Control of visual imagery in mental disorder

Costello, Charles G.

CONTROL OF VISUAL IMAGERY IN MENTAL DISORDER

by

Charles G. Costello B.A.

Candidate for the M. Sc. degree April, 1957.

C O N T E N T S

Page

Acknowledgements.....

PART ONE.

Chapter 1. The Development of the Project..... 1

Chapter 2. The Plan of the Project and Results obtained..... 5

Chapter 3. Discussion of the Results..... 21

PART TWO.

Chapter 1. A Review of the Work Relating the Alpha Rhythm to Imagery Processes..... 26

Chapter 2. Design of the Experiment and Experimental Results.... 30

Chapter 3. Discussion of the Results..... 42

PART THREE.

General Discussion and Conclusions..... 46

Appendix..... 50

Bibliography..... 122

ACKNOWLEDGEMENTS.

I wish to thank Dr. J. R. Murray, Medical Superintendent, St. George's Hospital, Morpeth, for permission to carry out this work, and Professor F.V. Smith for his supervision of the work. I also wish to thank the Consultant Psychiatrists at St. George's - Drs. Irwin, Easton and McDonald [illegible] for their assistance in selecting suitable cases. Thanks are due also to the normal subjects - mainly nurses and student nurses at St. George's - who co-operated so willingly.

I also wish to thank Mr. Peter McGregor, Senior Recordist, EEG Dept., St. George's for his technical advice and assistance throughout the EEG experiment.

Finally thanks are due to my wife for her assistance with the statistical computations and even more for her encouragement throughout the development of this research project.

PART ONE.

Chapter 1.

THE DEVELOPMENT OF THE PROJECT.

In this thesis is presented a further stage in the work started by Gordon (8) added to by Petrie (17) and continued by Costello (2). It may be considered an extension of the work done by Jaensch on eidetic imagery though it is not directly concerned with eidetic imagery.

In her first investigation Gordon found that two different kinds of imagery processes existed on the basis of which people could be divided into two contrasting groups. "On the one hand there were people whose imagery tended on the whole to be 'autonomous' that is to say, the images which they experienced were relatively independent of any volitional control that they might wish to exert... The other group, in contrast, consisted of persons whose images appeared to be part of a more or less integrated functioning of personality so that the nature, appearance and disappearance of these images was under the conscious control of the subject. "..... " The importance of this distinction was found to consist in the fact that the nature of the images differed between the autonomous and controlled group, the former being more liable than the latter to produce stereotyped, that is rigid and change-resisting image contents."

In her second investigation Gordon set out to find some more objective

criteria which might corroborate the differentiation of imagery processes. Arguing that perceptual and imagery processes are closely interlinked and interdependent she sought an answer to the problem: "Do subjects with autonomous imagery differ significantly from subjects with controlled imagery in the rate of reversal per unit time on a test of reversal of perspective?". She tested forty two patients and found that according to her criteria, twenty possessed autonomous imagery while twenty two had controlled imagery. As a check on the information each patient had given about his ability to control his images she gave them eleven scenes to image. The scenes all involve a car doing various things like climbing a hill, and crashing through a house. They will be described in full later. Only patients who were capable of imaging everyone of the eleven car scenes were classified as 'controlled' image types. The patients were also tested with the Necker Cube. She found a significant correlation between the type of imagery of a person and the ability to control the rate of reversal so that the subject whose imagery was relatively controlled was capable of exerting more volition in relation to rate of reversal than the autonomous imagery type.

Petrie found that there was an increase in reversals especially willed reversals on the Necker Cube after her subjects had been leucotomised and related this to Gordon's work. She suggested that the patients were better able to control their imagery after operation.

The present investigator in his study on the effects of prefrontal leucotomy obtained data suggesting a centralising tendency after operation on the Moray House Space Test Adv. 1. and the N.I.I.P. Space Test. He also found that, when a group of normal subjects were divided into two groups on the basis of their performance on the Gordon Test of imagery, those with controlled imagery did better on the space tests than those with autonomous imagery. The following explanation was proposed for the centralising tendency after operation on the space tests "..patients who before leucotomy scored low on the space tests had vivid autonomous imagery which was made weaker and more controlled by the operation thus resulting in a higher post-operative score. Secondly, patients who had high scores before leucotomy had weak controlled imagery which was made weaker by the operation. "Data was also obtained supporting Gordon's findings relating the type of imagery - autonomous or controlled - to the ability to control the rate of reversal on the Necker Cube.

It was felt that this controlled-autonomous continuum of visual imagery was worthy of further study. It was decided to investigate the relationships between the continuum and mental disorder. More specifically the project was planned to investigate the differences between the Dysthymic and Hysteric groups of patients. These two groups were chosen not only because they are the two on which the most systematic work has been done, particularly

by Eysenck and his associates (4) but also because this work did give some grounds for expecting a difference between the two groups. On the other hand the hypotheses which this work was planned to test were broad ones and not based directly on the work of Eysenck. It is proposed then to postpone the discussion of his work until later when it can be more profitably done so in the light of the findings to be presented.

It was hoped also to throw some light on the possible differences between normal subjects and psychiatric patients with respect to the autonomous controlled continuum.

The two main questions then that it was hoped to answer were:

(1) Are there any differences between the Dysthymic and Hysteric groups of patients in their ability to control their visual imagery?.

(2) Are there any differences between normal subjects and psychiatric patients in their ability to control their visual imagery?.

CHAPTER 2.

THE PLAN OF THE PROJECT AND THE RESULTS OBTAINED.

Twenty dysthymic patients, twenty hysteric patients and twenty normals were tested. The data relating to age, sex, intellectual capacity and verbal ability are presented in Table 1 below. All the raw data and computations for the results summarised in the body of the thesis will be found in the Appendix.

Table 1.

Data on Age, Sex, Intellectual Capacity and Verbal Ability.

(N = 20 in each group)

Group	Age in Years	Sex (no of subjects)		Matrices Raw Score	Mill Hill Vocabulary Scale Raw Score.
	Mean	M	F	Mean	Mean
Dysthymics	39.55.	10	10	34.25.	49.4.
Hysterics	34.55.	10	10	37.25.	43.85.
Normals	22.10.	6	14	47.25.	48.9.

Raven's Progressive Matrices (1938) was used to assess intellectual capacity and the Mill Hill Vocabulary Scale was used to assess verbal ability. Testing the significance of the difference in mean ages, Matrices Score and Vocabulary score for the three groups, the values of 't' and 'p' shown in Tables 2, Table 3 and Table 4 are obtained.

Table 2.

Values of 't' and 'p' for differences in mean age for the three groups.

	Hysterics	Normals
Dysthymic	t = 1.35. p > .05.	t= 5.719. p < .01
Normals	t = 4.346 p < .01	———

Table 3.

Values of 't' and 'p' for differences in Mean matrices score for the three groups.

	Hysterics	Normals.
Dysthymics	t = 1.09 p > .05.	t = 5.035 p < .01
Normals	t = 3.479 p < .01	———

Table 4.

Value of 't' and 'p' for differences in mean vocabulary scores for the three groups.

	Hysterics	Normals
Dysthymics	t = 1.88. p ≥ .05.	t = .1720. p ≥ .05.
Normals	t = 1.646 p > .05.	———

It will be seen that the two neurotic groups do not differ significantly in age, Matrices score, or Vocaulary Score. The normal group is significantly younger than the two neurotic groups and gets a significantly better mean score than the two neurotic groups on the Matrices Test. The bearing these differences have on the rest of the data will be discussed later. It may be pointed out here however, that the circumstances of the investigator made it difficult for him to obtain normal subjects of the same age and intelligence as the neurotics. It will be noted in this connection that there are far more females than males in the normal group. This too was unavoidable and will be discussed more fully later.

The basic data for the three groups having been presented, the groups will now be described in more detail, the procedure will be outlined and the rest of the results will be presented.

The 20 Normal Subjects.

The normal group consisted of members of the nursing staff of St. George's Hospital with one exception, this being a fourth year medical student. They were requested to avoid discussing their interviews with their friends. Apart from the fact that they were not given a Rorschach test the procedure adopted for them was exactly the same as for the neurotic groups.

The 40 Neurotic subjects (20 Dysthymics, 20 Hysterics)

All the neurotic subjects were in-patients at St. George's Hospital or out-patients at one of the clinics attached to the hospital. The Consultant Psychiatrists were asked to refer all neurotic patients who could be classified as Hysterics or Dysthymics.

No patient was used who had any evidence or history of psychotic features, brain injury or epilepsy or who had received any form of psychosurgery. No patient was used who had started ECT or insulin.

The patients were included included in the Dysthymic group if they could be diagnosed as having one or more of the following characteristics: manifest anxiety, reactive depression, obsessive compulsive features. They were included in the hysteric group if the psychiatrists could diagnose them as having one or more of the following characteristics: hysterical personality, conversion symptoms, hysteria, psychopathic personality.

All the patients were given the Rorschach which was administered scored and interpreted according to the method described by Klopfer (13). There was complete agreement between the classification - Dysthymic or Hysteric - decided upon by the psychiatrist and that based on the Rorschach results. It should be pointed out that the Rorschach protocols were not interpreted blindly but with the full knowledge of the

case history which fact helped to produce the complete agreement. Though the experience balance was of course given much weight when deciding into which neurotic groups the patients should go it was decided that at this stage of the research on the control of visual imagery no attempt should be made to minimize overlap between the neurotic groups along the dimension of introversion-extraversion by the use of Scales such as Guildford's R Scale (9).

All the patients were co-operative throughout the testing.

Procedure.

All the subjects were seen at two sessions, both sessions for each subject taking place within the same week.

During the first session all the subjects were given the Matrices test and the Mill Vocabulary Scale. These tests were followed by the Rorschach test in the case of the two neurotic groups.

During the second session all subjects were first of all given the N.I.I.P. space test (Group Test 80A). The instructions of the National Institute of Industrial Psychology were followed closely in the administration of the test. It is felt however that by giving the test individually a better understanding of what he had to do was obtained by the subject during the sample tests than is the case when the test is administered to a group.

The space test was followed by the Necker Cube. A card on which was drawn the reversible box pattern was presented to the subject and the

reversal of perspective was described to him until it was felt that he had grasped the idea. He was then told to look at the card for one minute and to tap the table with a pencil each time he noted a change in his perception of the drawing. The rate of reversal during this minute was taken as the subject's normal rate. The subject was next instructed to attempt to increase the number of reversals per minute as much as he could tapping each time there was a change of perspective. Finally the subject was told to reduce the number of reversals per minute as much as he could again tapping each time he noted a change in his perception.

The subject was then given what might be called a standard interview on visual imagery and related processes. At the beginning of the interview the nature of visual images was described to him and illustrated, distinctions such as that between remembering well what a person looked like and getting a visual image of the person being pointed out to him. The remainder of the interview included the Gordon Test of Visual Imagery, a small multiplication problem to be done mentally and questions on autonomous imagery, hypnagogic imagery, and dreams. The outline of the standard interview can be found in the Appendix and only the Gordon Test of Visual Imagery will be described in full here.

When it was felt that the subject had a clear idea of what was meant by a visual image he was asked to close his eyes and get a visual image of the following scenes simply saying "Yes" if he could get an image of the scene and "No" if he could not:

(1) A car standing in front of a garden gate.

(2) The same car but in a different colour than that seenat first.

(3) The same car lying upside down.

(4) The same car back on its four wheels.

(5) The car running along the road.

(6) The car climbing up a very steep hill.

(7) Climbing across the top of the hill.

(8) Getting out of control and crashing through a house.

(9) The same car running along theroad with a handsome couple inside.

(10) Crossing a bridge and falling into the stream below.

(11) The same car all old and dismantled standing in a car cemetry.

An attempt was made immediately afterwards to discover why the subject had failed, in the case of his failures and to discover if he had any difficulty with any of the scenes he finally managed to image.

RESULTS

Neurotic groups.

In Table 5 below the results on the N.I.I.P. test and the Necker Cube for the two neurotic groups are presented.

Table 5.

The Mean scores on the N.I.I.P. space test and the Necker Cube for the Dysthymics and Hysterics with the 't' and 'p' values for the differences between the means.

(N = 20 in each group)

Group.	N.I.I.P. Raw Score	Necker Normal Score.	Necker Fast Score.	Necker Slow Score.	Necker Fast-Normal Score.	Necker Fast-Slow Score.
	Mean.	Mean.	Mean.	Mean.	Mean.	Mean.
Dysthymics.	24.7.	10.75.	16.7.	5.8.	7.1.	12.05.
Hysterics.	20.4.	16.55.	23.9.	9.6.	7.9.	14.8.
	t = 1.16.	t =2.97.	t=1.87.	t=2.70	t=26	t=78
	$p \geq .05$.	$p < .01$	$p > .05$	$p < .05$	$p > .05$	$p > .05$

From the data presented in Table 5 it can be concluded that:

(1) The difference between the Dysthymics and Hysterics in their performance on the N.I.P.P. space test is not significant.

(2) The Hysterics' normal rate of fluctuation on the Necker Cube is significantly higher than that of the Dysthymics.

(3) The difference between the Dysthymics and Hysterics in their fast rate of fluctuation on the Necker Cube is not significant.

(4) The Dysthymics' slow rate of fluctuation on the Necker Cube is significantly lower than that of the Hysterics.

(5) The two groups do not differ significantly in their ability to vary the rate of reversal as assessed by the differences between the fast rates and the normal rates and between the fast rates and slow rates.

It was found that thirteen of the twenty Dysthymics were unable to visualise all the scenes in the Gordon test according to their reports and seven were able

to do so. Ten of the Hysteric group were unable to visualise all the scenes according to their reports and the other ten were able to do so. But it was also found that with one exception there was a clear cut distinction between the kind of difficulty experienced by the Dysthymics and the kind experienced by the Hysterics. The thirteen Dysthymics who failed on one or more of the scenes reported vivid imagery of an autonomous kind e.g. a vivid picture of a car that would not turn over, or that would not go up the hill" I saw the car and the hill clearly but the car just stayed at the bottom. ", or a car that would not crash into the house" The car kept going by the house and I could not get it to crash". Only one of the Hysterics reported this kind of difficulty. The other nine Hysterics who failed on one or other of the scenes reported weak imagery of an unstable kind e.g. "The car kept coming and going" "I could see the car but not the house" "I could only see the car at first - then I saw the house but the car faded away " "I could see the car but I could not see a couple inside it" Two of the Hysterics said they could not see the car at all.

It was decided to bunch the two neurotic groups together and to see if there were any differences in performance on the tests between the following sub-groups; The vivid-autonomous group (consisting of the fourteen patients - 13 Dysythmics and 1 Hysteric) - who had a strong visual images which they could not manipulate); the weak-unstable group (consisting of nine patients - all Hysterics) who had no visual images or weak ones which they found hard to hold in mind; the controlled groups (consis-

ting of the remaining seventeen patients- 7 Dysthymics and 10 Hysterics) who were able to visualise all the eleven scenes.

Differences between Vivid-autonomous group and Controlled Group.

Table 6.

The Mean ages, and mean scores on the Matrices, Vocabulary Scale, N.I.I.P. Space test and Necker Cube for the Vivid-autonomous group and Controlled group with the 't' and 'p' values for the differences between the means.

Group	Age.	Matrices Raw Score.	Mill Hill Vocabulary Scale Raw Score.	N.I.I.P. Raw Score.	Necker Normal Score.
	Mean.	mean.	Mean.	Mean.	Mean.
Vivid-Autonomous	34.5.	37.93.	46.07.	21.93.	9.71.
Controlled	41.29.	34.29.	50.41.	28	13.76.
	t=1.54. p >.1.	t= .89. p.>.3.	t=1.13. p>.2.	t=1.39. p >.05.	t=2.137. p < .95.
	Necker Fast Score. Mean.	Necker Slow Score Mean.	Necker Fast-Normal Score Mean.	Necker Fast Slow Score Mean.	
Vivid Autonomous	13.36.	5.429.	3.64	8.64.	
Controlled	23.47.	7.295.	9.70.	16.11.	
	t=3.00 p <.01.	t=1.381 p >.1.	t=3.08 p <.01	t=2.37. p<.05.	

From the data presented in Table 6 it can be concluded that

(1) The differences between the two groups in age, intellectual capacity and verbal ability are not significant.

(2) The difference between the two groups on their performance on the N.I.I.P. space test is not significant.

(3) The Controlled group's normal rate of fluctuation on the Necker Cube is significantly higher than that of the Vivid-autonomous group.

(4) The Controlled group's fast rate of fluctuation is significantly higher than that of the Vivid-autonomous group.

(5) The difference between the two groups in their slow rate of fluctuation is not significant.

(6) The Controlled Group are better able to vary the rate of fluctuation than the Vivid Autonomous group the difference between the means being significant for the Fast-Normal scores and the Fast-Slow scores.

Differences between Weak-Unstable group and Controlled group.

Table 7.

The Mean ages and mean scores on the Matrices, Vocabulary Scale, N.I.I.P. Space Test and Necker Cube for the Weak-Unstable Group and Controlled Group with the 't' and 'p' values for the differences between the means.

Group	Age	Matrices Raw Score	Mill Hill Vocabulary Scale Scale Raw Score.	N.I.I.P. Raw Score	Necker Normal Score.
	Mean	Mean	Mean	Mean	Mean
Weak-unstable	32.78.	35.11.	40.33	13.22	19.55.
Controlled	41.29.	34.29.	50.41	28	13.77.
	t=1.96 p >.05.	t=.023 p >.9.	t=2.563 p < .02.	t=2.905 p <.01	t=2.233 p< .05

	Necker Fast Score	Necker Slow Score	Necker Fast-Normal Score	Necker Fast Slow Score
	Mean	Mean	Mean	Mean
Weak Unstable	27.67.	13.11.	8.11.	14.55
Controlled	23.47.	7.29.	9.70.	16.11.
	t=.652 p >.05.	t=3.415 p < .01.	t=1.138. p >.05.	t= .328. p.>.05.

From the data presented in Table 7 it can be concluded that:

(1) The difference between the two groups in age and intellectual capacity is not significant but the Controlled group have a significantly higher vocabulary score than the Weak-unstable group.

(2) The Controlled group's performance on the N.I.I.P. Space Test is significantly better than that of the Weak-unstable group.

