

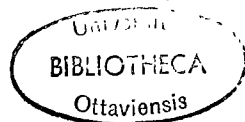
001047  
CSP.2

**INTROVERSION-EXTRAVERSION, NEUROTICISM,  
AND RETINO-CORTICAL INHIBITION**

by Paul R. Montville

Thesis presented to the School of  
Psychology and Education of the  
University of Ottawa as partial  
fulfillment of the requirements  
for the degree of Doctor of  
Philosophy

Ottawa, Canada, 1965



UMI Number: DC53396

### INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

UMI<sup>®</sup>

---

UMI Microform DC53396  
Copyright 2011 by ProQuest LLC  
All rights reserved. This microform edition is protected against  
unauthorized copying under Title 17, United States Code.

---

ProQuest LLC  
789 East Eisenhower Parkway  
P.O. Box 1346  
Ann Arbor, MI 48106-1346

## ACKNOWLEDGEMENTS

This thesis was prepared under the supervision of William F. Barry, Ph.D., of the School of Psychology and Education of the University of Ottawa. Gratitude is expressed for his supportive guidance and generous assistance.

The writer is indebted to L.P. Gendreau, M.D., Deputy Commissioner of Penitentiaries of Ontario, for his interest and approval which made this research possible.

Sincerest appreciation is expressed to Warden David M. McLean, Kingston Penitentiary, Kingston, Ontario, for his cooperation in permitting the experimentation, and providing the efficient assistance of his staff.

## CURRICULUM STUDIORUM

Paul R. Montville was born April 7, 1923, in New Britain, Connecticut. He received the Bachelor of Arts degree in Liberal Arts from Ohio University, Athens, Ohio, in August 1952. He received the Master of Science degree in Psychology from Ohio University, Athens, Ohio, in 1958. The title of his thesis was An Exploratory Study of the Hoarding Phenomenon in the Albino Rat.

## TABLE OF CONTENTS

Chapter	page
INTRODUCTION. . . . .	vii
I.- REVIEW OF THE LITERATURE. . . . .	1
1. Eysenck Theory and Related Studies . . . . .	1
2. The Nature of Cortical Inhibition . . . . .	6
3. Personality Correlates of the Inhibition Phenomenon . . . . .	12
II.- EXPERIMENTAL DESIGN . . . . .	21
1. The psychophysiological Tool . . . . .	21
2. The Psychological Tool . . . . .	23
3. The Sample Population . . . . .	25
4. The Experimental Procedures . . . . .	26
5. Data Evaluation . . . . .	29
III.- RESULTS AND DISCUSSION. . . . .	33
1. The Reliability of the <u>NAIT</u> Test . . . . .	33
2. Significance of the Algebraic Score . . . . .	35
3. Reliability of the <u>MPI</u> . . . . .	35
4. Correlations Between <u>NAIT</u> and <u>MPI</u> Scores . . . . .	37
5. Comparison of Normals and Convicts . . . . .	37
6. Discussion . . . . .	41
A. The Reliability and Validity of the <u>NAIT</u> Test . . . . .	41
B. The <u>NAIT</u> Test and Introversion-Extraversion, and Neuroticism . . . . .	43
C. Comparison of Normal and Convict Groups . . . . .	45
D. Suggestions for Further Research . . . . .	46
SUMMARY AND CONCLUSIONS . . . . .	46
BIBLIOGRAPHY. . . . .	50
 Appendix	
1. <u>ABSTRACT OF Introversion-Extraversion, Neuroticism and Retino-Cortical Inhibition.</u> . . . . .	52

LIST OF TABLES

Table	page
I.- Data for $t$ Test of Correlated Variances on <u>Negative After-Image Threshold Raw Scores</u> Between Trials One and Six $N=98$ . . . . .	36
II.- Critical Ratio Tests of the Difference in Means and Standard Deviations on the Negative After- Image Threshold Raw Scores and Inhibition Scores of Normal and Convict Groups . . . . .	40

LIST OF FIGURES

Figure	Page
1.- Curves of Mean Inhibition Scores for Normal and Convict Groups. . . . .	39

## INTRODUCTION

Contemporary psychology has in recent years increasingly concerned itself with experimental attempts to relate primary body physiology to human behavior and the concept of personality. The universally recognized influential role of human biological factors upon individual differences in learning and socialization has contributed the impetus towards attempts to search out and to define the nature of these correlates.

Eysenckian theory has postulated the molar concepts of excitatory and inhibitory cortical processes to explain individual differences in learning and behavior. Although having no clearly defined physiological identity these concepts have been the basis for extensive research designed to discover physiological and personality correlates.

Results of such studies have both supported and refuted the theoretical implications of the existence of such relationships. At best, reported research results leave much still open to speculation.

