours displayed by the patients that are construed of as being appropriate to the ameliorative effects of ECT.

Clearly, many of the so called controlled ECT studies were not properly controlled for the situational and expectancy factors involved in ECT administration. Campbell (1960) comments 'Indeed the literature which is at first sight large and varied can be made to vanish altogether if one insists that a placebo treatment should form part of an experimental design (p.620)'. With pseudoshock the effects of the convulsion itself can be examined independently of the other abovementioned factors. In view of the gains to be had from this experimental refinement it is surprising that use has not been made of pseudoshock.

Ideally in ECT research, it would be desirable to control for the diagnostic differences between ECT and non-ECT groups of patients. To achieve this goal, it would be necessary to withhold ECT from a group of patients assessed as requiring ECT. In this way the specific effects of ECT could be investigated and the natural recovery rate of patients selected for ECT be estimated.

We might ask why haven't these apparently obvious difficulties in ECT research been overcome by previous researchers. The answers to this question would appear to lie in part with the traditions of psychiatric hospital practice. Under present hospital conditions it is virtually impossible to conduct exacting ECT research. At the crux of the problem is the implicit and unquestioning faith held by medical and nursing staff alike in the efficacy of ECT.

In conducting the present research, the author expressed the view, to several members of the Tokanui Medical Staff that were ECT to be withheld from selected patients for a sufficient time to allow the establishment of baseline test data (i.e. two spaced sessions using the R.T. and serial learning tests) a much

more accurate measurement of the effects of ECT would ensue. (Since most S's in Group E received their first ECT within two or three days of admission this would have meant a weeks delay in receiving the first treatment.) The response from the Medical Staff was that such a procedure would be unethical on the grounds that they had no right to deny any patient treatment in order to facilitate research. By appealing to medical ethics, the Medical Staff at Tokanui Hospital evidenced an implicit acceptance of the positive efficacy of ECT and in so doing effectively prevented the addition of a useful refinement to the present research.

In addition to the medical faith in the efficacy of ECT there are additional difficulties to be encountered in conducting ECT research in the hospital environment. It appears that in general the psychiatric hospital routine is not geared toward the conducting of research.

In the present study when the subject of pseudoshock was mentioned, the Medical Staff agreed as to its desirability as an experimental condition but made it clear that they did not have the time available to co-operate by adopting this procedure.

Similarly, in the present study no really useful control for the effects of drugs could be employed. Since again it would have been 'unethical' to withhold drug administration in order to facilitate research. As there are wide variations in drug type and in level of intake between different S's and because the specific effects of many of these drugs are not well documented, the possibility that the present findings reflect the separate effects of drugs, rather than of ECT, should not be discounted. On this point, one can only rely on the aforementioned statement that within the psychiatric hospital ECT is considered an

addition to, rather than a substitute for, drug treatment.

Finally, the patient's hospital status, whether informal or committed, can have implications for ECT research. While committed patients (Mental Health Act 1969) are subjected to a course of treatment and discharged at a time considered appropriate by the Medical Staff, informal patients are under no obligation to remain at the hospital and may discharge themselves at their own discretion and, as it frequently happens, against the advice of Staff. Thus the patient's status may have considerable bearing on the length of stay at the hospital and upon the types of treatment received. The implication of status for ECT research is that patients of similar diagnosis but of different hospital status may receive quite different treatments. In the present study it was hoped that the approximate equating of Groups E and C with respect to hospital status may have controlled for the possible influence of hospital status upon treatment.

It can be seen then, that the psychiatric hospital ideology serves to raise serious methodological barriers to effective ECT research. Until these barriers are lifted, the findings of psychological investigations of the effects of ECT are likely to remain tentative in nature.

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### SUMMARY AND CONCLUSIONS

In the present study the effects of ECT upon simple visual reaction time and upon serial anticipation learning were assessed using a repeated measures experimental design. The above two tests were used in the present study for the following reasons :-

- (a) To provide an objective correlate to the psychomotor slowness reportedly associated with psychiatric disturbances
- (b) To assess the claim that ECT facilitates psychotherapy.

On the basis of the claim that ECT is effective in both overcoming psychiatric illnesses and in rendering the patient more amenable to psychotherapy an improvement in the test scores of the group receiving ECT was predicted. However, the results did not indicate any improvement in test scores that could be attributed solely to the effects of ECT. Over the testing period a significant improvement in serial learning scores was found for both groups but it was felt that this improvement could have resulted from a practice effect. Two explanations have been offered for the present findings. The failure of ECT to effect an improvement in the test scores may suggest that there are two separate effects of ECT therapeutic and deleterious that may operate so as to negate one another. Alternatively, it is possible that the effects of ECT upon mood and upon test performance are quite independent of one another.