(3) The Weak-unstable group's normal rate of fluctuation on the Necker Cube is significantly higher than that of the Controlled group.

(4) The difference between the two groups in their fast rate of fluctuation is not significant.

(5) The Controlled groups slow rate of fluctuation is significantly lower than that of the weak-unstable group.

(6) The Difference between the two groups in their ability to vary the rate of reversal is not significant.

Differences Between the Normal Group and the Neurotic Group.

Table 8.

The Mean scores on the N.I.I.P. Space test and the Necker Cube for the Normals and Dysthymics with the 't' and 'p' values for the differences between the means.

Group.	N.I.I.P. Raw Score.	Necker Normal Score.	Necker Fast Score.	Necker Slow Score.	Necker Fast-Normal Score.	Necker Fast-Slow Score.
	Mean.	Mean.	Mean.	Mean.	Mean.	Mean.
Normals	27.05	22.0	33.95	10.15.	13	24.3.
Dysthymics	24.7.	10.75	16.7.	5.8.	7.1.	12.05.
	t=.586	t=4.063	t=3.762	t=2.69	t=1.586	t=2.505
	p>.05	p<.01	p<.01	p<.02	p>.10	p<.05.
Normals	27.05	22.0	33.95	10.15	13	24.3.
Hysterics	20.4.	16.55	23.9.	9.6.	7.9.	14.8.
	t=1.88	t=2.086	t=2.018	t=.304	t=1.402	t=1.831
	p>.05	p>.05	p>.05.	p>.05	p>.05.	p>.05.

From the data presented in Table 8 it can be concluded that:

(1) The difference between the Normals and Dysthymics and between Normals and Hysterics in the performance on the N.I.I.P. Space test is not significant.

(2) The Normal groups' normal rate of fluctuation on the Necker Cube is significantly higher than that of the Dysthymics but is not significantly different from that of the Hysterics.

(3) The Normals' fast rate of fluctuation is significantly higher than that of the Dysthymics and the Hysterics.

(4) The Normals' slow rate of fluctuation is significantly higher than that of the Dysthymics but is not significantly different from that of the Hysterics.

(5) The differences between the Normals and Dysthymics and the Normals and Hysterics in their ability to vary the rate of reversal from normal to fast rates is not significant.

(6) The difference between the Normals and Dysthymics in varying the rate of reversal from Fast to slow speeds is significant - the Normals having a larger difference between Fast and Slow scores but the difference between the Normals and Hysterics is not significant.

It was found that thirteen of the normal subjects were able to visualise all of the eleven scenes in the Gordon test, two had vivid - autonomous imagery and five had weak-unstable imagery. As a further test of the relationships between control of imagery and performance on the N.I.I.P. space test and Necker Cube it was decided to combine the Normals and Hysterics and to compare the performances of the subjects with controlled imagery and those who had weak-unstable imagery.

Table 9.

The Mean scores on the N.I.I.P. space test and the Necker Cube for the Weak-unstable group and the Controlled group (Combining the Normals and Hysterics).

Group	N.I.I.P. Raw Score	Necker Fast-Normal Score	Necker Fast-Slow Score.
	Mean	Mean	Mean
Weak Unstable	14.40	7.19	13.86.
Controlled	30.57.	13.61	24.57.
	t 6.876 $p < .01$	$p > .05$	$p < .05$.

From the data presented in Table 9 it can be concluded that

(1) The controlled group's performance on the N.I.I.P. space test is significantly better than that of the weak unstable group.

(2) The difference in their ability to change from normal to fast rates of fluctuation is not significant.

(3) The Controlled group is significantly better able to change from Fast to Slow speeds

In view of the fact that the Normals were significantly younger than the two neurotic groups and got significantly better scores on the Matrices and yet did not do significantly better on the N.I.I.P. space test it was decided to calculate the coefficient of correlation between age and N.I.I.P. Scores and Matrices Scores and N.I.I.P. space test scores and for the Normals and Dysthymics and Normals and Hysterics.

Table 10.

Coefficients of correlation between age and N.I.I.P. space test scores and Matrices scores and N.I.I.P. space test scores for the Normals and Dysthymics and Normals and Hysterics taken separately.

Group.		N.I.I.P.	
Normals Dysthymics	Age	-.2084	$p > .05$.
	Matrices	.5067	$p < .01$.
Normals Hysterics	Age	-.1186	$p > .05$
	Matrices	.4976	$p < .01$.

From the data presented in Table 10 it can be concluded that

(1) There is a significant positive correlation between the Matrices scores and N.I.I.P. space test scores.

(2) There is an insignificant negative correlation between age and N.I.I.P. space test scores.

The data from the standard interview, apart from the Gordon test was not in a form that could be statistically or systematically analysed and will be presented during the discussion of the test results already presented.

CHAPTER 3.

DISCUSSION OF THE RESULTS.

One of the most important findings is the distinction between people who are unable to control their imagery because their images are vivid and of an autonomous nature and those who cannot control their imagery because their images are weak and of an unstable nature. The data from the Gordon test suggests that the first type of imagery is usually associated with Dysthymic disorders and the second type with Hysteric disorders. That mental disorder is not a necessary concomitant of inability to control imagery processes is clear from the amount of overlap between the normal and neurotic groups. It may however be a contributory factor

and certainly would seem to play a role in determining the kind of mental disorder to which the individual is prone.

This difference between the autonomous types and unstable types as compared with the controlled types is not based solely on the Gordon Test since we have shown that previous work relating the distinction to control of fluctuation on the Necker Cube has been substantiated and, in the case of comparisons between the weak-unstable group and controlled group, is also reflected in performance on the N.I.I.P. space test - the weak unstable group not doing as well as the controlled group.

Inability to control images is reflected in inability to vary the rate of reversal on the Necker Cube. A further analysis of the data suggests that other measures may indicate to which group - the vivid-autonomous or weak-unstable - the individual belongs.

The vivid-autonomous group have a significantly lower normal rate of reversal than the controlled whereas the weak-unstable groups have significantly higher normal rates of reversal than the controlled group. The vivid-autonomous group has a significantly lower Fast score than the Controlled group whereas the difference between the weak-unstable group and the Controlled group on this measure is not significant. There is no difference between the vivid-autonomous group and the controlled group in their ability to reduce the number of reversals (Slow score) but the

weak-unstable group shows a significantly higher mean slow score than the controlled group.

These findings suggest that the weak-unstable group have generally faster rates of reversals than the vivid autonomous group. If that is the case then we would expect difference between the Dysthymics and Hysterics in absolute rates of reversal - the Hysterics having a faster rate of reversal - and this is what we find (Table 5). It will be seen that they do not differ significantly in their ability to vary the rate of reversal (Fast - Normal and Fast - Slow scores) but the differences on the Normal and Slow scores are significant. There is no difference between their mean scores on the N.I.I.P. as would be expected since both groups have difficulty in the manipulation of their visual images.

It was found that the Normal Group used here was most like the Hysteric group in that five of the subjects had weak-unstable imagery as assessed by the Gordon Test and only two vivid autonomous imagery. This is reflected in the fact that three of the differences on the Necker Cube for the Dysthymics and Normals are significant, whereas none of the differences on the Necker Cube for the Hysterics and Normals are significant. When the Normals are compared with the two Neurotic groups in their ability to vary the rate of reversal it is found that though their scores are higher in every case on the Fast-Normal, Fast-Slow scores only one is significant-that between the mean Fast-Slow scores of the Dysthymics and Normals. This again suggests that the type of imagery indicates more the type of disorder to which the individual may be prone rather than indicating mental disorder itself. This probably accounts

in part for the fact that difference between the two Neurotic groups and the Normal group on the N.I.I.P. space test is not significant. In view of the fact that the Normal group was significantly different from the two Neurotic groups in scores on the Matrices and the fact that there is a significant correlation between the Matrices scores and the N.I.I.P. scores one might perhaps have expected significant difference between the groups due to difference in intelligence. The investigator can find no adequate reason for this though the negative correlation between age and N.I.I.P. scores, though insignificant for the samples studied may be worth further study.

The data from the standard interview did not reveal any differences between the Normals, Dysthymics, Hysterics or between the vivid autonomous, weak unstable and controlled groups in the incidence of dreams reported or the nature of the dreams. None of the subjects claimed a photographic memory or remembered instances of visual phenomena under anaethesia or instances of hynogogic visual imagery. Only one of the subjects remembered a clear cut instance of autonomous visual images. She was a young girl complaining of anxiety and depression and who belonged to the vivid-autonomous group. She had on numerous occasions had a vivid picture of children falling. She tried to see herself saving them but could not do so. This lack of significant data with respect to dream hypnogogic imagery etc. suggests

that they are not directly related, as was previously thought (2) to the daytime visual images studied here. The results obtained in part two of the thesis provide us with a possible explanation for this. Finally it is of interest that the Normal Hysteric and Dysthymics did not differ from one another in the extent to which visual or verbal imagery was reported in the solving of the multiplication problem given during the interview. Chi^2 corrected for continuity was calculated for the groups and was not significant. It is suggested that the two dimensions Controlled-imagery and uncontrolled imagery and vivid - autonomous vs. weak unstable imagery offers more promise than classification into visualists, verbalists etc.

PART TWO.

Chapter 1.

A REVIEW OF THE WORK RELATING THE ALPHA RHYTHM TO IMAGERY PROCESS.

Golla, Hutton and Grey Walter (7) made an attempt to use the EEG as an objective means of assessing imagery. Their subjects were given a number of tasks and the effect of the mental activity on the alpha rhythm was noted. They found large individual differences and concluded that there were three types of thinkers: the M or Minus type whose alpha rhythms were almost non-existent and who used mainly visual imagery in thinking; the P or Persistent type whose alpha rhythms continue even during mental activity; and who used mainly vocal-kinesthetic imagery; the R or Responsive type with a good resting alpha which blocked readily during mental activity and whose imagery was mixed. They used also a plethysmograph and found that the irregular respiratory type was found in subjects with predominantly vocal-kinesthetic imagery and the regular type in subjects with predominantly visual imagery. The main criticism of this work that can be made is that despite their attempt to find an objective measure of assessing imagery an appeal is made to introspection as a validating criterion. A second criticism is that the tasks they give their subject e.g. To think over to themselves the story of Red Riding Hood, to think over their plans for some definite ,

day, to think over the argument for and against some abstract propositions such as honesty is the best policy or the existence of free will - these task are such as to present difficult problems in the way of introspection. It is felt that if an attempt is to be made to find an objective means of assessing imagery some attempt should first of all be made to control the kind of imagery that will be used.

Short (21) published the report of an investigation designed to consolidate the original findings of Golla and his associates. He came to the same conclusions as the previous workers with regard to imagery types but the same criticisms can be made of his work as was made of the earlier investigation.

In a third investigation Short and Walter (22) made a further attempt to get away from dependence on introspective report. Their subjects had to outline with their fingers figures made with grooves in cement blocks. They claim that their results can be discussed in terms of M, P and R types and that the M and P types showed themselves to be more efficient than the R types in that they gave more correct answers when asked to say what the figure was or to draw it and in that they took less time to arrive at their answers. It was suggested that the crucial variable was consistent vs. fluctuating imagery. Here, a stoical attempt to get away from introspection has resulted in findings whose relationships to imagery are very doubtful.

The work of the above investigators remained unchallenged until recently when Drever (3) published some observations on the occiptal alpha rhythm recorded from groups of early blind, late blind and sighted subjects during the performance of two spatial tasks. Since the test scores differentiated between the groups it was argued that the performance probably involved a visual component. Here we have a successful attempt to determine the kind of imagery likely to be used. He found that when the subjects were classified into the three alpha-thythm types M, P and R the groups did not differ significantly from one another in terms of test scores. He regarded this as negative evidence in relation to the hypothesis of M, P and R types. Perhaps even more important than this finding however was the finding that the M type which is supposedly associated with predominant visual imagery was found most frequently among the blind. He concluded that the hypothesis tested is too simple and would have to be reformulated to fit the facts.

The most recent investigation is that of Barratt (1). He also made some attempt to determine the kind of imagery used by the subject. He rejects the 'imagery type' notion for the specific task criterion. "Ideally, " he writes " one task which necessitated visualizing and another which eliminated it would yield data from which the relation between alpha suppression and visualizing could be tested in a crucial fashion ".

Though the ideal could not be attained he did give the subjects a verbal reasoning problem likely to encourage verbalization in its solution and a task that was likely to encourage visualisation. His main finding was that there was a significant suppression of the alpha rhythm during both the verbal reasoning condition and the visual problem condition. There was a greater suppression effect in the case of the 'visual' problem but the results as a whole, he concludes, suggest that visual imagery appears to be only one of many factors that may produce suppression effects.

The classification into P, M and R types then no longer accounts for all the data and there is not a simple one to one relationship between alpha suppression and visualization. On the other hand there is a definite relationship between visualing and suppression of the alpha which demands further investigation. Second, there do seem to be marked individual differences in the behaviour of the alpha rhythm suggesting the possibility of some kind of classification.

In view of the findings in relation to the vividness of visual imagery it was felt that an investigation into the relationships between the vividness of imagery and the suppression of the alpha would be worthwhile. That this is a profitable line of work was indicated not only by the work suggesting important individual differences in the vividness and control of imagery but also by the work of Pavlov (16) Eysenck (4) Franks (5) and Shagass and Naiman (20) on cortical inhibition and excitation and

their behavioural counterparts. More recently the work of Gastaut and his associates (6) suggests a close relationship between cortical inhibition and excitation and the alpha rhythm. A discussion of all this work will be postponed until the results of the present experiment have been presented.

The problem to be investigated was formulated in a broad manner thus; Is there any relationship between the vividness of visual imagery and the amount of alpha suppression?.

CHAPTER 2.

Design of the Experiment and the Experimental Results.

The experiment was designed to investigate the relationship between vividness of visual imagery and amount of alpha suppression in two different ways. First of all by getting the subjects to visualise four completely different things chosen for the probable differences in the vividness of the imagery they would provoke. Secondly by comparing the different effects of visualization under normal conditions and in a drowsy stated induced by a small dose of Seconal. The work of Leaning (14) McKellar and Simpson (15) and others on hypnagogic imagery suggested the possibility that visualisations during the drowsy state would be more vivid than in the normal state.

Subjects.

The twenty normal subjects used in the first part of this study were also used for the experiment to be reported. They were seen within a week after they had completed the testing reported in the first part. The second Seconal session took place within two to three days after the first Normal session. All the subjects having been instructed previously about visual imagery knew exactly what was wanted of them during the experiment. They were asked not to discuss the experiment with their friends and did not know the purpose of the experiment beyond the fact that we were interested in changes in EEG when they were asked to visualise something.

Procedure.

First Normal Session.

The experiment was conducted in the EEG department of St, George's Hospital, Morpeth. The subjects were reassured that they would feel nothing when the record was being taken. The apparatus used was the standard eight-channel Ediswan Mark II EEG and an Ediswan eight-channel automatic wave analyser. The electrodes were fitted. A bipolar arrangement was used consisting of a chain of three electrodes on each side Mid-parietal - parieto-occiptal - occipital areas. The channel analysed was the one showing the maximum alpha amplitude during the eyes closed condition.

The following instructions were then given:

"During the recording you will have to open and close your eyes a number of times. I want you to listen carefully to the instructions because it is important that you have your eyes open or closed at the right time. Remain relaxed and still throughout the recording and do not say anything unless I ask you a question".

A trial run was then taken consisting of thirty seconds with eyes closed, and thirty seconds with eyes open. The purpose of the trial run was to establish a basic maximal measure for each subject with which the measure during the visualizing conditions could be compared.

At the end of the trial run the subject was shown a coloured photograph 10" x 8" of a Ford Consul. He was told to examine it carefully so that afterwards he would be able to get a good picture of it in his mind. After three minutes the photograph was taken from him. He was then told to relax and try to keep his mind a blank except when the experimenter asked him to get a picture of the car. He was then to remain relaxed but to get the best picture he could. The subject was then told to close his eyes and the EEG record commenced. After thirty seconds the subject was told to get a picture of the car. Each visualizing condition was planned to start at the beginning of the analyser's 10 sec epoch and was also indicated with an input marker. After thirty seconds the subject was told to forget the picture and after a further ten seconds

the subject was told to open his eyes. He was then given a card with the following six possible descriptions of his visual image and told to choose the one that he felt best described his image:

(1) Very clear almost like a photograph.

(2) Clear with definite shape.

(3) Moderately clear with some detail.

(4) Not very clear - only a general impression.

(5) Very vague - hardly any picture at all.

(6) Absent altogether.

After he had done this the subject was shown an abstract diagram for five seconds. A reproduction of the diagram which is the same size as the original appears in the Appendix. The subject was told to look at it carefully since he would be shown it for only five seconds and afterwards would be required to get a picture of it.

When the five seconds had elapsed the diagram was taken away, The subject was given the same instructions as before with regard to remaining relaxed and keeping his mind a blank except when visualising. He was then told to close his eyes, the EEG record was commenced and the procedure was exactly as before except that this time he was asked to get a picture of the diagram. He was afterwards asked to choose the best description of his picture from the card.

The following instructions were then given to the subject:

"In a few seconds I will ask you to close your eyes and get a picture of a scene. Try your best to get the picture but remain relaxed. After you have started getting the

picture in your mind you will hear a buzzer. This is a signal that a watch is going to be held near your ear. When you hear the buzzer I want you to keep the picture in your mind and at the same time try to listen to the ticking of the watch. A second buzz will be a signal that the watch has been taken away".

The subject was then told to close his eyes and the EEG record was commenced. After thirty seconds he was told to get a picture in his mind of a red United bus turning into the Morpeth Market Place, stopping and all the people getting out of it. Thirty seconds later a buzzer was sounded and a watch held near his ear. After a further twenty seconds the buzzer sounded and the watch was taken away. Twenty seconds later the subject was told to open his eyes. He was then asked to choose the best descriptions of his picture from the six descriptions listed and also to choose the best description of the movement, as he saw it, from the following five descriptions:

(1) Saw the movement clearly.

(2) Saw the movement with some effort.

(3) Experienced much difficulty in seeing the movement.

(4) Almost impossible to see the movement.

(5) Could not see the movement.