Little work has been done incorporating the negative after-image phenomenon as a measure of reactive cortical inhibition in attempts to correlate such a measure with personality factors. This research reports an attempt to further the work towards testing Eysenck's theory of introversion-extraversion. Measures of the after-image

phenomenon, interpreted as reactive cortical inhibition, were obtained by testing a group of individuals presumed to be extraverted. These measures were then correlated with scores of the Maudsley Personality Inventory, operationally defined as measures of introversion-extraversion, and neuroticism. This study also attempted to make some comparisons between the measures of reactive retino-cortical inhibition obtained from the experimental group and a group of normals.

This report is composed of three chapters, the first of which presents a review of Eysenck's rationale and psychoneurological theory together with a review of the pertinent literature. Chapter two provides a description of the psychological and psychophysiological tools employed, the sample experimental population, the nature of the experimental procedures, and the methods used to evaluate the data obtained. Chapter three contains the results of the study and a discussion of these results with some suggestions for further research.

## CHAPTER I

### REVIEW OF THE LITERATURE

This chapter presents a review of the basic rationale and fundamental postulates of Eysenck's psychoneurological theory of the personality dimension of introversion-extraversion, and a report of studies related to the phenomenon of reactive cortical inhibition. Section one reports the nature and origin of Eysenck's theory together with related studies. Section two is concerned with the several approaches developed which attempt to explain the phenomenon of reactive cortical inhibition, and section three deals more specifically with a review of studies which have attempted to uncover personality correlates of the inhibition phenomenon.

#### 1. Eysenck Theory and Related Studies.

Eysenck<sup>1</sup> has contended that personality research should progress beyond the point of a collection of empirical findings which establish concepts of types, traits, abilities, or factors. He has strongly advocated research designed to expose the nature of psychological and

---

<sup>1</sup> H.J. Eysenck, "Cortical Inhibition, Figural After-Effect, and Theory of Personality", in Journal of Abnormal and Social Psychology, Vol. 51, No. 1, July 1955, p. 94-106.

neurological causative factors underlying the dimensions of personality.

Through the extensive use of factor analytic methods, Eysenck<sup>2</sup> isolated two main personality dimensions; namely, introversion-extraversion, and neuroticism. He emphasized the importance of the contribution of inherited neurological predisposition to personality types and traits, and maintained that the degree of constitutional contribution could best be investigated through comparison studies of monozygotic and heterozygotic twins. In a subsequent report of studies, Eysenck<sup>3</sup> showed that groups of twins were compared on many trait variables in an effort to determine factorially the continuum of introversion-extraversion, and to assess the extent of hereditary contribution to these variables in relation to a person's position within this personality continuum. Three factors were isolated: introversion-extraversion, intelligence, and autonomic activity. Each was considered independent with identical twins resembling each other on these factors to a significantly greater degree than fraternal twins. Therefore, on the basis of these studies, the role of heredity seemed to assume major proportions.

---

2 H.J. Eysenck, Dimensions of Personality, London, Hogar Paul, 1947, xi-308 p.

3 -----, "The Inheritance of Extraversion-Introversion", in Acta Psychologica, Vol. 12, No. 2, 1956, p. 95-110.

Eysenck<sup>4</sup> has postulated individual differences in constitutionally determined excitatory and inhibitory potentials of the autonomic nervous system as determinants of behavior along the continuum of introversion-extraversion. He interpreted this aspect of his personality theory to be a simplification of Hull's law of reactive inhibition, itself in turn derived from Pavlov's theory of negative induction. Accordingly, both Pavlov's observations on the nature of cortical activity in animals, and Hull's law of reactive inhibition allow for the properties of excitation and inhibition during cortical stimulus-response occurrences. Utilizing these basic concepts, Eysenck formulated the following postulates:

Whenever a stimulus response connection is made in an organism (excitation) there also occurs simultaneously a reaction in the nervous structures mediating this connection which opposes its recurrence (inhibition).

Human beings differ with respect to the speed with which reactive inhibition is produced, the strength of reactive inhibition, and the speed with which reactive inhibition is dissipated. These differences themselves are properties of the physical structures involved in the evocation of responses.

Individuals in whom reactive inhibition is generated quickly, in whom strong reactive inhibitions are generated, and in whom reactive inhibition is dissipated slowly, are thereby predisposed to develop hysterical disorders in case of neurotic breakdown; conversely, individuals in whom reactive inhibition is generated slowly, in whom reactive inhibition is dissipated quickly, are thereby predisposed to develop dysthymic disorders in case of neurotic breakdown.<sup>5</sup>

---

<sup>4</sup> Eysenck, "Cortical Inhibition, Figural After-effect, and Theory of Personality", Op. Cit., p. 55.

<sup>5</sup> Ibid., p. 56.

Thus, hysterics and psychopaths (high cortical inhibition) are understood to take their positions at the extraversive end of the continuum and are characterized by a lack of outwardly observable behavioral inhibition. On the other hand, dysthymics (anxiety states, obsessive-compulsives, and depressives) lacking cortical inhibition, occupy the introversive end of the continuum and are characterized by observable inhibited behavior.

Within the limits of these postulates the problem of learning, in terms of socialization through conditioning, based upon the degree of constitutional predisposition, assumes a position of central importance.