Two obvious methodological deficiencies of past ECT research have been the failure to control for differences in diagnosis between ECT and control groups and for the situational effects associated with the administration of ECT.

These deficiencies of ECT research seem to stem

from restrictions placed upon research by the psychiatric hospital environment.

The hypotheses adopted for the present study predicting an improvement in reaction time and serial learning concurrently with the administration of ECT were not supported by the findings. Thus, it would appear that ECT does not reduce psychomotor retardation or facilitate learning and therefore presumably psychotherapy.

In view of likely 'Hawthorne effect', created by the ECT administration procedure, which should operate to improve clinical condition during a course of ECT, it is all the more surprising that no such improvement, as evidenced in the test scores, was found in the present study. It appears that further research in this area is required.

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RECOMMENDATIONS FOR FURTHER RESEARCH

The findings of the present study have indirectly questioned the efficacy of ECT. Since the evidence from animal research points to the deleterious effects of ECS, and as no study to date has been able to demonstrate that ECT is efficacious, the number one priority for further research would appear to be the thorough investigation of therapeutic efficacy of ECT. In order that such an investigation be effective, it is clear that a high degree of co-operation between researchers and psychiatric staff would be required. Until a high degree of co-operation has been achieved ECT research will continue to be plagued with the methodological problem alluded to earlier.

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APPENDIX TABLE I

HOSPITAL DIAGNOSES OF GROUPS E & C

GROUP E

S1	Reactive Depression
S2	Paranoid Schizophrenia
S3	Depressive Psychosis and obsessive-compulsive reaction
S4	Reactive Depression
S5	Schizo-Affective disorder
S6	Psychotic Depressive reaction
S7	Psychotic Depression
S8	Depression
S9	Schizophrenic acute attack
S10	Depressive Neurosis

GROUP C

S1	Neurotic depression
S2	Manic depressive reaction
S3	Chronic Schizophrenia
S4	Reactive depression
S5	Reactive depression
S6	Depressive Psychosis
S7	Schizo-Affective disorder
S8	Schizophrenic defective state
S9	Anxiety depression
S10	Probably a catatonic episode



APPENDIX TABLE II (A)

cont.

SUBJECTS	mg.	DAYS															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
S7																	
			TEST	ECT			ECT		ECT	TEST	ECT		ECT		ECT	TEST	
Amitriptyline	"	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
Lurmil	"	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	
Valium	"					20	20	20	20	20	20	20	20	20	20		
Melleril	"					100	100	100	100	100	100	100	100	100	100	100	
Largactyl	"												150	150	150	150	
S8			TEST	ECT			ECT		TEST	ECT		ECT		ECT	TEST		
Ismelin	"	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
Summontil	"	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	
S9			TEST	ECT					ECT	TEST	ECT		ECT		TEST		
Largactyl	"	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	
Phenergan	"									50	50	50	50	50	50	50	
S10			TEST	ECT		ECT		ECT	TEST	ECT		ECT		TEST			
Amitriptyline	"	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	
Ismelin	"	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	

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APPENDIX TABLE II (B)

cont.

<u>SUBJECTS</u>		<u>DAYS</u>															
GROUP C	mg.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
S7			TEST							TEST							TEST
Nortryptiline	"											75	75	75	75	75	75
Fuinal	"		400	400	400	400	400	400	400								
Sodium Amytal	"								400								
Trilafon											2	2	2	2	2	2	2
S8			TEST							TEST							TEST
Melleril		200	200	200	200												
Cogentin	"		1		1		1		1		1		1		1		1
Jectofer	"										2	2	2	2	2	2	2
S9			TEST							TEST				TEST			
Sodium Amytal	"	400	400	400	400	400	400	400	400	400	400	400	400				
S10			TEST							TEST							TEST
Stelazine	"							10	10	10	10	10	10	10	10	10	10
Disipal	"							100	100	100	100	100	100	100	100	100	100

.....

APPENDIX TABLE III

LISTS OF NONSENSE SYLLABLES USED IN LEARNING TASK

LOY	BUR	NIG
HAZ	YAJ	FAM
NUG	VIN	DET
VIC	TEX	SOV
JOK	MUF	WIL
MED	HOS	PAC
SUB	QIL	RUJ

NOTE The first syllable in each column served as a stimulus only.

APPENDIX TABLE IV

INSTRUCTIONS TO SUBJECTS

After being advised (vaguely) of the purposes of the testing S's were given the following instructions as preparation for the administration of the tests.