The subject was then shown a drawing of a wheel with two small figures on it for five seconds. A reproduction of the drawing the same size as the original appears in the Appendix. The subject was told to look at it carefully since he would be shown it for only five seconds and afterwards would be required to get a picture of it.

After the drawing of the wheel was taken away the following instructions were given to the subject:

> "In a few seconds I will ask you to close your eyes and then I will ask you to get a picture of the wheel with the two figures on it turning round. Try your best to get the picture but remain relaxed. After you have started getting the picture in your mind you will hear a buzzer. This is a signal that a watch is going to be held near your ear. When you hear the buzzer I want you to keep the picture in your mind and at the same time try to listen to the ticking of the watch. A second buzz will be a signal that the watch has been taken away".

The subject was then told to close his eyes and the EEG record was commenced. The procedure was exactly the same as before except that this time he was told to get a picture of the wheel turning round. He was afterwards asked to choose the best description of the clearness of the picture and the movement from the two cards.

This was the end of the first session and the subject was told when to come back for the second session.

Second Seconal Session.

Twenty minutes before the recording began the subject was given 2¼ gr. Seconal and was left alone lying on the couch. He was told to let himself drift into a pleasant drowsy state but not to go off to sleep. Though there were individual differences, in every case the Seconal produced a drowsy state that was neither too shallow nor too deep for our purposes.

Apart from the administration of Seconal the procedure was exactly the same as in the first session and it will not be repeated here.

RESULTS.

The path traced by the automatic analyser was taken as the source of data. The dominant frequency and the two adjacent frequencies within the alpha band (8-13 c/s) were measured for height in millimetres. within each 10 sec epoch and then averaged over the number of epochs occupied during each of the experimental conditions. These three values were then combined to give a single 'score' for each individual under each experimental condition. The investigator found (as did Barratt) that the dominant frequency and the two adjacent to it accounted for practically all the variation in amplitude. Each of these 'scores' was then converted into a percentage rise or fall from the resting alpha amplitude. This conversion into percentages was done for two reasons:

(1) The investigator was interested in alpha suppression rather than absolute alpha amplitude

(2) A Percentage rise or fall was not only more meaningful than absolute values but was not influenced by possible fluctuations in the machines activity, or displacement of the electrodes in the second session from the position they had in the first session. On the other hand it should be pointed out that every effort was made to keep everything standard.

The four different periods during which the subject visualised the different objects will be referred to as the "Car Condition" i.e. the period during which the subject was visualising a car, the "Diagram condition" and the "Bus Condition" and the "Wheel Condition". The periods during which the subject had to visualise the bus or the wheel and at the same time listen to the watch will be referred to as the Distraction condition. The significance of the obtained difference was tested by the statistic "A" which Sandler (19) has derived from Student's "t" and which yields exactly the same results as "t" but is not so time consuming'.

The results will now be presented in Table form and summarised after each table.

Table 1.

Mean percentage fall when the resting alpha amplitude is taken as the baseline, raw differences between means and "A" and "p" values for the differences between the means for the distributions of percentages obtained

under the four visualizing conditions during the 1st Normal Session taken two at a time. n = 20

Comparison	Mean 1	Mean 2	Diference	A	p
Car vs Diagram	-42.35	-33.15.	-9.2.	.167	< .02
Car vs Wheel	-42.35	-38.8	-3.05	3.287	> .10
Car vs Bus	-42.35	-30.1	-12.25	.275	> .05
Diagram vs Wheel	-33.15.	-38.8.	-5.3.	.961	> .10
Diagram vs Bus	-33.15	-30.1	-3.0	1.261	> .10
Wheel vs Bus	-38.8.	-30.1.	-8.7.	.264	< .05.

From the data in Table 1 we can conclude that:

(1) There is a significantly greater suppression effect on alpha amplitudes in the case of the Car Condition than in the case of the Diagram Condition.

(2) The differences between the Car Condition and the Wheel Condition, between the Car Condition and the Bus Condition, between the Diagram Condition and the Wheel Condition and between the Diagram Condition and the Bus Condition are not significant.

(3) There is a significantly greater suppression effect in the case of the Wheel Condition than in the case of the Bus Condition.

The experiment was designed with the assumption that the picture of the car would provoke a more vivid image than the diagram. The difference be-

the two pictures objectively was such that it was felt that the comparison of the vividness of the images provoked would not tax the ability of the subject to introspect. The simple method of asking the subjects to choose the appropriate description of his image from six presented seemed to be a sufficient test of the assumption. Seventeen of the twenty subjects chose descriptions from the card indicating clearly that they had much more vivid images of the car than of the diagram. Two of the subjects chose the same description for the car and diagram and only one subject chose descriptions suggesting a more vivid picture of the diagram than of the car. The significantly greater suppression of the alpha during the Car Condition with the large agreement between the subjects that it was the stronger image lends support to the hypothesis that there is a relationship between the vividness of a visual image and the amount of suppression.

It was also expected that the request to get a picture of the bus scene - a scene familiar to all the subjects - would provoke a more vivid image than the Wheel. Fifteen of the subjects chose descriptions indicating that the bus scene was more vivid than the wheel and five chose the same description for bus and wheel. But here we have a greater suppression under the wheel condition! The results seem to be contradictory. A possible explanation of this discrepancy will be presented during the over-all discussion of the results.

No differences were expected between the other conditions and the differences obtained are not significant.

Table 2.

Mean percentage fall when the resting alpha aplitude is taken as the baseline, raw differences between means and "A" and "p" values for difference between the means for the distribution of percentages obtained for the four visualising conditions during the First Normal Session and the Second Seconal Session. N = 20.

Condtion	1st Session Mean	2nd Session Mean	Difference	A	p.
Car	-42.35	-37.55	-4.8.	1.467	> .1.
Diagram	-33.15	-35.8.	-.2.7.	5.319	> .10.
Bus	-30.1.	-40.95	-10.85	.243	< .05
Wheel	-38.8.	-42.45	-3.65	2.822	> .10

From the data in Table 2 we can conclude that the difference between the two session for the Car, Diagram and Wheel conditions are not significant but the difference is significant for the Bus condition. It was expected that under Seconal the imagery would be more vivid but there are no clear cut difference between the two sessions for any of the conditions or, at least, none that appeared in their choice of descriptions with respect to the vividness and the movement of the images. What is noteworthy however is that five of the subjects said the bus scene came more easily and three of these subjects reported images associated with the scene they were trying to visualise but which they had not actually tried to get. One

subject said she had a clear picture of her husband driving the bus, the second subject said he had a persistent picture of himself driving the bus and a third subject said that after the bus he had visualised had come into the Market place other buses started coming in. Further discussion of the significance of this will be postponed until the remainder of the data has been presented.

Table 3.

Mean percentage fall when the resting alpha amplitude is taken as the baseline, raw differences between means and the "A" and "p" values for the differences between the means for the distribution of percentages obtained under the "Bus Condition and Wheel Condition and their two distraction conditions during the Normal Session and the Seconal Session.

n = 20.

Comparison.

	Mean	Mean	Diff.	A	p.
Bus vs Distraction (1st Session)	-30.1.	-34.3	-4.2.	1.174	> .10.
Wheel vs Distraction (1st Session)	-38.8.	-39.75	-8.05	.440	> .10.
Bus vs Distraction (2nd Session)	-40.9.	-21.05	-19.9.	.185	< .02
Wheel vs Distraction (2nd Session)	42.45	-18.1.	-24.35.	.109	<.001.

It should be noticed that the amplitudes being expressed as a percentage fall from the resting alpha amplitude the means for both the visualising and distracting conditions are minus values. When the percentage

for the distraction condition is smaller than that for the visualising condition this indicates a rise from the alpha amplitude during the visualising condition. For instance - 40% for the bus condition and 20% for the Distraction condition would mean that the Bus condition amplitude was 40% lower than the resting alpha and the distraction condition alpha 20% lower than the resting alpha.

It can be concluded from the data in Table 3 that there was a significantly greater rise in alpha amplitude during the distraction condition for the Seconal session than for the Normal Session. This distraction test followed, of course, Adrian's test where he found with subjects whose eyes were open that there was a greater rise in alpha amplitude when listening to a watch when the subjects wore lenses which blurred the visual field and therefore gained the attention less. It would seem, then, that, under Seconal, the visual images gained the attention less. This follows from Adrian's explanation but is supported also by the reports of the subject of this experiment who said that the images under Seconal came more easily. Some of the subjects also reported spontaneously that they were not concentrating so much during the Seconal session as they were during the Normal session.

CHAPTER 3.

DISCUSSION OF THE RESULTS.

The most important finding of the experiment is that supression of the alpha amplitude varies with the different types of visual images and under different conditions. Suppression of the alpha it would seem is not an all-or-none effect.

Car

The difference in suppression under the ± Condition and the Diagram condition suggests that there is a relationship between vividness of the image and alpha suppression such that the more vivid the image the greater the suppression. The result with the Bus Condition and the Wheel Condition on the other hand suggests that there may be other factors of importance apart from the vividness of the image and that these factors, despite the vividness of the image, may produce the opposite effect. In the face of this problem the first question that comes to mind is in what way does the Bus Condition differ from the other conditions. There are a number of important ways. First of all the subjects in all the other conditions were shown a picture of drawing of the thing they had to visualise. Secondly, and this follows from the first difference, the subjects had more freedom to visualise as they wished and this meant, thirdly that the visual image was less of a fixed kind than the other images. Fourthly the other three conditions may be regarded as more pure visualising situations in the sense that they had a specific thing which they had seen to visualise and which were not of the kind to provoke thought or association of a non visual kind. In the case of the Bus Condition there was ample room for the provocation of thought and associations and, in one sense, it may be true to say that they had to think about what they had to visualise in order to visualise it, whereas in the other conditions the object came ready made.

It will be seen that this fourth difference may be the crucial one.

It was noted before that some of the subjects reported that the visualising of the bus in the Seconal Session was more easy. This suggests that they were not concentrating so much and we not only have the reports of the subjects to substantiate this but also the fact of the known sedative effects of Seconal. We have also the findings in this experiment indicating clearly that the subjects were more easily distracted during the Seconal session.

This being the first attempt to investigate a difficult area of psychological and electrophysiological relationships the significant findings are few and one must beware of building a too heavy theoretical superstructure on them. On the other hand some attempt should be made to provide an explanation for the results if only to suggest hypotheses that can be tested in the future.

First of all the proposed explanation will be presented and the supporting data discussed afterwards. It is hypothesised that the amount of suppression of the alpha is a result of at least two factors. First of all the vividness of the image. Secondly the extent to which thought, associations, or what we may collectively call the higher thought process, are involved. If this is the case then, although the car suppressed the alpha more than the diagram did because it was a more vivid image,

the wheel suppressed the alpha more so than the bus, although the bus was more vivid, because the bus involved the higher process more. The examination we made of the differences between the bus and the other things to be visualised suggests that this explanation is at least a plausible one. Again if the hypothesis is correct then it would seem that the greater suppression during the Bus condition in the seconal session is a result of the inhbition of the higher processes by the seconal thus resulting in what we have called a more pure visualising condition, and so in a greater suppression. The greater ease with which the bus scene was visualised during seconal and the greater distractibility fits in with this explanation.

Piaget has written that "Whenever there is symbolism in dreams, in the images of the half sleeping state, or in children's play it is because thought in its state of low psychological tension or in its elementary stages, proceeds by egocentric assimilation and not by logical concepts"(18) This position is held by workers in many different fields. Psychoanalysts talk of representation of wishes in dreams when the superego is relaxed, Rorschach workers associate more vivid and revealing projections with a release of ego control (13). The explanation proposed fits in not only with these theories but with other experimental data but this we will leave for the general discussion in the next part of the thesis.

PART THREE.

General Discussions and Conclusion.

Pavlov referred to inhibitory and excitatory cerebral processes to account for the differences in the behaviour of his dogs. Since then there has been a growing interest in these concepts and a number of workers have used them to produce hypotheses and to explain their experimental results. Eysenck (4) has used them to explain his finding that Hysterics (as a prototype of the extraverted personality type) are differentiated from Dysthymics (as a prototype of the introverted personality type) in the speed of arousal, strength and length of persistence of figural after-effects. Hysterics develop satiation and figural after effects more quickly than Dysthymics, they develop stronger satiation and figural after-effects than do Dysthymics and they develop more persistent satiation and figural after affects than do Dythymics. He postulated that reactive inhibition is generated more quickly, more strongly and dissipated more slowly in those individuals predisposed to develop Hysterical disorders. The experiments by Welsh and Kubis (25) in which they found that Dysthymics conditioned more quickly than controls of Hysterics has also been interpreted in terms of inhibition and excitation. Franks (5) Taylor (23) and Taylor and Spence (24) also found that Dysthymics condition more quickly than normals and normals more quickly than Hysterics.

Both the faster rates of reversal on the Necker Cube for the Hysterics and the weaker imagery revealed by the Gordon Test can be interpreted in terms of reactive inhibition suggesting once more that the distinction between vivid-autonomous imagery and weak-unstable imagery is as important if not more important than the distinction between uncontrolled and controlled imagery.

If vivid images are related to excitatory processes and weak images result of inhibitory process then the greater alpha suppression with more vivid imagery suggests that the Alpha rhythm is related in some way to excitatory and inhibitory processes. The recent work of Gastaut and his associates showed that the process of central excitation was made manifest during conditioning of the electrical activity of the cortex by a blocking response. " The process of central inhibition " they write " is first made manifest by the disappearance of previously condition "blocking" responses. However it is also expressed in a positive way by increased amplitude of the alpha (6).

It is suggested that by the method used in this study variation of the stimulus conditions to be visualised and the use of drugs important advances will be made in the understanding of the cerebral processes of excitation and inhbition and their relation to psychiatric disorders.

The present work has also suggested another fruitful area of research

related more to temporary processes than to differences between individuals or groups of individuals. It would seem that with careful design of the stimulus conditions and the use of drugs such as Seconal along with an analysis of EEG activity it may be possible to throw some light on the mechanisms underlying such visual phenomena as dreams and hypnagogic imagery. It has been suggested that an important factor is the release of the visual processes from control by the higher processes. More specifically it is postulated that the higher process have an inhibitory effect on the visual processes such that the more involved the higher processes the less consistent are the visual images and this is reflected by a higher alpha amplitude than is the case with pure visualising situations with no involvment in the higher processes. Seconal producing an inhibitory effect on the higher processes (lack of concentration, drowsiness) more quickly than on the visual processes results in a release from inhibition of the visual processes this in turn being associated with visual images that come more easily and with a greater suppression of the alpha amplitude. Finally of course the Seconal will also have inhibitory effect on the visual processes and may eventually lead to sleep.

The relationships between the inhibitory processes of the higher processes, the inhibitory effect of drugs and the general state of reactive inhibition would seem to be an important area for research. It would be tempting to speculate further on these inter-relationships in the case of visual hallucinations particularly in view of the fact that there is considerable evidence suggesting increased cortical inhibition after brain injury Klein and Krech (12) Petrie(17) Hildebrand(10) but we have gone far enough with the data available.

In conclusion the writer would like to point out what he feels are the main contributions made by this thesis. First, he has confirmed the previous work by the evidence suggesting that individuals differ in their ability to control their images and that this is related to perceptual processes. He has shown further that a distinction must be made betwen those with vivid-autonomous images and those with weak unstable images. Though the evidence does not seem to suggest that inability to control one's images is indicative of a predisposition to mental disorder the distinction between the weak kind and the vivid kind does seem to be related to the kind of mental disorder a person would be likely to develop. Thirdly, it has been shown that a study of the relationships between aspects of imagery and EEG changes may be more fruitful than an attempt to classify people into types such as visualists and verbalists on the basis of introspections and their EEG records.

We are left with many problems. It is hoped in the next stage of this work to investigate the effects of seconal on the visualisations and alpha rythms of a group of Dysthymic and a group of Hysteric patients.

A P P E N D I X.

CONTENTS.

Notes on the statistics.....

Tables 1 to 64.....

Reproduction of the Diagram.....

Reproduction of the Wheel.....

Outline of Standard Interview on Visual Images and...
Related Processes.....

Notes on the Statistics.

1. The method of finding the sum of squares was determined by the availability of the hospitals calculating machine!

2. In cases of heterogeneity of variance where n_1 and n_2 differ the formula below was used for obtaining the significant value of t

$$t = \frac{(S\bar{x}_1^2)(t_1) + (S\bar{x}_2^2)(t_2)}{S\bar{x}_1^2 + S\bar{x}_2^2}$$

3. In cases of heterogeneity of variance when n_1 equals n_2 the t test was performed in the usual manner but the table of t was entered with one half the number of degrees of freedom usually available (Edward))

TABLE 1.

Data and calculations for testing the significance of the difference between the Mean Age of the Dysthymic and Hysteric groups.

Dysthymics Age	Hysterics. Age				
X_1	X2	x_1	x_1^2	x_2	x_2^2
41	37	1.05	1.10	2.45	6.00
56	29	16.05	257.60	5.55	30.80.
31	42	-8.95	80.10	7.45	55.50
50	52	10.05	101.00	17.45	304.50
37	38	2.95	8.70	3.45	11.90
54	34	14.05	197.40	.55	.30
42	35	2.05	4.20	.45	.20
18	31	-21.95	481.80	3.55	12.60
62	28	22.05	486.20	6.55	42.90
21	32	-18.95	359.10	2.55	6.60
22	16	-17.95	321.20	-18.55	344.10.
43	18	3.05	9.30	16.55	273.90
39	27	-.95	.90	7.55	57.00
59	49	19.05	362.90	14.45	208.80
55	20	15.05	226.50	14.55	211.70
25	30	-14.95	223.50	4.55	20.70
41	19	1.05	1.10	15.55	241.80
33	56	- 6.95	48.30	21.45	260.10
30	55	- 9.95	99.00	20.45	418.20
30	43	- 9.95	99.00	8.45	71.40.
789	691		3368.90		2779.00.
M = 39.95.	M = 34.55.				

$$t = \frac{5.40}{\sqrt{16.11.}} = \frac{5.40}{4.01} = 1.35 \quad Df = 38 \quad P > .05.$$

TABLE 2.

Data and calculations for testing the significance of the difference between the mean scores of the Dysthymic and Hysteric groups on the Matrices Test.