A study by Welch and Kubis<sup>6</sup> investigating the conditionability of anxious subjects, found that excitatory types conditioned faster, while the inhibitory types were at the other extreme of conditionability. Comparing normals with patients of the dysthymic type, they found the latter conditioned at a significantly faster rate and retained their conditioned responses for significantly longer periods of time.

---

<sup>6</sup> Livingston Welch and Joseph Kubis, "The Effect of Anxiety on the Conditioning Rate and Stability of the P.G.R.," in the Journal of Psychology, Vol. 23, First Half, January 1947, p. 83-91.

Franks,<sup>7</sup> utilizing the eye-wink reflex to a puff of air as the conditioned response, found that dysthymics conditioned significantly quicker, more strongly, and extinguished conditioned responses less quickly than normals. Hysterics conditioned less quickly, less strongly, and extinguished more readily than normals. Such findings were felt to suggest that conditionability is related to extraversion-introversion, and not to neuroticism.

Taylor and Spence<sup>8</sup> demonstrated in a study that anxiety, being related to drive level, would result in those individuals with high anxiety conditioning more quickly than those with lower anxiety levels. Eysenck<sup>9</sup> questioned that use of the Taylor Scale of Manifest Anxiety had little evidence supporting the assumption that it correlates with clinical estimates of anxiety.

Frank's study<sup>10</sup> previously mentioned, revealed that hysterics who showed equivalent levels of anxiety on the

---

7 C. Franks, "An Experimental study of Conditioning as Related to Mental Abnormality", unpublished doctoral dissertation, University of London, 1954, quoted by H.J. Eysenck, "Cortical Inhibition, Figural After-Effect, and Theory of Personality", Op. Cit., p. 97.

8 J.A. Taylor and K.W. Spence, "The Relationship of Anxiety to Performance in Serial Learning", in Journal of Experimental Psychology, Vol. 44, No. 1, 1952, p. 61-64.

9 Eysenck, "Cortical Inhibition, Figural After-Effect, and Theory of Personality", Op. Cit., p. 98.

10 Franks, Op. Cit., p. 97.

Taylor Scale of Manifest Anxiety, as his dysthymic sample, were more difficult to condition than normals.

Reactive cortical inhibition has been variously demonstrated through different sense modalities. A continuing problem remains with respect to the actual nature of the phenomenon of reactive cortical inhibition and its physiological processes. Several theoretical concepts have been advanced with each finding an almost equal number of protagonistic and antagonistic results developing out of related research.

## 2. The Nature of Cortical Inhibition.

Kohler and Wallach<sup>11</sup> assumed a basic attribute of cortical activity to be one of a functional communication between different areas of the cortex. This communication depends upon the polarizability of tissues and changes in polarization due to intruding current flow generated by stimuli impinging upon the cortex. A condition of electrotonus is said to occur as a result of repeated stimulation of a defined cortical area and impedes subsequent current flow to that area. Continued localized excitation increases

---

<sup>11</sup> Wolfgang Kohler and Hans Wallach, "Figural After-effects, An Investigation of Visual Processes", in Proceedings of the American Philosophical Society, 80, 1944, p. 269-357, quoted by George E. Klein and David Krech, "Cortical Conductivity in the Brain-Injured", in Journal of Personality, Vol. 21, No. 1, September 1952, p. 118-146.

the electrotonic state and alters current flow patterns to the area in question. Hence, the area is considered satiated. Satiation is equated to resistance, and perceptual judgments, either visual or kinesthetic, become distorted in the well-known sense of the figural after-effect.

In their discussion of the Kohler and Wallach theory, Klein and Krech<sup>12</sup> pointed out that the authors limit satiation to the set of events issuing from the isomorphic impression a stimulus figure makes on the cortex under conditions of strong figure-ground differentials. They enlarged upon this by claiming that any neuronal activity increases resistance to conductivity. Additionally, they hypothesized individual differences in basal levels of conductivity and primary characteristics in terms of the rate and degree of both satiation and dissipation of inhibition. Their experimental study to demonstrate these concepts compared brain-injured subjects with normals for kinesthetic figural after-effect. It was shown that satiation was achieved to a significantly greater extent and degree in the brain-injured. The authors concluded that severely traumatized cortical tissue results in reduced cortical conductivity.

---

12 Klein and Krech, Op. Cit., p. 118-148.

Eysenck<sup>13</sup> commented upon the value of the work of Klein and Krech pointing out that differences exist between the theories of inhibition and cortical conductivity. The former is concerned with the rate of arousal of inhibition rather than that of conductivity. The chief value of their study rests in the implication of individual differences in cortical reactivity in terms of basal levels, rate and degree of satiation and dissipation. Seemingly bearing some further relationships are the striking resemblances in the behavior of organics and hysterics.

Efforts by other researchers criticized the concept of satiation advanced by Kohler and Wallach. Osgood and Meyer<sup>14</sup> argued against the promulgation of theories in terms and concepts apart from established physioneurological mechanism. In the service of a more parsimonious interpretation, they explained the phenomenon of satiation underlying figural after-effects in terms of known neurological functions.