(a) Reaction Time

E, 'Now we have a very simple task which should not take long at all. I want you to place your forefinger (of dominant hand) on this key and at the same time watch this black box here for a light to come on. As soon as you see the light come on, I want you to press the key as quickly as you possibly can. I will say 'ready' some time before the light will appear so as soon as you hear 'ready' pay your full attention to the box. Shall we try this just a couple of times so that you are quite sure of what you have to do.'

At this point several practice trials were given to ensure that S's had fully grasped the instructions. Before the trials proper began, S's were given the final instruction, 'Remember it is very important that you press the key as quickly as you can as soon as the light appears.'

'Are there any questions?'

(b) Serial Anticipation

E, 'This task is quite different from the one you have just done. This time you are going to be given a list of meaningless three lettered words (hereafter referred to as 'words') which will appear briefly one at a time in this space (E pointing to window of memory drum apparatus where the stimulus word was showing). When we run through the list, I want you to tell me aloud what each word is that is going to come up next, just after

the one showing, before you can see it, it is no good telling me the word after you have seen it. Of course, as you have no idea what the words are at the moment, we will run once through the list before you get started. If you can't tell me any of the words on the second run through, make sure that you keep your eyes on the list so that you can pick up some for the next run through. At the head of each list, a word will be showing (Stimulus nonsense syllable) - before I start the machine, I will ask you what comes after this word (one of Loy, Bur, Yaj) and you tell me what it is if you know then I will start the machine'.

'Now remember that you have to say the word aloud just before it appears; if you dont know the word, pay attention to it when it does appear so that you may get it for the next run through.'

'Are there any questions?'

'At this time, S's were given one exposure of the list and if no questions then were forthcoming the trials proper were commenced. If S's at any stage appeared to be experiencing difficulty with the task relevant parts of the instructions were reiterated during the running of the trial.

APPENDIX TABLE V

(a) Mean visual reaction time scores.

	<u>TEST NO</u>		
	1	2	3
GROUP E	2.60	2.28	2.22
GROUP C	2.48	2.35	2.39

(b) Serial learning scores: Equated for number of trials with three correct.

	<u>TEST NO</u>		
GROUP E	5.88	4.11	4.80
GROUP C	6.30	4.50	4.40

(c) Serial learning scores: Equated for number of items correct at fourth trial.

	<u>TEST NO</u>		
GROUP E	1.4	2.5	3.2
GROUP C	2.3	2.4	2.9

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REFERENCES

- ALEXANDER, L. The effect of electroshock on a 'normal person under recent stress: an experiment elucidating the influence of electroshock on the defensive operations of the ego. American Journal of Psychiatry 1953, 109, 696-698.
- BECK, A.T. Depression; clinical, experimental and Theoretical aspects, New York 1967 Hoeber Medical Division.
- BALLIN R.A. Paired associate learning in depressive patients receiving electro-convulsive therapy, Unpublished Thesis M.A. Psychology; University of Canterbury 1964
- BRAUN, H.W., PATTON, R.A., AND BARNES, H.W. Effects of electroshock convulsions upon the learning performance of monkeys. 1. Object quality discrimination. Journal of Comparative and Physiological Psychology 1952, 45, 231-238
- BRAUN, H.W., PIERCE, J.F., PATTON, R.A. Learning performance of young rats subjected to convulsive and subconvulsive electric shocks The Journal of Psychology 1950, 37, 81-84
- BRAUN, H.W., RUSSELL, R.W., AND PATTON, R.A. Duration of decrements in learning and retention following electroshock convulsions in the white rat. Journal of Comparative and Physiological Psychology 1949, 42, 87-106.
- BRENGELMANN, J.C. The effect of repeated electroshock on Learning in Depressives Heidelberg, Springer, 1959
- BRILL, N.O., CRUMPTON, E., EIDUSON, S., GRAYSON, H.M. HELLMAN L.I., AND RICHARDS, R.A. Relative effectiveness of various components of electroconvulsive therapy. An experimental study. A.M.A. Archives of Neurology and Psychiatry 1959, 81; 627-635.
- BROWER, D., AND OPPENHEIM, S. The effects of electroshock