Dysthymics Matrices Scores. X_1	Hysterics. Matrices Scores. X_2	x_1	x_1^2	x_2	x_2^2
37	42	2.75	7.5625	4.75	22.5625
45	27	10.75	115.5625	10.25	105.0625
23	24	11.25	126.5625	13.25	175.5625
34	25	.25	.0625	12.25	150.0625
50	42	15.75	248.0625	4.75	22.5625
37	20	2.75	7.5625	17.25	297.5625
35	48	.75	.5625	10.75	115.5625
35	50	.75	.5625	12.75	162.5625
26	34	8.25	68.0625	3.25	10.5625
30	57	4.25	18.0625	19.75	390.0625
24	39	10.25	105.0625	1.75	3.0625
36	35	1.75	3. 0625	2.25	5.0625
34	33	.25	.0625	4.25	18.0625
32	35	2.25	5.0625	2.25	5.0625
41	37	6.75	45.5625	.25	.0625
30	34	4.25	18.0625	3.25	10.5625
40	40	5.75	33.0625	2.75	7.5625
18	50	16.25	264.0625	12.75	162.5625
43	30	8.75	76.5625	7.25	56.5625
35	43	.75	.5625	5.75	33.0625
685	745		1143.7500		1749.7500

$M = 34.25$. $M = 37.25$.

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - M}{S_{\bar{x}_1 - \bar{x}_2}} = \frac{3.00}{\sqrt{7.5157}} = 1.09 \qquad Df = 38 \qquad P > .05$$

TABLE 3.

Data and calculations for testing the significance of the difference between the Mean Scores of the Dysthymic and Hysteric Groups on the Mill Hill Vocabulary Scale.

Dysythmics. Vocabulary Scores.	Hysterics. Vocabulary Scores.				
X_1	X_2	x_1	x_1^2	x_2^2	x_2^2
556	52	6.6.	43.56	8.15	66.4225
50	40	.6	.36	3.85	14.8225
35	60	14.4	207.36	16.15.	260.8225
48	48	1.4	1.96	4.15	17.2225
55	63	5.6	31.36	19.15	368.7225
47	56	2.4	5.76	12.15	147.6225
66	44	16.6	275.56	.15	.0225
49	42	.4	.16	1.85	3.4225
60	35	10.6	112.36	8.85	78.3225
52	32	2.6	6.76	11.85	140.4225
42	26	7.4	54.76	17.85	318.6225
40	44	9.4	88.36	.15	.0225
58	32	8.6	73.96	11.85	140.4225
55	49	5.6	31.36	5.15	26.5225
44	52	5.4	29.16	8.15	66.4225
48	42	1.4	1.96	1.85	3.4225
46	35	3.4	11.56	8.85	78.3225
60	36	10.6	112.36	7.85	61.6225
47	40	2.4	5.76	3.85	14.8225
30	49	1904	376.36	5.15	26.5225
988	877		1470.80		1834.5500

$M = 49.4.$ $M = 43.85.$

$$t = \frac{5.55}{\sqrt{8.7016}} = \frac{5.55}{2.949} = 1.88 \quad Df = 38 \quad P > .05$$

TABLE 4.

Data and calculations for testing the significance of the Difference between the Mean Scores of the Dysthymic and Hysteric groups on the N.I.I.P. Space Test.

Dysthymics. Scores X_1	Hysterics. Scores. X_2	X_1^2	X_2^2
31	30	961	900
10	13	100	169
11	14	121	196
22	32	484	1024
24	41	576	1681
19	12	361	144
32	16	1,024	256
46	31	2,116	961
14	14	196	196
49	13	2,401	169
16	10	256	100
17	16	289	256
15	11	225	121
31	15	961	225
16	29	256	841
12	15	144	225
11	37	121	1369
51	21	2,601	441
45	13	2,025	169
22	25	484	625
494	498	15,702	10,068

M. 24.7. M 20.4.

$$t = \frac{4.3.}{\sqrt{\frac{5246}{380}}} = \frac{4.3.}{\sqrt{13.80}} = 1.16. \quad Df = 38 \quad P > .05.$$

TABLE 5.

Data and calculations for testing the significance of the Difference between the Mean normal scores of the Dysthymic and Hysteric groups on the Necker Cube.

Dysthymics. Score	Hysterics. Score.				
X_1	X_2	x_1	x_1^2	x_2	x_2^2
6	13	4.75	22.5625	3.55.	12.6025
4	21	6.75	45.5625	4.45	19.8025
20	10	9.25	85.5625	6.55	42.9025
10	24	.75	.5625	7.45	55.5025
1	7	9.75	95.0625	9.55	91.2025
18	14	7.25	52.5625	2.55	6.5025
15	14	4.25	18.0625	2.55	6.5025
12	16	1.25	1.5625	.55	.3025
12	12	1.25	1.5625	4.55	20.7025
9	21	1.75	3.0625	4.45	19.8025
10	18	.75	.5625	1.45	2.1025
10	25	.75	.5625	8.45	71.4025
10	34	.75	.5625	17.45	304.5025
9	8	1.75	3.0625	8.55	73.1025
4	20	6.75	45.5625	3.45	11.9025
8	10	2.75	7.5625	6.55	42.9025
8	18	2.75	7.5625	1.45	2.1025
23	10	12.25	150.0625	6.55	42.9025
8	20	2.75	7.5625	4.45	19.8025
18	15	7.25	52.5625	1.55	2.4025.
215	331		601.7500		848.9500

M = 10.75. M = 16.55.

$$t = \frac{M1 - M2}{\sqrt{\frac{\Sigma x1 + \Sigma x2}{N(N-1)}}} = \frac{5.80}{\sqrt{3.82}} = \frac{5.80}{1.95.} = 2.97 \quad Df = 38 \quad p < .01.$$

$$F = \frac{S_1^2}{S_2^2} = \frac{44.681}{31.671} = 1.41. \quad p > .05$$

TABLE 6.

Data and Calculations for testing the significance of the Difference between the Mean Fast Scores of the Dysthymic and Hysteric groups on the Necker Cube.

Dysthymics. Scores	Hysterics. Scores				
X_1	X_2	x_1	x_1^2	x_2	x_2^2
10	25	6.7	44.89	1.1	1.21
35	29	18.3	334.89	5.1	26.01
15	11	1.7	2.89	12.9	166.41
12	23	4.7	22.09	.9	. 49
6	16	10.7	114.49	7.9	62.41
27	16	10.3.	106.09	7.9	62.41.
24	17	7.3	53.29	6.9.	47.61.
16	22	.7	. 49	1.9	3.61
14	22	2.7	7.29	1.9	3.61
21	12	4.3	18.49	11.9	141.61
3	9	13.7	189.69	14.9	222.01
36	51	19.3	372.49	27.1	734.41
10	55	6.7	44.89	31.1	967.21
16	15	.7	.49	8.9	79.21
4	35	12.7	161.29	11.1	123.21
11	10	5.7	32.49	13.9	193.21
13	36	3.7	13.69	12.1	146.41
27	15	10.3	106.09	8.9.	79.21
37	45	20.3	412.09	21.1	445.21
20	14	3.3	10.89.	9.9.	98.01.
334	478		2947.00.		2603.48.

M = 16.7. M = 23.9.

$$F = \frac{189.656}{107.736} = 1.751 \qquad p > .95.$$

$$t = \frac{7.2}{\sqrt{\frac{5650.48}{380}}} = \frac{7.2.}{3.86} = 1.87 \qquad Df = 38 \quad P > .05$$

TABLE 7.

Data and calculations for testing the significance of the Difference between the Mean Slow Scores of the Dysthymic and Hysterics groups on the Necker Cube.

Dysthymics. Scores	Hysterics. Scores				
X	X_2	X_1	X_1^2	X_2	X_2^2
4	6	1.8	3.24	3.6	12.96
0	16	5.8	33.64	6.4	40.96
8	6	2.2	4.84	3.6	12.96
6	13	.2	.04	3.4	11.56
0	3	5.8	33.64	6.6	43.56
6	12	.2	.04	2.4	5.76
14	9	8.2	67.24	.6	.36
3	9	2.8	7.84	.16	.36
8	6	2.2	4.84	3.6	12.96
2	10	3.8	14.44	.4	.16
3	6	2.8	7.84	3.6	12.96
10	14	4.2	17.64	4.4	19.36
7	20	1.2	1.44	10.4	108.16
7	13	1.2	1.44	3.4	11.56
3	0	2.8	7.84	9.6	92.16
5	4	.8	.64	5.6	31.36
8	11	2.2	4.84	1.4	1.96
8	6	2.2	4.84	3.6	12.96
11	18	5.2	27.04	8.4	70.56
3	10	2.8	7.84	.4	.16.
116	192		251.20		502.80

M = 5.8 M = 9.6

$$F = \frac{26.463}{13.221} = 2.00 \qquad P > .05$$

$$t = \frac{3.8}{\sqrt{\frac{754.00}{380}}} = \frac{3.8}{1.98} = 2.70 \qquad Df = 38 \qquad P < .05$$

TABLE 8a.

Data and calculations for testing the significance of the Mean Difference between Fast-Normal Scores on the Necker Cube for the Dysthymics and Hysterics.

Dysthymics Differences. X_1	Hysterics. Differences. X_2	X_1^2	X_2^2
4	12	16	144
31	6	961	36
-5	1	25	1
2	-1	4	1
5	9	25	81
9	2	81	4
9	3	81	9
4	6	16	36
2	10	4	100
12	-9	144	81
-7	-7	49	49
26	26	676	676
0	21	0	441
7	7	49	49
0	15	0	225
3	0	9	0
5	18	25	324
4	5	16	25
29	24	841	576
2	0	4	0
142	158	3010	2858

$M = 7.1.$ $M = 7.9.$

$$\Sigma x_1^2 = 3010 - \frac{20164}{20} = 2001.8.$$

$$\Sigma x_2^2 = 2858 - \frac{25964}{20} = 1609.8.$$

$$t = \frac{.8.}{\sqrt{\frac{3611.6.}{380}}} = \frac{.8}{3.079} = .2598 \qquad Df = 38 \qquad P > .05$$

Fast - Slow.

TABLE 8.

Data and calculations for testing the significance of the Mean Differences between Fast and Slow Scores on the Necker Cube for the Dysthymics and Hysteric groups.

Dysythmic Scores X_1	Hysteric Scores X_2	X_1^2	X_2^2
6	19	36	361
35	13	1225	169
7	5	49	25
6	10	36	100
6	13	36	169
21	4	441	16
10	8	100	64
13	13	169	169
6	16	36	256
19	2	361	4
0	3	0	9
26	37	676	1369
3	35	9	1225
9	2	81	4
1	35	1	1225
6	6	36	36
5	25	25	625
19	9	361	81
26	37	676	1369
17	4	289	16.
241	296	4643	7292

$M = 12.05.$ $M = 14.8.$

$$\Sigma x_1^2 = 4643 - \frac{58081}{20} = 1738.95.$$

$$\Sigma x_2^2 = 7292 - \frac{87616}{20} = 2911.2.$$

$$F = \frac{153.2.}{91.49} = 1.674 \qquad P. > .05.$$

$$t = \frac{2.75}{\sqrt{12.24.}} = \frac{2.75}{3.497} - .7861 \qquad p. > .05$$

TABLE 9.

Data and calculations for testing the significance of the Difference between the Mean age of the vivid-autonomous group and the controlled group.

Vivid-Autonomous Ages	Controlled. Ages		
X_1	X_2	X_1^2	X_2^2
41	56	1681	3136
31	54	961	2916
50	42	2500	1764
37	62	1369	3844
18	59	324	3481
21	33	441	1089
22	30	484	900
43	37	1849	1369
39	42	1521	1764
55	52	3025	2704
25	38	625	1444
41	31	1681	961
30	28	900	784
30	20	900	400
483	19	18261	361
	56		3136
	43		1849
M = 34.5.	702		31902

M = 41.29.

$\Sigma x_1^2 = 1597.5.$ $\Sigma x_2^2 = 2913.5.$

$F = \frac{182.09.}{122.88.} = 1.4.$ $P > .05.$

$t = \frac{6.79}{\sqrt{20.22.}} = \frac{6.79}{4.41.} = 1.54.$ $Df = 29$ $P > .1.$

TABLE 10.

Data and calculations for testing the significance of the Difference between the Mean Scores of the Vivid Autonomous group and the Controlled group on the Matrices test.

Vivid-Autonomous Scores. X_1	Controlled Scores. X_2	X_1^2	X_2^2
42	27	1764	729
24	20	576	400
25	48	625	2304
42	34	1764	1156
50	35	2500	1225
57	56	3249	2500
39	30	1521	900
35	37	1225	1369
33	23	1089	529
37	34	1369	1156
34	50	1156	2500
40	35	1600	1225
43	26	1849	1676
30	41	800	1681
531	40	21187	1600
	18		324
	35		1225
M = 37.93.	583		21499

M = 34.29.

$\Sigma x_1^2 = 1046.93$

$\Sigma x_2^2 = 2682.0.$

$F = \frac{167.62}{80.53} = 2.08 \qquad p > .05.$

$t = \frac{3.64}{\sqrt{16.59}} = \frac{3.64}{4.07} = .89. \qquad Df = 29 \qquad P > .3.$

TABLE 11.

Data and calculations for testing the significance of the Difference between the Mean Scores of the Vivid-autonomous group and the Controlled group on the Mill Hill Vocabulary Scale.

Vivid-Autonomous Score X_1	Controlled Score X_2	X_1^2	X_2^2
56	50	3136	2500
35	47	1225	2209
48	66	2304	4356
55	60	3025	2600
49	55	2401	3025
52	60	2704	2600
42	47	1764	2209
40	52	1600	2704
58	60	3364	3600
44	48	1936	2304
48	63	2304	3969
46	42	2116	1764
30	35	900	1225
42	52	1764	2704
645	35		1225
	36	30543	1296
M = 46.07	49		2401
	857		44696
	M = 50. 41.		

$\Sigma x_1^2 = 826.93.$

$\Sigma x_2^2 = 1493.12.$

$F = \frac{93.32}{63.61.} = 1.46 \quad P > .05$

$t = \frac{3.64}{\sqrt{10.40}} = \frac{3.64}{3.22} = 1.13 \quad Df = 29 \quad P > .2$

TABLE 12

Data and calculations for testing the significance of the Difference between the Mean scores on the vivid autonomous group and the controlled group on the N.I.I.P. Space Test.

Vivid Autonomous Score	Controlled Score		
X_1	X_2	X_1^2	X_2^2
31	10	961	100
11	19	121	361
22	32	484	1024
24	14	576	196
46	31	2116	961
49	51	2401	2601
16	45	256	2025
17	30	289	900
15	14	225	196
16	32	256	1024
12	41	144	1681
11	31	121	961
22	14	484	196
15	29	225	841
	37		1369
307	21	8659	441
	25		625
M = 21.93			
	476		155 02

M = 28

$\Sigma X_1^2 = 1926.93$

$\Sigma X_2^2 = 2173.42$

$F = \frac{148.22}{135.84} = 1.09 \quad P > .05$

$t = \frac{6.07}{\sqrt{18.38}} = \frac{6.07}{4.29} = 1.39 \quad Df = 29 \quad P > .05$

TABLE 13.

Data and calculations for testing the significance of the Difference between the Mean normal scores of the Vivid-autonomous group and the Controlled group on the Necker Cube.

Vivid-Autonomous Scores	Controlled Scores.		
X_1	X_2	X^2_1	X^2_2
6	4	36	16
20	18	400	324
10	15	100	225
1	12	1	144
12	9	144	81
9	23	81	529
10	8	100	64
10	13	100	169
10	10	100	100
4	24	16	576
8	7	64	49
8	16	64	256
18	12	324	144
10	20	100	400
136	18	1630	324
	10		100
M= 9.71	15		225
	234		3726

M = 13.76

$$\Sigma X^2_1 = 1630 - \frac{18496}{14} = 309$$

$$\Sigma X^2_2 = 3726 - \frac{54756}{17} = 505$$

$$F = \frac{31.56}{23.78} = 1.327 \qquad P > .05$$

$$t = \frac{4.05}{\sqrt{2.8478}} = \frac{4.05}{1.895} = 2.137 \qquad Df = 29 \qquad P < .05$$

TABLE 14.

Data and calculations for testing the significance of the Difference between the Mean Fast Scores of the Vivid-Autonomous group and the Controlled group on the Necker Cube.

Vivid-Autonomous Scores X_1	Controlled Scores X_2	X_1^2	X_2^2
10	35	100	1225
15	27	225	729
12	24	144	576
6	14	36	196
16	16	256	256
21	27	441	729
3	37	9	1369
36	25	1296	625
10	11	100	121
4	23	16	529
11	16	121	256
13	22	169	484
20	22	400	484
10	35	100	1225
	36		1296
187	15	3413	225
	14		196
M = 13.36	399		10821
	M = 23.47		

$$\Sigma X_1^2 = 3413 - \frac{34969}{14} = 915$$

$$\Sigma X_2^2 = 10821 - \frac{159201}{17} = 1454$$

$$F = \frac{90.88}{70.37} = 1.291 \qquad P > .05$$

$$t = \frac{10.11}{\sqrt{10.621}} = \frac{10.11}{3.258} = 3.002 \qquad Df = 29 \qquad P < .01$$

TABLE 15.

Data and calculations for testing the significance of the Difference between the Mean slow scores for the Vivid-autonomous and Controlled groups on the Necker Cube.

Vivid-autonomous Scores. X_1	Controlled Scores. X_2	X_1^2	X_2^2
4	0	16	0
8	6	64	36
6	14	36	196
0	8	0	64
3	7	9	49
2	8	4	64
3	11	9	121
10	6	100	36
7	6	49	36
13	13	169	169
5	3	25	9
8	9	64	81
3	6	9	36
4	0	16	0
	11		121
76	6	570	36
	10		100
M = 5.429	124		1154

M = 7.295

$$\Sigma x_1^2 = 570 - \frac{5776}{14} = 157.3.$$

$$\Sigma x_2^2 = 1154 - \frac{15376}{17} = 249.4.$$

$$F = \frac{15.59.}{12.10} = 1.288 \qquad P > .05$$

$$t = \frac{1.866}{\sqrt{1.8239}} = 1.381 \qquad Df = 29 \qquad P > .1.$$

TABLE 16.