The arguments of whether inhibition is diffused or generalized throughout the cortex, or essentially localized in specific "inhibitor" loci also found proponents supporting

---

13 Eysenck, 'Cortical Inhibition, Figural After-Effect, and Theory of Personality', Op. Cit., p. 94-106.

14 C.E. Osgood and H.W. Meyer, "A New Interpretation of Figural After-Effects", in Psychological Review, Vol. 59, No. 2, March 1952, p. 98-113.

both concepts. Hamilton's<sup>15</sup> review of Pavlovian concepts of inhibition stated that inhibition is a phenomenon generalized throughout the cortex rather than being of a localized nature. He enlarged his discussion to state that the generalized nature of cortical functions either facilitated or inhibited learning processes.

Duncan<sup>16</sup> compared both theories of Reactive Inhibition and Neural Satiation and declared that both theories were sufficiently alike to be considered the same process. He pointed out that reactive inhibition and satiation both result as consequences of afferent stimulation, and that satiation has a central locus as demonstrated by figural after-effects. Both processes are characterized by distorting behavior away from some criterion or standard. In satiation, the process is inferred from distortions in figural after-effects. In the instance of reactive inhibition, the effect is measured while stimulation is still continuing, e.g., during highly massed practice on a motor task. A measure of depression in performance as compared with either an initial performance level, or to performance of subjects

---

<sup>15</sup> Max Hamilton, "On the Nature of Inhibition in the Cerebral Cortex", in Psychological Review, Vol. 59, No. 1, January 1952, p. 49-53.

<sup>16</sup> Carl P. Duncan, "On the Similarity Between Reactive Inhibition and Neural Satiation", in American Journal of Psychology, Vol. 69, No. 2, June 1956, p. 227-235.

working under distributed practice, is understood to reflect the degree of inhibition. It is also commonly measured in terms of recovery from distortion as in reminiscence during rest following massed practice.

Osgood and Heyer,<sup>17</sup> previously mentioned, in attempting a parsimonious explanation of the inhibition phenomenon were severely criticized by Smith<sup>18</sup> for their inability to explain on the basis of known neurological mechanisms, how the stimulus of an inspection figure having presented to one eye could influence the perception of a test figure in the striate area of the opposite eye.

A further argument for the centrality of the inhibition phenomenon was advanced in a study by Urist.<sup>19</sup> His findings suggested a central locus rather than one of retinal origin when he reported that when eyes or head are moved voluntarily, after-images move. However, when the eye is pushed with the finger, the after-image remains stationary. Placing a subject in a spinning chair, the after-image moves when the subject is aware his eyes have moved, but spontaneous nystagmus does not move the after-image.

---

<sup>17</sup> Osgood and Heyer, Op. Cit., p. 90-111.

<sup>18</sup> R.S. Smith, "Comments on a New Interpretation of Figural After-Effects", in Psychological Review, Vol. 60, No. 3, May 1953, p. 211-212.

<sup>19</sup> Martin J. Urist, "After Images and Ocular muscle Proprioception", in AMA Archives of Ophthalmology, Vol. 61, 1959, p. 230-232.

Krauskopf<sup>20</sup> also found grounds for objecting to the Kohler theory when he experimentally demonstrated, contrary to prediction according to the Kohler theory, that the magnitude of figural after-effect decreased as a function of exposure time. Kohler had maintained that an increase of polarizability (satiation) is the result of prolonged fixation. Krauskopf's results showed that after-effects could be maximized with shortest exposures and that reliability of measurement could be increased provided this variable is controlled.

It is apparent from the studies reviewed thus far, the results of research relating to Eysenck's Reactive Inhibition Theory, and the nature of the psychoneurological processes of the inhibition phenomenon remain unclear and inconclusive. It cannot be stated definitively that the bulk of any directly or indirectly related studies support or deny the assumption implicit to the theory itself. The remaining section of this chapter deals with a review of research attempting to correlate personality factors with the phenomenon of reactive cortical inhibition.

---

<sup>20</sup> JOEL Krauskopf, "The Magnitude of Figural After-Effects as a Function of Duration of the Test Period", in the American Journal of Psychology, Vol. 67, no. 4, December 1954, p. 604.

### 3. Personality Correlates of the Inhibition Phenomenon.

Eysenck<sup>21</sup> attempted to relate learning theory and personality by means of his typological postulates. He predicted that extraverts would show a greater degree of reminiscence in a learning task on the pursuit rotor under conditions of massed practice. He hypothesized that massed practice would result in greater amounts of inhibition being generated by the extraverts as compared with the introverts; that extraverts, having accumulated more inhibition, would have more to dissipate, and therefore, would demonstrate greater reminiscence effects. The personality criterion used was the Maudsley Personality Inventory which dichotomized subjects into groups of extraverts and introverts. A relationship considered significant at .29 was found to exist between extraversion and reminiscence, and between reminiscence and performance intervals. Upon retesting, the correlation proved insignificant at .10. The failure to find significance in this instance was attributed to the factor of conditioned inhibition adding to the reactive inhibition. Conditioned inhibition is defined as a habit of non-response, reinforced by the reactive inhibition. The dissipation rate is thus slowed resulting in the second testing results.