- therapy on mental functions as revealed by psychological tests, The Journal of General Psychology 1951, 45, 171-188
- BROWN, W.L., AND SIMPSON, A.D. Electroconvulsive shock the the learning of visual patterns, Journal of Genetic Psychology 1956, 89, 213-220
- CAMPBELL, D. The psychological effects of cerebral electroshock in Eysenck, H.J. (ed) Handbook of Abnormal Psychology 1960 London Pitman
- COSTELLO, C.G., BELTON G.P., ABRA, J.C., AND DUNN B.E. The amnesic and therapeutic effects of bilateral and unilateral ECT, British Journal of Psychiatry 1970, 116, 69-78
- DILLON, D.J. The variation of choice reaction time among groups of hospitalized psychiatric patients The Journal of Psychology 1961, 52, 105-114
- ERIKSEN, C.W., PORTER, P.B., AND STONE, C.P. Learning ability in rats given electroconvulsive shock in late infancy, Journal of Comparative and Physiological Psychology 1948, 41, 144-154.
- ERWIN, E.F., AND HAMPE, E. Assessment of perceptual-motor changes following electroshock treatment, Perceptual and Motor Skills 1966, 22, 770.
- FISHER, K.A. Changes in test performance of ambulatory depressed patients undergoing electroshock therapy, Journal of General Psychology 1949, 41, 195-232.
- FOULDS, G.A. Temperamental differences in maze performances: II. The effect of distraction and of electroconvulsive therapy on psychomotor retardation, British Journal of Psychology, 43, 33-41, 1952
- GARRON, D.G. AND CHEIFETZ, D.I. ECT and Bender Gestalt test performance, Perceptual and Motor Skills 1968, 26, 9-10.
- GELLER, M.R. Studies on Electroconvulsive Therapy 1939-1963 - a selected annotated bibliography Public Health Service Publication No. 1447  
U.S. Department of Health, Education and Welfare

- GERSHMAN, H Psychological factors in shock therapy  
Psychiatric Quarterly 1950, 24, 300-308
- GRAY, JOHN E. An investigation of certain prognostic  
measures in the electroconvulsive treatment of  
depressed patients, Unpublished Thesis M.A. Psychology  
University of Canterbury 1964.
- HETHERINGTON, R. Psychological changes due to ECT as  
measured by a battery of tests given repeatedly,  
Journal of Mental Science 1952, 98, 334-341
- HETHERINGTON, R. The effects of ECT on the drawings of  
depressed patients, Journal of Mental Science 1952,  
98, 450-453.
- HETHERINGTON, R. The effects of ECT on the efficiency  
and retentivity of depressed patients, British  
Journal of Medical Psychology 1956, 29, 258-269.
- HILGARD, E.R. Methods and procedures in the study of  
learning. In S.S. Stevens (Ed) Handbook of  
Experimental Psychology New York: Wiley, 1951  
P;. 517-567.
- HILL, L.B. AND PATTON, J.D. When physical therapy (shock)  
facilitates psychotherapy, American Journal of  
Psychiatry 1956, 113, 60-65
- JANIS, I.L. Psychologic effects of electric convulsive  
treatments: II Changes in word association reactions,  
Journal of Nervous and Mental Disease, 1950, III,  
383-397.
- JANIS, I.L. Psychologic effects of electric convulsive  
treatments: III changes in affective disturbances,  
Journal of Nervous and Mental Disease, 1950, III,  
469-489
- JANIS, I.L., AND ASTRACHAN, M. The effects of electrocon-  
vulsive treatments on memory efficiency, Journal  
of Abnormal and Social Psychology, 1951, 46, 501-511.
- KARAGULLA, S. Evaluation of electric convulsive therapy  
as compared with conservative methods of treatment  
in depressive states, Journal of Mental Science

- 1950, 96, 1060-1091.
- KALINOWSKY, L.B. & HOCK P.H. Shock Treatments, Psycho-Surgery (2nd Ed) New York, Grune and Stratton, 1952
- KORIN, H., FINK, M., KWALWASSER, S. Relation of changes in memory and learning to improvement in electroshock  
Confinia Neurologica, 1956, 16, 88-96.
- KORNGOLD, M. An investigation of some psychological effects of electric shock treatment, American Psychologist 1953, 8, 381-382.
- LANDIS, C., DILLON, D., AND LEOPOLD, J. Changes in flicker fusion threshold and in choice reaction time induced by electroconvulsive therapy, The Journal of Psychology 1956, 41, 61-80.
- LINN, L., AND ROSEN, S.R. Brief shock therapy .. an adjuvant to psychotherapy, Psychiatric Quarterly 1950, 24, 506-514.
- MCDONALD, DAVID, AND STERN, J.A. Effects of a series of 5 and 15 ECS on concurrent learning of a simple runway, Psychological Reports, 1958, 4, 535-542.
- MICHAEL, S.T. Impairment of mental function during electric convulsive therapy, A.M.A. Archives of Neurology and Psychiatry, 1954, 71, 362-366.
- MILLER, E. Psychological theories of ECT: A Review, British Journal of Psychiatry 1967, 113, 301-311.
- MILLER, EDGAR, The effects of ECT on memory and learning, British Journal of Medical Psychology 57-62, 43 1 1970.
- MISTOS, S.B. Learning in the Post-Electroshock Period Journal of Clinical Psychology, 1960, 16, 187-188.
- MONTAGU, J.D., AND DAVIES, L.S. Electrical treatment of anxiety states, Journal of Mental Science 1955, 101, 577-592.
- MUHLHAN, G.J., AND STONE, C.P. Effects of electroconvulsive shocks on rat behavior in a dashiell-type of water maze, Journal of Comparative and Physiological Psychology, 1949, 42, 17-26.