Data and calculations for testing the significance of the Difference between the Mean Differences between Fast and Normal scores on the Necker Cube for the Vivid-autonomous and Controlled groups.

Vivid-Autonomous Differences	Controlled. Differences.		
X_1	X_2	X_1^2	X_2^2
4	31	16	962
-5	9	25	81
2	9	4	81
5	2	25	4
4	7	16	49
12	4	144	16
-7	29	49	841
26	12	676	144
0	1	0	1
0	-1	0	1
3	9	9	81
5	6	25	36
2	10	4	100
0	15	0	225
51.00	18	993	324
	5		25
M = 3.64	-1		1
	165		2972
	M = 9.70		

$\Sigma x_1^2 = 993 - \frac{2601}{14} = 807.22.$

$\Sigma x_2^2 = 2972 - \frac{27225}{17} = 137-.53.$

$F = \frac{85.658}{62.09} = 1.37 \quad P > .05.$

$t = \frac{6.06}{\sqrt{9.479}} = 3.08 \quad Df = 29 \quad P < .01.$

TABLE 17.

Data and calculations for testing the significance of the Mean Differences between Fast and Slow scores on the Necker Cube for the Vivid-autonomous and Controlled groups.

Vivid-Autonomous Differences	Controlled Differences.		
X_1	X_2	X_1^2	X_2^2
6	36	36	1225
7	21	49	441
6	10	36	100
6	6	36	36
13	9	169	81
19	19	361	361
0	26	0	676
26	19	676	361
3	5	9	25
1	10	1	100
6	13	36	169
5	13	25	169
17	16	289	256
6	35	36	1225
	25		625
	9		81
	4		16
121	275	1759	5947
M = 8.64	M = 16.11.		

$$\Sigma x_1^2 = 1759 - \frac{14641}{14} = 713.22.$$

$$\Sigma x_2^2 = 5947 - \frac{75625}{17} = 1498.47.$$

$$F = \frac{93.65.}{54.93.} = 1.70 \qquad P > .05.$$

$$t = \frac{7.47.}{\sqrt{9.91}} = \frac{7.47}{3.15.} = 2.37 \qquad P. < .05.$$

TABLE.18.

Data and calculations for testing the significance of the Difference between the Mean Ages of the weak-unstable group and the controlled group.

Weak-unstable Ages X_1	Controlled. Ages X_2	X_1^2	X_2^2
29	56	841	3136
34	54	1156	2916
35	42	1225	1764
32	62	1027	3844
16	59	256	3481
18	33	324	1089
27	30	729	900
49	37	2401	1369
55	42	3025	1764
	52		2704
295	38	10981	1444
	31		961
M=32.78	28		784
	20		400
	19		361
	56		3136
	43		1849
	702		31902

M = 41.29.

$\Sigma x_1^2 = 10981 - \frac{87025}{9} = 9670$

$\Sigma x_2^2 = 31902 - \frac{492804}{17} = 2913.5.$

$F = \frac{1209}{182.09.} = 6.637.$ $P < .01.$

$t = \frac{18.51.}{\sqrt{89.114.}} = \frac{18.51}{9.439} = 1.961$ $P > .05.$

TABLE 19.

Data and calculations for testing the significance of the Difference between the Mean Scores of the Weak-unstable and Controlled groups on the Matrices Test.

Weak-unstable Scores	Controlled Scores		
X_1	X_2	X_1^2	X_2^2
45	27	2025	729
37	20	1369	400
35	48	1225	2304
30	34	900	1156
24	35	576	1225
36	50	1296	2500
34	30	1156	900
32	37	1024	1369
43	23	1849	529
	34		1156
316	50	11420	2500
	35		1225
M = 35.11	26		676
	41		1681
	40		1600
	18		324
	25		1225
	583		21499

M = 34.29.

$$\Sigma x_1^2 \quad 11420 - \frac{99856}{9} = 324.89.$$

$$\Sigma x_2^2 \quad 21499 - \frac{339889}{17} = 1505.5.$$

$$F = \frac{94.96}{40.61} = 2.316 \qquad P > .05.$$

$$t = \frac{.82}{\sqrt{12.9642}} = .023 \qquad P > .9$$

TABLE 20.

Data and calculations for testing the significance of the Difference between the Mean Scores of the weak-unstable and Controlled groups on the Mill Hill Vocabulary Scale.

Weak-unstable Scores X_1	Controlled Scores X_2	X_1^2	X_2^2
40	50	1600	2500
56	47	3136	2209
44	66	1936	4356
32	55	1024	3600
26	60	676	3025
44	47	1936	3600
32	52	1024	2209
49	60	2401	2704
40	48	1600	3600
	63		2304
363	42	15333	3969
	35		1764
M = 40.33	52		1225
	35		2704
	36		1225
	49		1296
	857		2401
			44696

M = 50.41.

$$\Sigma x_1^2 = 15333 - \frac{131769}{9} = 692$$

$$\Sigma x_2^2 = 44696 - \frac{734449}{17} = 1493.12.$$

$$F = \frac{93.32}{86.50} = 1.079 \qquad P > .05$$

$$t = \frac{10.08}{\sqrt{15.48.}} = \frac{10.08}{3.933} = 2.563 \qquad Df = 24 \quad P. < .02.$$

TABLE 21.

Date and calculations for testing the significance of the Difference between the Mean Scores of the weak-unstable group and the controlled group on the N.I.I.P. Space Test.

Weak-unstable Score	Controlled Score		
X_1	X_2	X_1^2	X_2^2
13	10	169	100
12	19	144	361
16	32	256	1024
13	14	169	196
10	37	100	961
16	57	256	2601
11	45	121	2025
15	30	225	900
13	14	169	196
	32		1024
119	41	1609	1681
	31		961
M = 13.22.	14		196
	29		841
	37		1369
	21		441
	25		625
	476		15502

M = 28

$$\Sigma x_1^2 = 1609 - \frac{14161}{9} = 35.56$$

$$\Sigma x_2^2 = 15502 - \frac{226576}{17} = 3173.42.$$

$$F = \frac{135.84}{24.482} = 30.3. \quad P. < 01.$$

$$S\bar{x}_1 = \frac{4.482}{9} \qquad S\bar{x}_2 = \frac{135.84.}{17}$$

$$S\bar{x}_1 - \bar{x}_2 = \sqrt{.498 + 7.989} = 2.914$$

TABLE 21 continued.

$$t = \frac{14.78}{2.914} = 5.069$$

$$t_{.01} = \frac{(S\bar{x}_1^2)(t_1) + (S\bar{x}_2^2)(t_2)}{S\bar{x}_1^2 + S\bar{x}_2^2} = 2.905. \qquad P. < 01.$$

TABLE 22.

Data and calculations for testing the significance of the Difference between the Mean normal scores for the Weak-unstable and Controlled groups on the Necker Cub.

Weak-unstable Scores	Controlled Scores		
X_1	X_2	X_1^2	X_2^2
21	4	441	16
14	18	196	324
14	15	196	225
21	12	441	144
18	9	324	81
25	23	625	529
34	8	1156	64
8	13	64	169
21	10	441	100
	24		576
176	7	3884	49
	16		256
	12		144
M=19.55	20		400
	18		326
	10		100
	15		225
	234		3726
	M = 13.77.		

$$\Sigma x_1^2 = 3884 - \frac{30976}{9} = 442.22.$$

$$\Sigma x_2^2 = 3726 - \frac{54756}{17} = 505$$

$$F = \frac{55.28}{31.56} = 1.752 \qquad P. > .05.$$

$$t = \frac{5.78}{\sqrt{6.699}} - \frac{5.78}{2.588} = 2.233 \qquad Df = 24. \qquad P < .05.$$

TABLE 23.

Data and calculations for testing the significance of the Difference between the Mean Fast scores for the Weak-unstable and Controlled groups on the Necker Cube.

Weak-unstable Scores	Controlled Scores		
X	X	X	X
29	35	841	1225
16	27	256	729
17	24	289	576
12	14	144	196
9	16	81	256
51	27	2601	729
55	37	3025	1369
15	25	225	625
45	11	2025	121
	23		529
249	16	9487	256
	22		484
M = 27.67	22		484
	35		1225
	26		1296
	15		225
	14		196
	399		10821

M = 23.47.

$\Sigma x_1^2 = 9487 - \frac{62001}{9} = 2529$

$\Sigma x_2^2 = 10821 - \frac{159201}{17} = 1454$

$F = \frac{324.75}{90.88} = 3.572 \quad P < .05.$

$S_{\bar{x}_1}^2 = \frac{324.75.}{9} \qquad S_{\bar{x}_2}^2 = \frac{90.88.}{17}$

$S_{\bar{x}_1 - \bar{x}_2} = \sqrt{36.08 + 5.347} = \sqrt{41.427.}$

$t = \frac{4.20}{\sqrt{41.427}} = \frac{4.20}{6.436} = .6525 \qquad Df = 24 \quad P > .05.$

TABLE 24.

Data and calculations for testing the significance of the Difference between the Mean Slow scores for the Weak-unstable and Controlled groups on the Necker Cube.

Weak-unstable Scores	Controlled. Scores.		
X_1	X_2	X_1^2	X_2^2
16	0	256	0
12	6	144	36
9	14	81	196
10	8	100	64
6	7	36	49
14	8	196	64
20	11	400	121
13	6	169	36
18	6	324	169
	13		9
118	3	1706	81
	9		36
M=13.11.	6		0
	0		121
	11		36
	6		100
	10		1154
	124		

$M = 7.295.$

$\Sigma x_1^2 = 1706 - \frac{13924}{17} = 160$

$\Sigma x_2^2 = 1154 - \frac{15376}{17} = 249.4.$

$F = \frac{20}{15.59} = 1.283 \quad P > .05$

$t = \frac{5.815}{\sqrt{2.9002}} = \frac{5.815}{1.703} = 3.415. \quad Df = 22 \quad P \leq .01$

TABLE 25.

Data and calculations for testing the significance of the Mean Difference between the Fast and Normal Scores on the Necker Cube for the Weak-unstable and Controlled groups.

Weak-unstable Differences	Controlled Differences		
X_1	X_2	X_1^2	X_2^2
8	31	64	962
2	9	4	81
3	9	9	81
-9	2	81	4
-9	7	81	49
26	4	676	16
21	29	441	41
7	12	49	144
24	1	576	1
	-1		1
73	96	1981	81
M = 8.11.	10		100
	15		225
	18		324
	5		25
	-1		1
	165		2972
	M = 9.70		

36

$$\Sigma x_1^2 = 1981 - \frac{5329}{9} = 1388.89.$$

$$\Sigma x_2^2 = 2972 - \frac{27225}{7} = 1370.53$$

$$F = \frac{174.11}{85.658} = 2.03 \qquad P > .05$$

$$t = \frac{1.59}{\sqrt{1.9533}} = \frac{1.59}{1.1397} = 1.138 \qquad P > .05.$$

TABLE 26.

Data and calculations for testing the significance of the Mean Differences between the Fast and Slow Scores on the Necker Cube for the Weak-unstable and Controlled groups.

Weak-unstable Differences.	Controlled Differences.		
X_1	X_2	X_1^2	X_2^2
13	35	169	1225
4	21	16	441
8	10	64	100
2	6	4	36
3	9	9	81
37	19	1369	361
35	26	1225	25
2	19	4	100
27	5	729	169
	10		169
131	13	3589	256
	13		1225
M = 14.55	16		625
	35		81
	25		16
	9		5947
	4		
	275		
	M = 16.11.		

$$\Sigma x_1^2 = 3589 - \frac{17161}{9} = 1682.23.$$

$$\Sigma x_2^2 = 5947 - \frac{75625}{17} = 1498.47.$$

$$F = \frac{210.27}{93.65} = 2.245 \quad P > .05$$

$$t = \frac{1.56}{\sqrt{22.525}} = \frac{1.56}{4.745} = .3287 \quad P > .05.$$

TABLE 27.

Data and calculations for testing the significance of The DiHerence between the ages of the Dysythmic and Normal groups.

Dysthymics. Ages X	Normal Ages X_2	X_1^2	X_2^2
41	24	1681	576
56	26	3136	676
31	18	961	324
50	21	2500	441
37	23	1369	529
54	18	2916	324
42	27	1764	729
18	18	324	324
62	21	3844	441
21	24	441	576
22	19	484	361
43	22	1849	484
39	18	1521	324
59	21	3481	441
55	18	3025	324
25	19	625	361
41	27	1681	729
33	34	1089	1156
30	25	900	625
30	19	900	361
789	442	34491	10106
M = 39.95	M = 22.1.		

$$\Sigma x_1^2 = 34491 - \frac{622521}{20} = 3364.95.$$

$$\Sigma x_2^2 = 10106 - \frac{195364}{20} = 337.8.$$

$$F = \frac{177}{17.77.} = 9.961. \qquad P < .01.$$

$$t = \frac{17.85}{\sqrt{\frac{3702.75}{.380}}} = \frac{17.85}{3.121} = 5.719 \qquad Df=19 \quad P < .01.$$

TABLE 28.

Data and calculations for testing the significance of the difference between the Mean scores of the Dysthymic and Normal groups on the Matrices Test.

Normal Scores	Dysthymic Scores		
X_1	X_2	X_1^2	X_2^2
53	37	2809	1369
55	45	3025	2025
49	23	2401	529
53	34	2809	1156
56	50	3136	2500
45	37	2025	1369
54	35	2916	1225
50	35	2500	1225
43	26	1849	676
38	30	1444	900
48	24	2304	576
20	36	400	1296
43	34	1849	1156
46	32	2116	1024
50	41	2500	1681
49	30	2401	900
47	40	2209	1600
54	18	2916	324
56	43	3136	1849
36	35	1296	1225
945	685	46041	24605

$M = 47.25$ $M = 34.25.$

$$\Sigma x_1^2 = 46041 - \frac{893025}{20} = 1389.5.$$

$$\Sigma x_2^2 = 24605 - \frac{469225}{20} = 1143.75.$$

$$t = \frac{13}{\sqrt{\frac{2533.25}{380}}} = 5.035 \qquad Df = 38 \qquad P < .01.$$

TABLE 29.

Data and calculations for testing the significance of Mean differences between the Dysthymic and Normal Groups on the N.I.I.P. Space Test.

Dysthymics. Scores. X_1	Normals. Scores. X_2	X_1^2	X_2^2
31	31	961	961
10	28	100	984
11	48	121	361
22	26	484	676
24	48	576	2304
19	17	361	289
32	18	1024	324
46	20	2116	400
14	47	196	2209
49	15	2401	225
16	45	256	2025
17	16	289	256
15	10	225	100
31	17	961	289
16	31	256	961
12	15	144	225
11	19	121	2304
51	39	2601	1521
45	33	2025	1089
22	18	484	324
494	541	15702	17627

$M = 24.7.$ $M = 27.05.$

$$\Sigma x_1^2 = 15702 - \frac{244036}{20} = 3500.2.$$

$$\Sigma x_2^2 = 17627 - \frac{292681}{20} = 2992.95.$$

$$t = \frac{2.35}{\sqrt{\frac{649.15}{380}}} = \frac{2.34}{4.133.} = .5680 \qquad Df = 38 \qquad P > .05.$$

TABLE 29b.

Data and calculations for testing the significance of the Difference between the Mean Scores of the Dysthymics and Normals on the Mill Hill Vocabulary Scale.

Dysthymics Scores X_1	Normals. Scores. X_2	X_1^2	X_2^2
56	65	3136	4225
50	61	2500	3721
35	44	1225	1936
48	57	2304	3249
55	55	3025	3025
47	47	2209	2209
66	48	4356	2304
49	54	2401	2916
60	47	3600	2209
52	33	2704	1089
42	40	1764	1600
40	33	1600	1089
58	35	3364	1225
55	41	3024	1681
44	51	1936	2601
48	45	2304	2025
46	58	2116	3364
60	60	3600	3600
47	59	2209	3481
30	46	900	2116.
988	979	50278	49665

M = 49.4. M = 48.9.

$$\Sigma x_1^2 = 50278 - \frac{976144}{20} = 1470.8.$$

$$\Sigma x_2^2 = 49665 - \frac{958441}{20} = 1742.95.$$

$$t = \frac{.5}{\sqrt{\frac{3213.75}{380}}.} = \frac{.5}{2.908} = .1720 \quad Df = 38 \quad P > .05.$$

TABLE 30.

Data and calculations for testing the significance of the Difference of the Mean Normal Scores for the Dysthymic and Normal Groups on the Necker Cube.

Dysthymics Scores	Normal Scores		
X_1	X_2	X_1^2	X_2^2
6	27	36	729
4	5	16	25
20	20	400	400
10	18	100	324
1	36	1	1296
18	16	324	256
15	35	225	1225
12	52	144	2704
12	30	144	900
9	22	81	484
10	28	100	784
10	16	100	256
10	16	100	256
9	29	100	841
4	17	81	289
8	10	16	100
8	12	64	144
23	23	64	529
8	19	529	361
18	9	64	81
	16	324	256
215	440	2913	11984

$M = 10.75$ $M = 22.0.$

$$\Sigma x_1^2 = 2913 - \frac{46225}{20} = 601.75.$$

$$\Sigma x_2^2 = 11984 - \frac{193600}{20} = 2304$$

$$F = \frac{121.3.}{31.66.} = 3.828 \quad P. < .05.$$

$$t = \frac{11.25.}{\sqrt{\frac{2905.75.}{380}}} = \frac{11.25}{} = 4.068 \quad Df = 19 \quad P < .01.$$

TABLE 31.

Data and calculations for testing the significance of the Difference between the Mean Fast Scores for the Dysthymic and Normal groups on the Necker Cube.