---

<sup>21</sup> Eysenck, "Reminiscence, Drive and Personality Theory", Op. Cit., p. 326-333.

In a similar study, Ray<sup>22</sup> explored the possible relationships between personality as measured by the Maudsley Personality Inventory and measures of motor reminiscence. He isolated four criterion groups of normal introverts, normal extraverts, neurotic introverts, and neurotic extraverts. His results demonstrated significant differences only in terms of reactive cortical inhibition increment differentiating between introverts and extraverts. No significant relationships were found between reminiscence scores and the personality criterion groups on the basis of the four categories.

Lynn<sup>23</sup> dichotomized introverts and extraverts using the Maudsley Personality Inventory as the personality criterion. The Archimedes Spiral After-Effect and an Inverted Alphabet Printing task were utilized to provide measurements of satiation and reminiscence respectively. According to inhibition theory, he hypothesized a negative correlation would exist between extraversion and duration of after-effect; that the extraverts would see progressively less of the after-effects under conditions of massed

---

22 Oakley S. Ray, "Personality Factors in Motor Learning and Reminiscence", in the Journal of Abnormal and Social Psychology, Vol. 59, No. 2, September 1959, p. 199-203.

23 R. Lynn, "Extraversion, Reminiscence, and Satiation Effects", in the British Journal of Psychology, Vol. 51, Part 4, November 1960, p. 319-324.

practice; that extraverts would tend to recover in their perception of after-effects following rest; and that a negative correlation would exist between a measure of massed practice in the Inverted Alphabet Printing task and duration of after-effects. Further, that a positive correlation would be found between extraversion and reminiscence; and finally, that extraverts would show greater amounts of work decrement with the massed practice on the Alphabet Printing task.

Four of the hypotheses proved significant with correlations ranging from .41 to .43. A positive correlation was not found between extraversion and reminiscence, nor did the extraverts see progressively less after-effect following rest.

Rechtschaffen<sup>24</sup> tested the following experimental hypotheses: extraverts develop greater visual after-effects than introverts; extraverts develop more Ir (reactive inhibition) via motor learning tasks than introverts; the degree of after-effects and Ir exhibited correlate positively. The R scale (Rhythmia) of Guilford's Inventory of Factors ITDCR as a measure of extraversion-introversion, and the Inverted Alphabet Printing task to stimulate the

---

<sup>24</sup> Allan Rechtschaffen, "Neural Satiation, Reactive Inhibition and Introversion-Extraversion", in the Journal of Abnormal and Social Psychology, Vol. 57, No. 3, November 1958, p. 283-291.

after-effects were used. No significant correlations were found to relate introversion-extraversion scores to the amount of I<sub>r</sub> (inhibition) or to the after-effects, nor were any significant correlations found relating after-effects to inhibition. The extreme scores in each of the criterion groups for introversion-extraversion were compared for both I<sub>r</sub> and after-effects without significant results being obtained.

These results are supported by the findings of Norcross, Lipman and Spitz<sup>25</sup> who obtained measurements of the rate of development and total amount of visual satiation; measures of kinesthetic satiation and its dissipation; and the rate of dissipation of visual satiation. Using the Maudsley Personality Inventory to obtain a measure of introversion-extraversion, an attempt was made to discover positive relationships with little success. One significant correlation (.29) at the .05 level of confidence was discovered linking female extraversion scores with total visual satiation.

---

<sup>25</sup> Kathryn Norcross, Ronald Lipman, and Herman Spitz. "The Relationship of Extraversion-Introversion to Visual and Kinesthetic After-Effects", in Journal of Abnormal and Social Psychology, Vol. 63, No. 1, July 1961, p. 210-211.

Bendig and Vaughn<sup>26</sup> found little evidence to relate the personality dimensions of extraversion-introversion as defined by the Maudsley Personality Inventory, to motor learning performance measures obtained by Inverted Alphabet Printing. Their results showed no significant relationships. The authors suggested lack of results due to a simple dichotomization of subjects on the Maudsley Inventory scale does not provide groups extreme enough to demonstrate significant relationships between personality traits and learning. They suggested that dichotomization into extreme groups may show differences.

An extensive study by Becker<sup>27</sup> reviewed the Eysenckian theory of cortical inhibition and its relation to individual differences in introversion-extraversion. He first pointed out a contributing source of confusion characterizing research in reactive inhibition in the problem of synonymous usage and interpretation of the terms cortical inhibition, reactive inhibition, cortical conductivity, and satiation. He next clarified these terms by definition

---

26 A.W. Bendig and Charles Vaughn, "Extraversion, Neuroticism and Motor Learning", in the Journal of Abnormal and Social Psychology, Vol. 59, no. 3, November 1959, p. 399-403.

27 Wesley C. Becker, "Cortical Inhibition and Extraversion-Introversion", in the Journal of Abnormal and Social Psychology, Vol. 61, no. 1, July 1960, p. 52-56.

and identified each with the type of psychological measurement with which it could be used.