- NORRIE, M.L. Effect of practice on true score and intra-individual variability for reaction and movement times for simple and complex movements, The Research Quarterly, 1966, 38, 457-467.
- PASCAL, G.R., AND ZEAMAN, J.B. Measurement of some effects of electroconvulsive therapy on the individual patient, Journal of Abnormal and Social Psychology, 1951, 46, 104-115.
- PORTER, P.B., AND STONE, C.P., AND ERIKSEN, C.W. Learning ability in rats given electroconvulsive shocks in late infancy. Part II. Journal of Comparative and Physiological Psychology, 1948, 41, 423-431.
- PRONKO, N.H. SITTERLY, R., AND BERG, K. Twenty years of shock therapy in America, 1937-1956: an annotated bibliography, Genette Psychology Monographs 62, 1960 (Second half).
- PUMROY, D.K., AND KOGAN, W.S. A validation of measures that predict the efficacy of shock therapy, Journal of Clinical Psychology, 1958, 14, 46-47.
- RUSSELL, R.W. Effects of electroshock convulsions on learning and retention in rats as functions of difficulty of the task, Journal of Comparative and Physiological Psychology, 1949, 42, 137-142.
- SCHERER, I. The effect of brief stimulus electroconvulsive therapy upon psychological test performances, Journal of Consulting Psychology, 1951, 15, 430-434.
- SCHERER, I. Prognoses and Psychological Scores in Electroconvulsive therapy, psychosurgery and Spontaneous Remission, American Journal of Psychiatry, 1951, 107, 926-931.
- SHAPIRO, M.B., CAMPBELL, D., HARRIS, A., AND DEWSBERY, J.P. Effects of ECT upon psychomotor speed and the 'deterioration effect' in depressed psychiatric patients, Journal of Mental Science, 1958, 104, 681-695.

- STONE, C.P. Characteristic losses and gains in scores on the Wechsler Memory Scales as applied on psychotic patients before, during and after a series of electroconvulsive shocks, American Psychologist 1946, 1, 245.
- STONE, C.P. The course of change in intellectual functions associated with electroconvulsive shock, American Psychologist, 1946, I, 449-450.
- STONE, C.P. Losses and gains in cognitive functions as related to electroconvulsive shocks, Journal of Abnormal and Social Psychology, 1947, 42, 206-214.
- STONE, C.P., AND BAKHTIARI, A.B. Effects of electroconvulsive shocks on maze relearning by albino rats, Journal of Comparative and Physiological Psychology, 1956, 49, 318-320.
- TATTAN, J.V. Effects of electroshock convulsions on learning in rats as a function of age Journal of Comparative and Physiological Psychology, 1957, 50, 405-407.
- THOMAS, HOBART F., AND STONE, CALVIN P. Maze performance of Albino rats under influence of dilantin sodium white subjected to electroshock The Journal of Psychology, 1952, 33, 127-132.
- TSAI Loh Seng and PEREZ, VERNON J. Effects of insulin, metrazol, and electroconvulsive shocks upon learning to learn 30 successive reversal problems by rats Psychological Reports, 1970, 26, 551-558.
- WILCOX, K.W. Perceptual motor changes following electroconvulsive therapy, Confinia Neurologica 1952, 12, 337-342.
- WINER, B.J. Statistical Principles in Experimental Design McGraw-Hill Book Co. New York, San Francisco, Toronto, London, 1962
- WITTMAN, M.P. AND RUSSELL, J.T. Mental efficiency levels before and after shock therapy, The Journal of General Psychology 1942, 26, 3-17.

WOODWORTH, R.S., AND SCHLOSBERG, H. Experimental Psychology  
Holt, Rinehart and Winston Inc. 1954.

ZIRKLE, G.A. Learning in the immediate post shock period  
Journal of Consulting Psychology 1956, 20,  
399-402.

ZUBIN, J. Psychological changes in patients receiving  
electric shock therapy, American Psychologist,  
1946, 1, 461.

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FOOTNOTE

1. BST differs from conventional ECT in that it uses a square wave of very low pulse duration. In all other respects the treatments are comparable.

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