Dysthymics. Scores X_1	Normals. Scores. X_2	X_1^2	X_2^2
10	29	100	841
35	44	1225	1936
15	41	225	1681
12	31	144	961
6	63	36	3969
27	26	729	676
24	32	576	1024
16	72	256	5184
14	71	196	5041
21	17	441	289
3	31	9	961
36	23	1296	529
10	40	100	1600
16	16	256	256
4	34	16	1156
11	14	121	196
13	12	169	144
27	24	729	576
37	37	1369	1369
20	22	400	484
334	679	7743	22873

$M = 16.7.$ $M = 33.95.$

$$\Sigma x_1^2 = 7743 - \frac{111556}{20} = 2165.2.$$

$$\Sigma x_2^2 = 28873 - \frac{461041}{20} = 5820.95$$

$$\frac{2165.2.}{19} = 114 \qquad \frac{5820.95}{19} = 306.3.$$

$$F = \frac{306.3.}{114} = 2.688 \qquad P < .05$$

$$t = \frac{17.25}{\sqrt{\frac{7986.15.}{380}}} = \frac{17.25}{\sqrt{21.01.}} = 3.862 \qquad Df = 19 \qquad P < .01.$$

TABLE 32.

Data and calculations for testing the significance of the Difference between the Mean Slow Scores for the Dysthymic and Normal groups on the Necker Cube.

Dysthymics Scores	Normals. Scores.		
X_1	X_2	X_1^2	X_2^2
4	16	16	256
0	2	0	4
8	6	64	36
6	2	36	4
0	13	0	169
6	6	36	36
14	27	196	729
3	18	9	324
8	9	64	81
2	11	4	121
3	11	9	121
10	13	100	169
7	4	49	144
7	12	49	116
3	4	9	16
5	6	25	36
8	13	64	169
8	16	64	256
11	4	121	16
3	10	9	100
116	203	924	2803
M = 5.8.	M = 19.15.		

$$\Sigma x_1^2 = 924 - \frac{13456}{20} = 251.2. \qquad \frac{251.2}{19} = 13.221.$$

$$\Sigma x_2^2 = 2803 - \frac{41209}{20} = 742.55. \qquad \frac{742.55.}{19} = 39.07.$$

$$F = \frac{39.07}{13.221} = 2.956 \qquad P < .05.$$

$$t = \frac{4.35}{\sqrt{\frac{993.75}{380}}} = \frac{4.35}{1.617} = 2.690 \qquad Df = 19 \qquad P < .02.$$

TABLE 33.

Data and calculations for testing the significance of The Difference of the Mean Difference between the Fast and Normal Scores on the Necker Cube for the Dysthymic and Normal groups.

Dysthymics Differences.	Normals. Differences.		
X_1	X_2	X_1^2	X_2^2
4	12	16	144
31	39	961	1521
-5	20	25	400
2	13	4	169
5	27	25	729
9	10	81	100
9	-3	81	9
4	10	16	100
2	41	4	1681
12	15	144	225
-7	3	49	9
26	7	676	49
0	11	0	121
7	1	49	1
0	24	0	576
3	2	9	4
5	-11	25	121
4	5	16	25
29	28	841	784
2	6	4	36.
142	260	3026	6804.
M = 7.1.	M = 13		

$$\Sigma x_1^2 = 3026 - \frac{29164}{20} - 2017.8.$$

$$\Sigma x_2^2 = 6804 - \frac{67600}{20} - 3424.0.$$

$$\frac{2017.8.}{19} = 106.3. \qquad \frac{3424.0.}{19} = 180.2.$$

$$F = \frac{180.2.}{106.3.} = 1.696 \qquad P > .05.$$

$$t = \frac{6.0.}{\sqrt{\frac{5441.8.}{380}}} = \frac{6.0.}{14.32.} = \frac{6.0.}{3.784.} = 1.586 \qquad Df = 38 \; P > .10.$$

TABLE 34.

Data and calculations for testing the significance of the Difference of Mean Difference between Fast and Slow Scores on the Necker Cube for the Dysthymic and Normal groups.

Dysthymics Differences	Normals. Differences.		
X_1	X_2	X_1^2	X_2^2
6	23	36	529
35	42	1225	1764
7	35	49	1225
6	29	36	841
6	50	36	2500
21	20	441	400
10	5	100	25
13	54	169	2916
6	62	36	3844
19	6	361	36
0	20	0	400
26	10	676	100
3	36	9	1296
9	4	81	16
1	30	1	900
6	8	36	64
5	-1	25	1
19	8	361	64
26	33	676	1089
17	12	289	144
241	486	4643	18154.

M = 12.05 M = 24.3.

$$\Sigma x_1^2 = 4643 - \frac{58081}{20} = 1738.95.$$

$$\Sigma x_2^2 = 18154 - \frac{236196}{20} = 73442.$$

$$\frac{1738.95}{19} = 91.49 \qquad \frac{7344.2.}{19} = 386.5.$$

$$F = \frac{386.5.}{91.49.} = 4.225 \qquad P < .05.$$

$$t = \frac{12.25}{\sqrt{\frac{9083.15}{380}}} = \frac{12.25}{\sqrt{23.90.}} = \frac{12.25}{4.889} = 2.505 \qquad Df = 19 \qquad P < .05.$$

TABLE 35.

Data and calculations for testing the significance of the Difference between the Mean ages of the Hysteric and Normal Groups.

Hysteric Ages X_1	Normal Ages. X_2	X_1^2	X_2^2
37	24	1369	576
29	26	841	676
42	18	1764	324
52	21	2704	441
38	23	1444	529
34	18	1156	324
35	27	1225	729
31	18	961	324
28	21	784	441
32	24	1024	576
16	19	256	361
18	22	324	484
27	18	729	324
49	21	2401	441
20	18	400	324
30	19	900	361
19	27	361	729
56	34	3136	1156
55	25	3025	625
43	19	1849	361
691	442	26653	10106

$M = 34.55$ $M = 22.1.$

$$\Sigma x_1^2 = 26653 - \frac{477481}{20} = 2778.95.$$

$$\Sigma x_2^2 = 10106 - \frac{195364}{20} = 337.8.$$

$$\frac{2778.95}{19} = 146.2. \quad \frac{337.8.}{19} = 17.77.$$

$F = 8.23.$ $P < .05.$

$$t = \frac{12.45.}{\sqrt{\frac{3116.75.}{380}}} = \frac{12.45.}{2.864} = 4.346 \quad Df = 19 \quad P < .01.$$

TABLE 36.

Data and calculations for testing the significance of the Difference between the Mean Scores of the Hysteric and Normal groups on the Matrices Test.

Hysteric. Scores.	Normal. Scores.		
X_1	X_2	X_1^2	X_2^2
42	43	1764	2809
27	55	729	3025
24	49	576	2401
25	53	625	2809
42	56	1764	3136
20	45	400	2025
48	54	2304	2916
50	50	2500	2500
34	43	1156	1849
57	38	3249	1444
39	48	1521	2304
35	20	1225	400
33	43	1089	1849
35	46	1225	2116
37	50	1369	2500
34	49	1156	2401
40	47	1600	2209
50	54	2500	2916
30	56	900	3136
43	36	1849	1296
745	945	29501	46041

$M = 37.25$ $\quad M = 47.25$

$$\Sigma x_1^2 = 29501 - \frac{555025}{20} = 1749.75$$

$$\Sigma x_2^2 = 46041 - \frac{893025}{20} = 1389.5.$$

$$t = \frac{10}{\sqrt{\frac{3139.25}{380}}} = \frac{10}{2.874} = 3.479. \quad Df = 38 \quad P < .01.$$

TABLE 38.

Data and calculations for testing the significance of the Difference between the Mean scores of the Hysteric and Normal groups on the N.I.I.P. Space Test.

Hysterics. Scores	Normals. Scores.		
X_1	X_2	X_1^2	X_2^2
30	31	900	961
13	28	169	784
14	48	196	361
32	26	1024	676
41	48	1681	2304
12	17	144	289
16	18	256	324
31	20	961	400
14	47	196	2209
13	15	169	225
10	45	100	2025
16	16	256	256
11	10	121	100
15	17	225	289
29	31	841	961
15	15	225	225
37	19	1369	2304
21	39	441	1521
13	33	169	1089
25	18	625	324
408	541	10068	17627

$M = 20.4.$ $M = 27.05.$

$$\Sigma x_1^2 \quad \frac{10068}{1} - \frac{(408)}{20} = 1744.8.$$

$$\Sigma x_2^2 = 17627 - \frac{(541)}{20} = 2992.95.$$

$$t = \frac{6.65.}{\sqrt{\frac{4737}{380}}} = \frac{6.65}{3.53} = 1.88 \quad P > .05$$

TABLE 39.

Data and calculations for testing the significance of the Difference between the Mean Normal Scores forthe Hysteric and Normal Groups on the Necker Cube.

Hysterics. Scores.	Normals. Scores.		
X_1	X_2	X_1^2	X_2^2
13	27	169	729
21	5	441	25
10	20	100	400
24	18	576	324
7	36	49	1296
14	16	196	256
14	35	196	1225
16	52	256	2704
12	30	144	900
21	22	441	484
18	28	324	784
25	16	625	256
34	29	1156	841
8	17	64	289
20	10	400	100
10	12	100	144
18	23	324	529
10	19	100	361
21	9	441	81
15	16	225	256
331	440	5767	11984

$M = 16.55$ $M = 22.0.$

$$\Sigma x_1^2 = 5767 - \frac{109561}{20} = 288.95.$$

$$\Sigma x_2^2 = 11984 - \frac{193600}{20} = 2304$$

$$F = \frac{2304}{288.95.} = 7.973 \quad P < .01.$$

$$t = \frac{5.45.}{\sqrt{\frac{2592.95}{380}}} = \frac{5.45.}{2.611} = 2.086 \quad Df = 19 \quad P > .05.$$

TABLE 40.

Data and calculations for testing the significance of Difference between the Mean Fast Scores for the Hysteric and Normal groups on the Necker Cube.

Hysterics Scores	Normals Scores		
x X_1	X_2	X_1^2	X_2^2
25	29	625	841
29	44	841	1936
11	41	121	1681
23	31	529	961
16	63	256	3969
16	26	256	676
17	32	289	1024
22	72	484	5184
22	71	484	5041
12	17	144	289
9	31	31	961
51	23	2601	529
55	40	3025	1600
15	16	225	256
35	34	1225	1156
10	14	100	196
36	12	1296	144
15	24	225	576
45	37	2025	1369
14	22	196	484
478	679	15028	28873

M = 23.9. M = 33.95.

$$\Sigma x_1^2 = 28873 - \frac{461041}{20} = 5820.95.$$

$$\Sigma x_2^2 = 15028 = \frac{228484}{20} = 3603.8.$$

$$\frac{5820.95}{19} = 306.3. \quad \frac{3603.8.}{19} = 189.656.$$

$$F = \frac{396.3.}{189.656} = 1.614 \quad P > .05.$$

$$t = \frac{10.05}{\sqrt{\frac{9424.75}{380}}} = \frac{10.05}{\sqrt{24.80}} = \frac{10.05}{4.979} = 2.018 \quad Df = 38 \quad P > .05.$$

TABLE 41.

Data and calculations for testing the significance of the Difference between the Mean Slow Scores for the Hysteric and Normal groups on the Necker Cube.

Hysterics Scores	Normals. Scores.		
X_1	X_2	X_1^2	X^2_2
6	16	36	256
16	2	256	4
6	6	36	36
13	2	169	4
3	13	9	169
12	6	144	36
9	27	81	729
9	18	81	324
6	9	36	81
10	11	100	121
6	11	36	121
14	13	196	169
20	4	400	16
13	12	169	144
10	4	100	16
4	6	16	36
11	13	121	169
6	16	36	256
18	4	324	16
10	10	100	100
192	203	2346	2803

$M = 9\frac{1}{2}.6.$ $\quad M = 10.15.$

$$\Sigma x_1^2 \quad 2346 - \frac{36864}{20} = 502.8.$$

$$\Sigma x_2^2 = 2803 - \frac{41209}{20} = 742.55.$$

$$\frac{742.55}{19} = 39.07 \qquad \frac{502.8}{19} = 26.463$$

$$F = \frac{39.07}{26.463.} = 1.477 \qquad P > .05$$

$$t = \frac{.55}{\sqrt{\frac{1245.35}{380}}} \qquad \frac{.55}{\sqrt{3.275}} = \frac{.55}{1.809} = .304 \qquad Df = 38 \qquad P > .95.$$

TABLE 42.

Data and calculations for testing the significance of the Mean Difference between Fast and Normal Scores for the Hysteric and Normal groups on the Necker Cube.

Hysterics Differences X_1	Normals. Differences. X_2	X_1^2	X_2^2
12	12	144	144
6	39	36	1521
1	20	1	400
- 1	13	1	169
-9	27	81	729
2	10	4	100
3	-3	9	9
6	10	36	100
10	41	100	1681
-9	15	81	225
-7	3	49	9
26	7	676	49
21	11	441	121
7	1	49	1
15	24	225	576
0	2	0	4
18	-11	324	121
5	5	25	25
24	28	576	784
0	6	0	36
158	260	2858	6804

$M = 7.9.$ $M = 13.$

$$\Sigma x_1^2 = 6804 - \frac{67600}{20} = 3424.0.$$

$$\Sigma x_2^2 = 2858 - \frac{24964}{20} = 1609.8.$$

$$\frac{3424}{19} = 180.2. \quad \frac{1609.8.}{19} = 84.72.$$

$$F = \frac{180.2.}{84.72.} = 2.127 \quad P > .05.$$

$$t = \frac{5.1.}{\sqrt{\frac{5033.8.}{380}}\sqrt{13.24.}} = \frac{5.1.}{3.639} = 1.402 \quad Df = 38. \quad P > .05.$$

TABLE 43.

Data and calculations for testing the significance of the Mean Difference between Fast and Slow Scores on the Necker Cube for the Hysteric and Normal Groups.

Hysterics. Score	Normals. Score.		
X_1	X_2	X_1^2	X_2^2
19	23	361	529
13	42	169	1764
5	35	25	1225
10	29	100	841
13	50	169	2500
4	20	16	400
8	5	64	25
13	54	169	2916
16	62	256	3844
2	6	4	36
3	20	9	400
37	10	1369	100
35	36	1225	1296
2	4	4	16
35	30	1225	900
6	8	36	64
25	-1	625	1
9	8	1369	64
37	33	16	1089
4	12		144
296	486	7292	18154

M = 14.8. M = 24.3.

$$\Sigma x_1^2 = 7292 - \frac{87616}{20} = 2911.2.$$

$$\Sigma x_2^2 = 18154 - \frac{236196}{20} = 7344.2.$$

$$\frac{2911.2}{19} = 153.2. \qquad \frac{7344.2.}{19} \quad 386.5.$$

$$F = \frac{38615.}{153.2.} = 2.523 \qquad P < .05.$$

$$t = \frac{9.5.}{\sqrt{\frac{10255.4.}{380}}} = \frac{9.5.}{5.187} = 1.831 \qquad Df = 19 \qquad P > .05.$$

TABLE 44.

Data and calculations for testing the significance of the Difference of the Mean Differences between Fast and Normal Scores on the Necker Cube for the weak-unstable group and the controlled group (combining Hysterics and Normals).

Weak-unstable. Differences.	Controlled. Differences.		
X_1	X_2	X_1^2	X_2^2
8	12	64	144
2	39	4	1521
3	20	9	400
-9	13	81	169
-9	27	81	729
26	10	676	100
21	10	441	100
7	41	49	1681
24	3	576	9
-3	7	9	49
15	24	225	576
11	5	121	25
1	28	1	784
6	12	36	144
+103	1	2273	1
M = 7.19.	9		81
	6		36
	10		100
	15		255
	18		324
	5		25
	-1		1
	+313		7225

M = 13.61.

$$\Sigma xx_1^2 = 2373 - \frac{10609}{14} = 1615.2.$$

$$\Sigma x_2^2 = 7225 - \frac{97969}{23} = 2965$$

$$\frac{1615.2.}{13} = 124.3. \qquad \frac{2965}{22} = 134.8.$$

$$F = \frac{134.8.}{124.3.} = 1.085 \quad P > .05.$$

$$t = \frac{6.42.}{\sqrt{\frac{44580.2.}{35} \times .1149}} = \frac{6.42.}{\sqrt{15.03.}} = \frac{6.42}{3.877} = 1.656 \quad Df = 35 \quad P > .05.$$

TABLE 45.

Data and calculations for testing the significance of the Differences of the Mean Differences between Fast and Slow Scores on the Necker Cube for the Weak-unstable group and the Controlled group. (Combining Hysterics and Normals).

Weak-unstable. Differences. X_1	Controlled. Differences. X_2	X_1^2	X_2^2
13	23	169	529
4	42	16	1764
8	35	64	1225.
2	29	4	841
		9	
3	50	1369	2500
37	20	1225	400
35	54	4	2916
2	62	729	3844
27	20	25	400
5	10	36	100
6	30	1296	900
36	8	16	64
4	33	144	1089
12	19		361
194	5	5106	25
	10		100
	13		169
M = 13.86	13		169
	16		256
	35		1225
	25		625
	9		81
	4		16
	565		19599

$M = 24.57$

$\Sigma x_1^2 = 5106 - \frac{37636}{14} = 2417. \qquad \frac{2417}{13} = 185.9.$

$\Sigma x_2^2 = 19599 - \frac{319225}{23} = 5719 \qquad \frac{5719}{22} = 259.9.$

$F = \frac{259.9.}{185.9.} = 1.398 \qquad P > .05$

$$t = \frac{10.71.}{\sqrt{\frac{8136}{35} \times .1149}\sqrt{26.71}} = \frac{10.71}{5.168} = 2.072 \quad Df = 35 \quad P < .05.$$

TABLE 46.

Data and calculations for testing the significance of the Difference between the Mean Scores of the Weak-unstable group and Controlled Group (Combining Hysterics and Normals) on the N.I.I.P. Space Test.

Weak-unstable. Scores X_1	Controlled Scores. X_2	X_1^2	X_2^2
13	31	169	961
12	28	144	784
16	48	256	2304
13	26	169	676
10	48	100	2304
16	17	256	289
11	20	121	400
15	47	225	2209
13	45	169	2025
18	16	324	256
15	31	225	961
10	39	100	1521
17	33	289	1089
18	30	324	900
	14		196
197	32	2871	1024
	41		1681
M = 14.40	31		961
	14		196
	29		841
	37		1369
	21		441
	25		625
	703		24013
	M = 30.57.		

$$\Sigma x_1^2 = 2871 - \frac{38809}{14} = 99$$

$$\Sigma x_2^2 = 24013 - \frac{494209}{23} = 2523$$

$$\frac{99}{13} = 7.615 \quad \frac{2523}{22} = 114.7.$$

$$F = \frac{114.7}{7.615.} = 15.06 \qquad P < .05$$

TABLE 46.