The experimental portion of Becker's study investigated the relationships between the different types of inhibition and attempted to correlate these with individual differences in introversion-extraversion. The following main hypotheses were tested:

a) That individual differences in satiation effects and reactive inhibition effects are correlated, thus justifying the more general concept of reactive cortical inhibition; b) that individual differences in basal cortical inhibition are correlated with individual differences in reactive cortical inhibition, as assumed by Klein and Kreeh (1952); and c) that individual differences in satiation, reactive inhibition or basal cortical inhibition are related to individual differences in extraversion-introversion.<sup>28</sup>

The findings of this comprehensive study were essentially negative. Little evidence was found to support the main hypotheses of relationships between the various kinds of inhibition or of correlations with individual differences in introversion-extraversion.

The preceding studies have attempted to discover possible relationships between reactive cortical inhibition and the personality dimension of introversion-extraversion as defined by Eysenck. The reported results of research remain inconclusive with the need for further clarification

---

<sup>28</sup> Becker, Op. Cit., p. 53.

in many areas apparent. Several provocative and basic aspects of the problem of reactive inhibition remain outstanding. These are: 1) that inhibition can be demonstrated and measured in several sense modalities; 2) that individual differences are seen to exist; and 3) that studies utilizing the visual sense modality to measure satiation have resulted in uncovering significant relationships between this type of reactive cortical inhibition and the personality dimension of introversion-extraversion.

Barry<sup>29</sup> has pointed out the need for investigation of the nature of retino-cortical inhibition and its possible relationships to introversion-extraversion in extreme behavioral groups. The extraverted criminal is an example of such a category meeting this criterion.

The approach to be used in this research may be explained in terms of two working hypotheses which will be tested. The first entails an investigation of possible relationships between reactive retino-cortical inhibition, in terms of after-image sensitivity, and the personality dimensions of introversion-extraversion, and neuroticism as defined by Eysenck, in a group of convicts. Sensitivity

---

<sup>29</sup> William F. Barry, An Investigation of Relationships Between Introversion-Extraversion and the Negative After-Image Threshold, unpublished doctoral dissertation, University of Ottawa, School of Psychology and Education, 1961, ix-80 p.

is interpreted as an effect of reactive retino-cortical inhibition measured by the negative after-image threshold. Introversiion-extraversiion, and neuroticisim are operationally defined as high and low scores on the Maudsley Personality Inventory.

A second working hypothesis derives from a recognition of contentious results in research utilizing the Maudsley Personality Inventory. In an attempt to circumvent the inherent weakness of operationally defined variables, this research includes deliberately a testing of possible significant differences in two presumably divergent populations. One sample of individuals is presumed to represent a neurophysiologically and psychologically normal universe; the second sample is presumed to represent a universe in which are found examples of individuals with extreme personality attributes being expressed in uninhibited behavior and commonly observed difficulties in learning (socialization).

The Negative After-Image Threshold Apparatus<sup>30</sup> developed by Barry will be used in this study to provide reliable measurements of figure-ground light intensities to produce and sustain the negative after-image phenomenon.

---

30 Barry, Op. Cit., p. 31.

The term Relative After-Image Threshold, hereafter referred to as RAIT, will be used to denote the level of field light intensity at which loss of the after-image occurs.

The term inhibition score, used throughout the following chapters, denotes the algebraic sum of increments of the six trial scores with the score of trial one representing the basal level.

The Maudsley Personality Inventory, hereafter referred to as MPI, will be utilized as the means of obtaining the criterion for the personality dimensions of introversion-extraversion, and neuroticism.

The previously described experimental problems stated in the form of null hypotheses are as follows:

- A. There will be no significant positive correlations between MPI scores and RAIT scores for a sample of male convicts.
- B. There will be no significant differences between the mean inhibition scores of normals and a group of convicts as measured by the RAIT apparatus.

## CHAPTER II

### EXPERIMENTAL DESIGN

This chapter presents the experimental design employed to test the hypotheses of this study. The description which follows is apportioned into sections in the following manner: section one presents a brief description of the psychophysiological tool employed; section two is devoted to a presentation of the psychological personality test utilized to obtain a measure of introversion-extraversion and neuroticism; section three describes the sample population and the criteria for inclusion against which they were selected; section four explains the experimental procedures employed; and section five is devoted to a report of the methods and statistical formulas used to evaluate the obtained experimental data.

#### 1. The Psychophysiological Tool.

Barry<sup>1</sup> has developed and utilized the Negative After-Image Threshold Apparatus as a means of obtaining reliable measurements of figure-ground light intensities

---

<sup>1</sup> William F. Barry, An Investigation of Relationships Between Introversion-Extraversion and the Negative After-Image Threshold, unpublished doctoral dissertation, University of Ottawa, School of Psychology and Education, 1961, ix-80 p.

capable of evoking and sustaining the negative after-image phenomenon. An exhaustive description of the instrument's design and its use may be found in Barry's study.<sup>2</sup> However, a brief review of its essential components and operation is presented here.

The Negative After-Image Threshold Apparatus consists of a Stimulus Viewer and a Control Unit, each contained in its own steel cabinet and mounted for use at bench height. The mechanism within the stimulus Viewer is designed in such a way as to elicit a sustained negative after-image of a visual stimulus. A red light of constant intensity is used as the stimulus source. When viewed through a circular port in the front panel of the Stimulus Viewer, it is perceived as a small, solid circle of green light surrounded by a white field, in actuality, the negative after-image of the stimulus in its complementary color. The field upon which the negative after-image is seen consists of a rotating white disc positioned within the cabinet at right angles to the subject's line of vision to the stimulus source. Two fifteen degree-angle sections cut opposite one another in the disc, with apices meeting at disc centre, serve to obscure intermittently the stimulus light. The nature of its action results in keeping the true identity of the stimulus light hue below the subject's level of

---

<sup>2</sup> Barry, Op. Cit., p. 31.

awareness. The surface of the disc is illuminated by reflected white light, the intensity of which determines the production and sustainance of the after-image phenomenon.

In any given trial, the subject begins viewing the stimulus under conditions of high disc-light intensity. The intensity level of the disc light is allowed to diminish automatically at a constant rate under the control of a motor driven variac to a level at which the subject reports a disappearance of the green after-image. The term LATI is used to denote the point at which loss of the after-image occurs and the red hue of the stimulus light enters the subject's awareness.

The Control Unit contains the power supply and other operating components including control variacs for the stimulus light source; ON-OFF switches for the disc motor, stimulus and disc lights. In addition, two microammeters indicate stimulus and disc light intensities. The microammeter for the reflected disc light indicates the light intensity at any given moment including that at which loss of the negative after-image occurs.

## 2. The Psychological Tool.

In order to obtain criterion measures in the sample population of the personality dimensions under study here,

the Maudsley Personality Inventory<sup>3</sup> was used. The MPI is assumed to measure the dimensions of introversion-extraversion and neuroticism at a verbal level. Eysenck<sup>4</sup> sought to obtain "purer" measures of introversion-extraversion and neuroticism and developed the MPI by applying factor analytic methods to B and C Scale items of Guilford's Inventory of Factors STDCR, GANLE, and the Maudsley Medical Questionnaire.

The MPI consists of two twenty-four item scales defining, at a verbal level, the dimensions of introversion-extraversion and neuroticism. The test is considered to have high "construct validity" and the two factors of introversion-extraversion and neuroticism are represented as orthogonal.

Eysenck<sup>5</sup> as well as many other researchers have used the MPI to obtain a measure of self-reported behavior in the personality dimensions of introversion-extraversion and neuroticism. Reliability of the MPI is reported in its manual in terms of split-half and Kuder-Richardson

---

3 H.J. Eysenck, "The Questionnaire Measurements of Neuroticism and Extraversion", in Revista di Psicologia, Vol. 50, 1956, p. 113-140.

4 Ibid.

5 ----- The Maudsley Personality Inventory Manual, prepared by Robert R. Knapp, Educational and Industrial Testing Service, San Diego, California, 1962, p. 21.

coefficients ranging from .75 to .88 for both scales. Others, such as Bartholomew<sup>6</sup> and Knowles<sup>7</sup> favorably report test-retest reliabilities above .70.

### 3. The Sample Population.

The sample population consisted of one hundred male convicts housed at Kingston Penitentiary, Kingston, Ontario. A random selection was made by the writer with the assistance of the personnel office staff from the master files of the inmate population. All participants were volunteers. The subjects' ages ranged from twenty-one to forty-five years with a mean age of 32.4, and an educational range of grade six through first year college, with a mean of grade nine. Three of the original one hundred volunteers were deleted from the sample upon notice from prison authorities of suspected illicit use of drugs. This reduced the sample population to ninety-eight in the experimental group and twenty-nine in the reliability group.

All subjects were reported to be in good health; free from organic disease, and none had medical histories of

---

<sup>6</sup> A.A. Bartholomew and E. Marley, "The Temporal Reliability of the Maudsley Personality Inventory", in the Journal of Mental Science, Vol. 105, 1959, p. 120-129.

<sup>7</sup> J. Knowles, "The Temporal Stability of the MPI Scores in Normal and Psychiatric Population", in the Journal of Consulting Psychology, Vol. 24, No. 3, June 1960, p. 278.

serious head injuries or cerebral involvement. None were currently in treatment involving the use of sympathomimetic drugs which could influence autonomic system functioning. Color blindness was controlled on the basis of the subject being able to report the negative after-image hue. Prison officials reported that all subjects were considered "adjusted" to prison routine thus precluding the possible introduction of intervening variables due to acute emotional upset observed in some prisoners during early stages of incarceration. The normal group was represented by the data obtained from NAII tests on seventy-two males in Barry's study.<sup>8</sup>

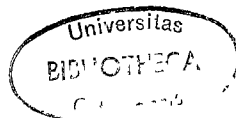
#### 4. The Experimental Procedures.