$S\bar{x}_1^2 = \frac{7.615}{14}$ $S\bar{x}_2^2 = \frac{114.77}{23}$

$S\bar{x}_1 - \bar{x}_2 = .5441 + 4.986$

$t = \frac{16.17}{5.5301} = 6.876$

$t_{.01} = \frac{(S\bar{x}_1^2)(t_1) + (S\bar{x}_2^2)(t_2)}{S\bar{x}_1^2 + S\bar{x}_2^2} = \frac{15.699}{5.5301} = 2.839.$

$P < .01.$

TABLE 47.

Data for the calculation of the Correlation Coefficient between Matrices and N.I.I.P Space Test scores of the Dysthymics and Normals.

Matrices. Scores	N.I.I.P. Scores.			
X	Y	X	Y	XY
53	31	2809	961	1643
55	28	3025	784	1540
49	48	2401	2304	2352
53	26	2809	676	1378
56	48	3136	2304	2688
45	17	2025	289	765
54	18	2916	324	972
50	20	2500	400	1000
43	47	1849	2209	2021
38	15	1444	225	570
48	45	2304	2025	2160
20	16	400	256	320
43	10	1849	100	430
46	17	2116	289	782
50	31	2500	961	1550
49	15	2401	225	735
47	19	2209	361	893
54	39	2916	1521	2106
56	33	3136	1089	1848
36	18	1296	324	648
42	31	1764	961	1302
27	10	729	100	270
24	11	576	121	264
25	22	625	484	550
42	24	1764	576	1000
20	19	400	361	380
48	32	2304	1024	1536
50	46	2500	2116	2300
34	14	1156	196	476
57	49	3249	2401	2793
39	16	1521	256	624
35	17	1225	289	595
33	15	1089	225	495
35	31	1225	961	1085
37	16	1369	256	592
34	12	1156	144	408
40	11	1600	121	440
50	51	2500	2601	2550
30	45	900	2025	1350
43	22	1849	484	946
1690	1035	75542	33329	46365

$$\frac{N \Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{\left[N\Sigma X^2 - (\Sigma X^2)(N\Sigma Y^2 - (\Sigma Y)^2\right]}} = \frac{1854600 - 1749000}{165680 \times 262160}$$

Table 47 (Continued)

$$= \frac{105600}{208400} = .5067 \qquad P < .01$$

TABLE 48.

Data for the calculation of the Correlation Coefficient between the Ages and N.I.I.P. Space Test scores of the Dysthymics and Normals.

Age.	N.I.I.P.	X	Y	XY
24	31	576	961	744
26	28	676	784	728
18	48	324	2304	864
21	26	441	676	546
23	48	529	2304	1104
18	17	324	289	306
27	18	729	324	486
18	20	324	400	360
21	47	441	2209	987
24	15	576	225	360
19	45	361	2025	855
22	16	484	256	352
18	10	324	100	180
21	17	441	289	357
18	31	324	961	558
19	15	361	225	285
27	19	729	361	513
34	39	1156	1521	1326
25	33	625	1089	825
19	18	361	324	342
41	31	1681	961	1271
56	10	3136	100	560
31	11	961	121	341
50	22	2500	484	1100
37	24	1369	576	888
54	19	2916	361	1026
42	32	1764	1024	1344
18	46	324	2116	828
62	14	3844	196	868
21	49	441	2401	1029
22	16	484	256	352
43	17	1849	289	931
39	15	1521	225	585
59	31	3481	961	1829
55	16	3025	256	880
25	12	625	144	300
41	11	1681	121	451
33	51	1089	2601	1683
30	45	900	2025	1350
30	22	900	484	660
1221	1035	44597	33329	30154

$$\frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2 v(N\Sigma Y^2 - (\Sigma Y)^2)]}} = \frac{1206160 - 1264000}{293880 \times 262160}$$

$$= \frac{-57840}{277600} = -.2084 \qquad P > .05.$$

TABLE 49.

Data for the calculation of the Correlation Coefficient between Matrices and N.I.I.P. Space Test scores of the Hysterics and Normals.

Matrices.	N.I.I.P.	X	Y	XY
53	31	2809	961	1643
55	28	3025	784	1540
49	48	2401	2304	2352
53	26	2809	676	1378
56	48	3136	2304	2688
45	17	2025	289	765
54	18	2916	324	972
50	29	2500	400	1000
43	47	1849	2209	2021
38	15	1444	225	570
48	45	2304	2025	2160
20	16	400	256	320
43	10	1849	100	430
46	17	2116	289	782
50	31	2500	961	1550
49	15	2401	225	735
47	19	2209	361	893
54	39	2916	1521	2106
56	33	3136	1089	1848
36	18	1296	324	648
37	30	1369	900	1110
45	13	2025	169	585
23	14	529	196	322
34	32	1156	1024	1088
50	41	2500	1681	2050
37	12	1369	144	444
35	16	1225	256	560
35				
26	31	1225	961	1085
30	14	676	196	364
24	13	900	169	390
36	10	576	100	240
34	16	1296	256	576
32	11	1156	121	375
41	15	1024	225	480
30	29	1681	841	1189
40	15	900	225	450
18	37	1600	1369	1480
43	21	324	441	378
35	13	1849	169	559
	25	1225	625	875
1630	949	70646	27695	41001

$$\frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2]}} = \frac{1640040 - 154700}{168840 \quad 207100} = \frac{93040}{186900} = .4976 \quad P < .01$$

TABLE 50.

Data for the calculation of the Correlation Coefficient between the Ages and N.I.I.P. Space Test scores of the Hysterics and Normals.

Age	N.I.I.P.	X	Y	XY
24	31	576	961	744
26	28	676	784	728
18	48	324	2304	864
21	26	441	676	546
23	48	529	2304	1104
18	17	324	289	306
27	18	729	324	486
18	30	324	400	360
21	47	441	2209	987
24	15	576	225	360
19	45	361	2025	855
22	16	484	256	352
18	10	324	100	180
21	17	441	289	357
18	31	324	961	558
19	15	361	225	285
27	19	729	361	513
34	39	1156	1521	1326
25	33	625	1089	825
19	18	361	324	342
37	30	1369	900	1110
29	13	841	169	377
42	14	1764	196	588
52	32	2704	1024	1664
38	41	1444	1681	1558
34	12	1156	144	408
35	16	1225	256	560
31	31	961	961	961
28	14	784	196	392
32	13	1024	169	416
16	10	256	100	160
18	16	324	256	288
27	11	729	121	297
49	15	2401	225	735
20	29	400	841	250
30	15	900	225	450
19	37	361	1369	703
56	21	3136	441	1176
55	13	3025	169	715
43	25	1849	625	1075
1133	949	36759	27695	26291

$$\frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2]}} = \frac{1051640 - 1075000}{187360 \times 207100} = \frac{-23360}{19700} = -.1186$$

$P > .05$

TABLE 51.

Data and calculations for testing the significance of the difference between the alpha amplitude (converted to percentage rise or fall from the resting alpha amplitude) during the "Car" condition and "Diagram" condition in the First Normal Session.

Car Condition. Percentage Differences.	Diagram Condition. Percentage Differences.		
X_1	X_2	d	d^2
-15	-4	-11	121
-88	-85	-3	9
-24	-7	-17	289
-41	-35	-6	36
-32	-7	-25	625
-40	+3	-43	1849
-29	+2	-31	961
+19	+3	+16	256
+9	+22	-13	169
-35	-35	0	0
-34	-12	-22	484
-71	-74	+3	9
-63	-44	-19	361
-42	-57	+15	225
-57	-49	-8	64
-51	-50	-1	1
-72	-63	-9	81
-64	-64	0	0
-84	-88	+4	16
-33	-19	-14	196
-847	-663	-184	5752
M = -42.35	M = -35.15	M = -9.2.	

$$A = \frac{\Sigma d^2}{(\Sigma d)^2} = \frac{5752}{33856} = .1699 \quad Df = 19 \quad P < .02.$$

TABLE 52.

Data and calculations for testing the significance of the difference between the alpha amplitudes (converted to percentage rise or fall from the resting alpha amplitude) during the "Car Condition" and the "Bus Condition" in the first normal session.

Car Condition. Percentage Differences.	Bus Condition. Percentage Differences.		
X_1	X_2	d	d^2
-15	-39	+24	576
-88	-85	-3	9
-24	-14	-10	100
-41	-19	-22	484
-32	-45	+13	169
-40	-24	-16	256
-29	-11	-18	334
+19	-44	+63	3969
+9	+51	-42	1764
-35	-11	-24	576
-34	-1	-33	1089
-71	-60	-11	121
-63	-56	-7	49
-42	-34	-8	64
-57	-51	-6	36
-51	+6	-57	3249
-72	-38	-34	1156
-64	-22	-42	1764
-84	-60	-24	576
-33	-45	+12	144
-847	-602	-245	16485

M = -42.35 M = -30.1 M = -12.25.

$$A = \frac{16485}{60025} = .2746 \quad Df = 19 \quad P > .05.$$

TABLE 53.

Data and calculations for testing the significance of the difference between alpha amplitudes (converted to percentage rise or fall from the resting alpha amplitude) during the "Car Condition" and the "Wheel Condition" in the First Normal Session.

Car Condition. Percentage Differences.	Wheel Condition Percentage Differences.		
X_1	X_2	d	d^2
-15	-32	+27	729
-88	-86	-2	4
-24	-6	-18	324
-41	-19	-22	484
-32	-29	-3	9
-40	-13	-37	1369
-29	-28	-1	1
+19	-58	+77	5929
+9	+30	-21	441
-35	-42	+7	49
+34	-12	-22	484
-71	-73	+2	4
-63	-40	-13	169
-42	-19	-23	529
-57	-46	-11	121
-51	-43	-8	64
-72	- 3	+1	1
-64	-42	-22	484
-84	-65	+33	1024
-847	-776	-61	12235
M = -42.35	M= -38.8.	M = -3.05.	

$$A = \frac{12235}{3721} = 3.287 \quad P > .10$$

TABLE 54.

Data and calculations for testing the significance of the difference between the alpha amplitudes (converted to percentage rise or fall from the resting alpha amplitude) during the "Diagram Condition" and the "Bus Condition" in the first normal session.

Diagram Condition Percentage Differences	Bus Condition Percentage Differences.		
X	X 2	d	d^2
-4	-39	+35	1225
-85	-85	0	0
-7	-14	+7	49
-35	-19	-16	256
-7	-45	+38	1448
+3	-24	+27	729
+2	-11	+13	169
+3	-44	+47	2209
+22	+51	-29	841
-35	-11	-24	576
-12	-1	-11	121
-74	-60	-14	196
-44	-56	+12	144
-57	-34	-23	529
-49	-51	+3	9
-50	+6	-56	3136
-63	-38	-25	625
-64	-22	-42	1764
-88	-60	-28	784
-19	-45	+26	676
-663	-602	-60	15186
M = -33.15	M = - 30.1.	M = -3	

$$A = \frac{15186}{3600} = 1.216 \qquad P > .10.$$

TABLE 55.

Data and calculations for testing the significance of the difference between the alpha amplitudes (converted to percentage rise or fall from the resting alpha amplitude) during the "Diagram Condition" and the "Wheel Condition" in the first normal session.

Diagram Condition Percentage Differences	Wheel Condition. Percentage Differences.		
X_1	X_2	d	d^2
-4	-32	+28	784
-85	-86	+1	1
-7	-6	-1	-
-35	-19	-16	256
-7	-29	+22	484
+3	-13	+16	256
+2	-28	+30	900
+3	-58	+61	3721
+22	+30	-8	64
-35	-42	+7	49
-12	-12	0	0
-74	-73	-1	1
-44	-40	-4	16
-57	-19	-38	1444
-49	-46	-3	9
-50	-43	-7	49
-63	-73	+10	100
-64	-42	-22	484
-88	-80	-8	64
-19	-65	+46	2116
-663	-776	+106	10799
M = 33.15	M = -38.8.	M = 5.3.	

$$A = \frac{10799}{11236} = .9610 \qquad P > 10$$

TABLE 56.

Data and calculations for testing the significance of the difference between amplitudes (converted to percentage rise or fall from the resting alpha amplitude) during the "Bus Condition" and the "Wheel Condition" in the First Normal session.

Bus Condition Percentage Differences.	Wheel Condition. Percentage Differences.		
X_1	X_2	d	d^2
-39	-32	-7	-49
+86	-86	+1	+1
-14	-6	-8	-64
-19	-19	0	0
-45	-29	+26	-256
-24	-13	-11	-121
-11	-28	+17	+289
-44	-58	+14	+196
+55	+30	+21	+441
-11	-42	+31	+961
			+121
-1	-12	+11	+169
-60	-73	+13	-256
-56	-40	-16	-225
-34	-19	-15	-25
-51	-46	-5	+2401
+6	-43	+49	1225
-38	-73	+35	+400
-22	-42	+20	+400
-70	-80	+20	+400
-45	-65	+20	
-602	-776	+174	8000
M = -30.1.	M = -38.8.	M = 8.7.	

$$A = \frac{\sqrt{8000}}{30276} = .2642 \qquad P < .05$$

TABLE 57.

Data and calculations for testing the significance of the difference between the alpha amplitudes (converted to percentage rise or fall from the resting alpha amplitude), during the "Bus Condition" and "Distraction Condition" in the first normal session.

Bus Condition Percentage Differences	Distraction Condition. Percentage Differences.		
X_1	X_2	d	d^2
-39	-36	-3	9
-85	-87	+2	4
-14	+5	-19	361
-19	-20	+1	1
-45	-35	-10	100
-24	-27	+3	9
-11	-11	0	0
-44	+3	-47	2209
+51	+15	+36	1296
-11	-36	+25	625
-1	-14	+13	169
-60	-70	+10	100
-56	-46	-10	100
-34	-34	0	0
-51	-43	-8	64
+6	-36	+42	1764
-38	-66	+28	784
-22	-40	+18	324
-60	-48	-12	144
-45	-60	+15	225
-602	-686	+84	8288
M = - 30.1.	M = - 34.3.	M = + 4.2.	

$$A = \frac{8288}{7056} = 1.174 \quad P > .10.$$

TABLE 58.

Data and calculations for testing the significance of the difference between the alpha amplitudes (converted to percentage rise or fall from the resting alpha amplitude) during the "Wheel Condition" and the "Distraction Condition" in the first normal session.

Wheel Condition Percentage Differences	Distraction Condition. Percentage Differences.		
X_1	X_2	d	d^2
-32	-36	+4	16
-86	-87	+1	1
- 6	- 2	-4	16
-19	-24	+5	25
-29	-15	-14	196
-13	-26	+13	169
-28	-28	0	0
-58			
+30	+3	-61	3721
-42	+54	-24	576
-12	-19	-23	529
-73	-36	+24	576
-19	-65	-8	64
-46	-19	0	0
-43	-44	-2	4
-73	-33	-10	100
-42	-27	-46	2116
-80	-54	+12	144
	-63	-3	
-65	-22	-17	289
-40	-72	-43	1849
		+32	1024
-776	-615	-161	11415
M =-38.8.	M = -30.75	M = - 8.05.	

$$A = \frac{11415}{25921} = .4402 \qquad P > .10.$$

TABLE 59.

Date and calculations for testing the significance of the difference between the alpha amplitudes (converted to percentage rise or fall from the testing alpha amplitude) during the "Car Condition" of the Normal Session and the "Car Condition" of the Seconal Session.

Car Condition. (Normal Session). Percentage Differences. X	Car Condition. (Seconal Session). Percentage Differences. X_2	d	d^2
-15	-64	+49	2401
-88	-87	-1	1
-24	+2	-26	676
-41	+10	-51	2601
-32	-1	-31	961
-40	-30	-10	100
-29	-40	+11	121
+19	-37	+56	3136
+9	-6	+15	225
-35	-30	-5	25
-34	-36	+2	4
-71	-73	+2	4
-63	-58	-5	25
-42	+1	-43	1849
-57	-53	-4	16
-51	-51	0	0
-72	-51	-21	841
-64	-35	+29	8416
-84	-88	+4	16
-33	-24	-9	81
-847	-751	-96	13524
M = -42.35	M= -37.55	M = -4.8.	

$$A = \frac{13524}{9216} = 1.467 \quad P > .10.$$

TABLE 60.

Data and calculations for testing the significance of the difference between the alpha amplitudes (converted to percentage rise or fall from the resting alpha amplitude) during the "Diagram Condition" of the Normal Session and the "Diagram Condition" of the Seconal session.

Diagram Condition. (Normal Session).	Diagram Condition. (Seconal Session)		
X_1	X_2	d	d^2
-4	-6	+2	4
-86	-86	+2	4
-7	+8	-15	225
-35	+10	-45	2025
-7	-12	+5	25
+3	-40	+43	1849
+2	-32	+34	1156
+3	-39	+42	1764
+22	-19	+41	1681
-35	-60	+25	625
-12	-41	+29	841
-74	-74	+ 0	0
-44	-47	+3	9
-57	-25	-32	1024
-49	-52	+3	9
-50	-17	-33	1089
-63	-55	-8	64
-64	-16	-48	2304
-88	-71	-17	289
-19	-42	+23	529
-663	-716	+54	15516
M = -33.15	M = -35.8.	M = +2.7.	

$$A = \frac{15516}{2916} = 5.319 \qquad P > .10.$$

TABLE 61.

Data and calculations for testing the significance of the difference between the alpha amplitudes (converted to percentage rise or fall from the resting alpha amplitude) during the "Bus Condition" of the Normal Session and the "Bus Condition" of the Seconal Session.

Bus Condition. (Normal Session).	Bus Condition. (Seconal Session).		
X_1	X_2	d	d^2
-39	-26	-13	169
-85	-81	-4	16
-14	-36	+22	529
-19	+14	-33	1089
-45	-37	-8	64
-24	-43	+19	361
-11	-28	+17	289
-44	-48	+4	16
+51	-17	+68	4624
-11	-46	+35	1225
-1	-17	+16	256
-60	-69	+9	81
-56	-48	-8	64
-34	-31	-3	9
-51	-61	+10	100
+6	-31	+37	1369
-38	-51	+14	196
-22	-36	+14	196
-60	-86	+26	676
-45	-61	+16	256
-602	-819	+217	10808
M = -30.1.	M = -40.95	M = +10.85.	

$$A = \frac{11438}{47089} = .2430 \quad P < .05.$$

TABLE 62.

Data and calculations for testing the significance of the difference between the alpha amplitudes (converted to percentage rise or fall from the resting alpha amplitude) during "Wheel condition" of the Normal session and the "Wheel Condition" of the Seconal Session.

Wheel Condition (Normal Session)	Wheel Condition. (Seconal Session)		
X_1	X_2	d	d^d
-32	-63	+31	961
-86	-89	+3	9
-6	-1	-5	25
-19	+12	-31	961
-29	-67	+38	1444
-13	-39	+26	676
-28	-18	-10	100
-58	-48	-10	100
+30	-25	+53	2809
-42	-51	+9	81
-12	-44	+32	1024
-73	-69	-4	16
-40	-51	+11	121
-19	-34	+15	225
-46	-50	+4	16
-43	-68	+25	625
-73	-16	-57	3249
-42	-33	-9	81
-80	-84	+4	16
-65	-13	-52	2704
-776	-849	+73	15243
M = 38.8.	M = -42.45	M = 3.65.	

$$A = \frac{15243}{5399} = 2.822 \quad P > .10$$

TABLE 63.

Data and calculations for testing the significance of the difference between the alpha amplitudes (converted to percentage rise or fall from the resting alpha amplitude) during the "Bus Condition" and the "Distraction Condition" in the Seconal session.

Bus Condition. Percentage Differences	Distraction Condition. Percentage Differences.		
X	X_2	d	d^2
-26	+30	-56	3136
-81	-91	+10	100
-36	-10	-26	676
+14	+11	+3	9
-37	-27	-10	100
-43	-56	+13	169
-28	-3	-25	625
-48	-4	-44	1936
-17	-21	+4	16
-46	-45	-1	1
-17	-9	-8	64
-69	-71	+2	4
-31	-15	-16	256
-61	-42	-20	400
-31	+2	-33	1089
-31	+105	-136	18496
-36	-27	-9	81
-86	-57	-29	841
-61	-28	-33	1089
-48	-64	+16	256
-819	-421	-398	29344
M = 40.95	M = -21.05	M = -19.91	

$$A = \frac{29344}{158404} = .1852 \quad P < .02.$$

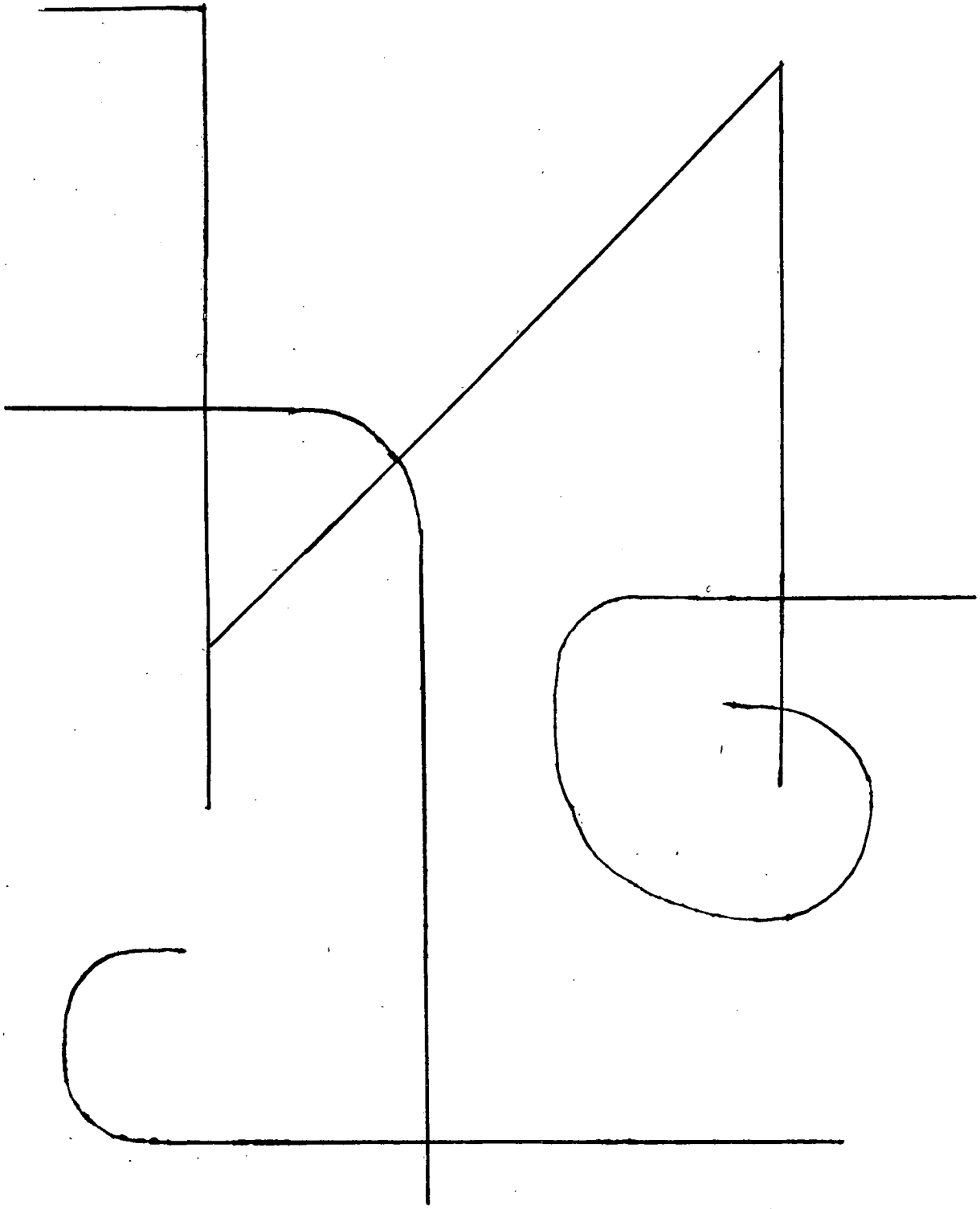
TABLE 64.

Data and calculations for testing the significance of the difference between the alpha amplitudes (converted to percentage rise or fall from the resting alpha amplitude) during the "Wheel Condition" and the "Distraction Condition" in the Seconal Session.

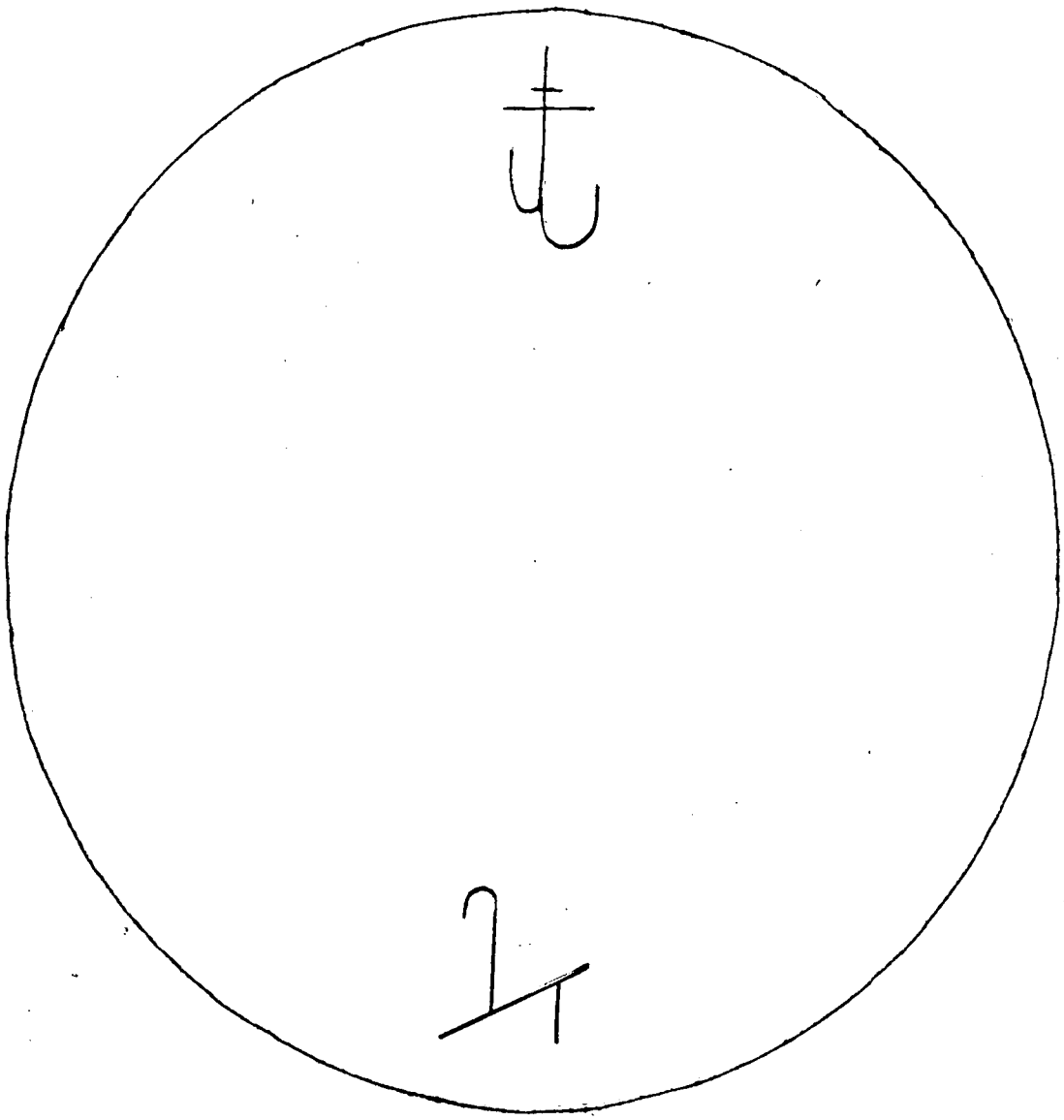
Wheel Condition Percentage Differences. X_1	Distraction Condition Percentage Differences. X_2	d	d^2
-63	-6	-57	3249
-89	-40	-49	2401
-1	+6	-7	49
+12	+18	-6	36
-67	-68	+1	1
-39	-12	-27	729
-18	-2	-16	256
-48	-1	-47	2209
-23	-13	-10	100
-51	-44	-7	49
-44	-4	-40	1600
-69	-36	-33	1089
-34	-10	-24	576
-50	-26	-24	576
-68	+44	-112	12544
-16	-18	+2	4
-33	-28	-5	25
-84	-67	-17	289
-13	-4	-9	81
-51	-51	0	0
-849	-362	-487	25863
M = - 42.45	M = -18.11	M = -24.35	

$$A = \frac{25863}{237169} = .1090 \qquad P < .001.$$

The Diagram.



The Wheel.



Department of Psychology,
St. George's Hospital,
MORPETH. (1955).

Name..... Age.....

Sex..... Clinical Diagnosis.....

GUIDE FOR INTERVIEW ON VISUAL IMAGES AND RELATED PROCESSES.

(1) Describe to subject the nature of an image e.g. a horse.

(2) Do you have visual images?.....

Are they vivid
or weak.....

(3) Think of the last meal which you had. Can you see a picture of the table and things on it?.....

(a) Is it as clear as the original scene?

Clear....
Moderately clear...
Not very clear.....
Hardly any picture at all.....

(b) Is your image coloured?.....

(4) Have you ever had a visual image of the page of a book or of some piece of writing which formed a mental picture so clear that you were able to read it?

Yes.....
No.....

(5) Multiply 25 x 9 in your head.

Did you "see" the numbers?.....
Or did you say them in your head?....

(6) ROSEMARY GORDON TEST.

I want you to image the following scenes. Say "Yes" if you can image the scene, and "No" if you cannot.

(1) A car standing in front of a garden gate.
(2) The same car but in a different colour than that seen at first.
(3) The Same car lying upside down.

ROSEMARY GORDON TEST (CONTINUED)

(4) The same car back on it's four wheels.
(5) The car running along the road.
(6) The car climbing up a very steep hill.
(7) Climbing across the top of the hill.
(8) Getting out of control and crashing through a house.
(9) The same car running along the road with a handsome couple inside.
(10) Crossing a bridge and falling into the stream below.
(11) The same car all old and dismantled standing in a car cemetery.

Why could you not image scene/s no/s.....? Describe what happened.

Were any of the one's you could image difficult for you?.....

In what way?.....

(7) Describe the nature of autonomous imagery and give example of table leg.
Do you ever have images like this that you cannot control?.....

(8) If you have ever had a general anaesthetic did you when going under or coming out of it experience vivid visual or other images?.....
Describe them to me.

(9) (a) Just before falling asleep some people have unusually vivid visual images. These images just come and seem to have nothing to do with what you are thinking about. Have you ever had an image of this kind?.....
If you have describe it to me.

(b) Had the experience anything to do with what you had previously seen perhaps during the day?

(c) Was the image coloured? If it was, describe the colour to me.

(d) In what way was the image different from an ordinary dream?

(e) In what way was it different from an ordinary waking image?

(f) Were your eyes open or closed?.....

(g) Do you have these visual, falling asleep images?.....

Regularly.....
Often.....
Occasionally.....
Never.....

(h) Did you have these images more frequently as a child?.....

(10) How did you know you were in fact awake and not asleep when you had these experiences of visual images?

(11) How did you react to these experiences? e.g. with amusement, worry, fear, etc.....

(12) (a) Have you ever had a somewhat similar visual image when waking up? If you have describe it to me.

(b) Have you had such waking up experiences?

Regularly.....
Often.....
Occasionally.....
Never.....

(13) (a) Do you have dreams?.....
How often.....

Almost every night.....
Often.....
Occasionally.....
Never.....

(b) Are they vivid dreams?.....

(c) Do you usually on waking remember the content of the dreams you have?.....

(13c Continued)

More or less completely.....
Partly.....
Only very fragmentarily.....
Not at all.....

(d) Are your dreams coloured?

Usually.....
Often.....
Occasionally.....
Never.....

(14) Is there any particular kind of dream you have often?.....
Describe it to me.

(15) When did you last dream?.....
Describe your dream.

BIBLIOGRAPHY.

1. BARRATT, P.E. (1956). Use of the EEG in the study of imagery. Brit.J.Psychol.47 101-114

2. COSTELLO, C.G.(1956) The Effects of Prefrontal Leucotomy upon Visual Imagery and the Ability to Perform Complex Operations. J. Ment. Sci. 102 507 - 516

3. DREVER, J.(1955). Some Observations on the Occipital Alpha Rhythm. Quart.J.Exp. Psychol. 7 91-7

4. EYSENCK, H.J.(1955). Cortical Inhibition, Figural After effect, and Theory of Personality. J.Abn.Soc.Psychol.51 94-106

5. FRANKS, C.M.(1956). Conditioning and Personality: A Study of Normal and Neurotic Subjects. J.Abn.Soc.Psychol.52 143-150

6. GASTAUT, H.(1957). Etude Topographique des Reactions Electroencephalographiques Conditionees Chez L'Homme.EEG Clin.

7. GOLLA,F., HUTTON,E.L.&WALTER,W. GREY (1943) The Objective Study of Mental Imagery:I. Physiological Concomiatants.J.Ment.Sci.89 216. Neurophysiol. 9 1-34.

8. GORDON, R.A.(1950). An Experiement Correlating the Nature of Imagery with Performance on a Test of Reversal of Perspective.Brit.J.P. Psychol.41 63.

9. GUILFORD, J.P.(1942) An Inventory of factors STDCR.Sheridan Supply Company.

10. HILDEBRAND, H.P. A Factorial study of introversion-extraversion by means of objective tests. Doctor's dissertation.London.1953.

11. JAENSCH,E.R.(1930) Eidetic Imagery.London:Routledge.

12. KLEIN,G.S.& KRECH,D.(1952). Cortical Conductivity in the Brain Injured J Pers. 21 118-148.

13. KLOPFER, B.,AINSWORTH,M.D.,KLOPFER,W.G.,HOLT,R.R.(1954) Developments in Rorschach Technique Vol.I.World Book Co.N.Y.

14. LEANING,F.E.,(1925)An Introductory study of hypnagogic phenomena. Proc.Soc.Psych.Res., Lond.,35 289 -409

15. McKellar,P.,& SIMPSON,L.(1954) Between Wakefulness and Sleep: Hypnagogic Imagery.Brit.Jnl.Psychol.45 266-276

16. PAVLOV,I.P.(1941). Conditioned Reflexes and Psychiatry. International Publishers N.Y.

17. PETRIE,A.(1952).Personality and the Frontal Lobes.Routledge & Kegan Paul.London.

18. PIAGET,J. Play Dreams and Imitation. Routledge and Kegan Paul. Lond.

19. SANDLER,J.A. (1955) Test of the significance of the difference between Means of Correlated measures Based on a Simplification of Students t. Brit.Jnl.Psychol.46, 225-226.

20½ SHAGASS,C. & NAIMAN,J. 1955. The Sedation Threshold, manifest anxiety, and some aspects of ego function. Arch.Neurol. Psychiat. 74, 397-406.

21. SHORT.P.L. (1953) The objective Study of Mental Imagery. Brit.J.Psychol. 44, 38-51.

22. SHORT.P.L. & WALTER,W. GREY (1954) The Relationship between Physiological Variables and Sterognosis. Electroenceph. Clin.Neurophysiol. 6, 29 - 44½.

23. TAYLOR.J.A. 1951. The relationship of anxiety to the conditioned eyelid response. J.Exp.Psychol. 41 81-92.

24. TAYLOR.J.A. & SPENCE.K.W. (1952) The Relationship of anxiety level to performance in serial learning. J.exp.Psychol. 44.

25. WELCH.L., AND KUBIS.J. 1947. Conditioned PGR in states of pathological anxiety. J.Nerve Ment.Dis. 105 372-381.