The methods and procedures described in this section are essentially consistent with those devised and used by Barry<sup>9</sup> in his study. The Negative After-Image Apparatus was installed on a table approximately thirty inches high in a darkened room. The subjects were seated before the viewing port of the Stimulus Viewer at a distance of twelve inches. This viewing distance was insured for all subjects by a barrier strip which prevented the head from being held closer.

---

<sup>8</sup> Barry, Op. Cit., p. 29.

<sup>9</sup> Ibid., p. 39.



The MPI was administered to each subject prior to testing with the MAIT apparatus. Following completion of the personality inventory, each subject entered the room in turn and having been seated before the apparatus was requested to give the experimenter information as to his prison number, age, his state of health, the condition of his eyesight, and whether he had a history of head injury. The interval of time needed to obtain and to record the above information provided adequately for adaptation to the darkness. Each subject was then informed that he was to be given a special type of eye test and was instructed in the following manner: "When you look into the hole you will see a colored circle. During the test, try hard not to move your head or to blink your eyes." The disc motor is started and the subject is allowed to view the negative after-image as the disc light is turned on at a pre-set high level of 800 microamperes. The question, "Now, what color is it?", is asked. Any reply in terms of various hues of blue or green is acceptable as the subject reports perceiving the negative after-image of the stimulus light. "Good, now you are to look at the centre dot in the circle of light. The green (or blue) color may fade and reappear, or it will get darker until it disappears. Before we begin the test we will see how it happens." A trial test is then begun with the subject being handed the push

button OFF switch with the instruction, "As soon as you no longer see any of the green color, push the button." With the variac controlling the disc illumination set at 800 microamperes, the run down of light intensity on the revolving disc is initiated with the experimenter pressing the ON switch. At the end of the demonstration run down the subject is asked, "Do you have any questions? If not, we can begin the test." The experimenter then repeats the basic instructions. "Remember, try hard not to move your head or to blink your eyes. You are to look at the centre dot in the green circle. The green color may fade and reappear, or it may get darker until it disappears. Press the button as soon as you are sure the green is all gone."

Following the repetition of instructions to the subject, the experimenter resets the disc light level to 800 microamperes, and after a momentary pause to insure the motor driving the disc is operating at capacity, turns the stimulus and disc lights to ON and the trial is begun. The subject presses the OFF switch as he loses the green negative after-image. The operator takes a visual reading from the microammeter dial of the illumination on the disc at the point when the machine was stopped by the subject. The experimenter then resets the range switch on the microammeter for the next trial, turns up the intensity of the

disc light to its original level of brightness, and repeats the test trial procedure.

Each subject was given six consecutive trials which completed the test session. The six visual microammeter readings tabulated by the experimenter were converted to foot candle units in order to minimize random fluctuations in meter measurements. The technique for obtaining the conversions is described in the study by Barry.<sup>10</sup>

Retesting of all ninety-eight subjects was not permitted by prison authorities for security reasons and a general disruption of prison work routines incurred by the testing procedures. Provision for obtaining retest data for reliability purposes was arranged with permission being granted to recall thirty randomly selected subjects of the original group. Each subject repeated the testing in the prescribed manner thus providing data for measures of reliability.

#### 5. Data Evaluation.

The raw test data obtained from the six trial test-retest with the MAIT apparatus and the MPI of the sample of ninety-eight convicts will be analyzed for the following: the test-retest reliability of raw trial scores; the test-retest reliability of the inhibition scores; the statistical

---

<sup>10</sup> Barry, Op. Cit.

significance of the sum of increments between trials one and six for the total group, interpreted as reactive retino-cortical inhibition; test-retest reliability of MPI scores, a statistical analysis of means and standard deviations of each trial of test-retest; an evaluation of possible relationships between introversion-extraversion and neuroticism scores and inhibition scores; and an investigation of possible differences between normal and convict basal and inhibition scores.

Measures of reliability for the MAIT test will be obtained by correlating the raw scores of each trial with the corresponding trial scores on retest. Inhibition score reliability will be calculated on the algebraic sum of trial increments for both test and retest sessions.

Measures of reliability for the MPI test will be obtained by correlating the scores of the introversion-extraversion and neuroticism scales of the first testing with the scores of the second testing.

The formula to be used in each of the reliability measurements is the Pearson product moment coefficient of correlation:

$$r_{12} = \frac{\sum XY - (\sum X)(\sum Y)}{\sqrt{\sum X^2 - (\sum X)^2} \sqrt{\sum Y^2 - (\sum Y)^2}}$$

In order to test the significance of the mean increment between trials one and six, the  $t$  test of independence for correlated groups will be applied to the difference between scores for trials one and six. The formula is as follows:

$$t = \frac{(\sigma_1^2 - \sigma_2^2) \sqrt{N - 2}}{\sqrt{4 \sigma_1^2 \sigma_2^2 (1 - r_{12}^2)}}$$

$$\text{where } \sigma^2 = \frac{\sum (X - \bar{X})^2}{n - 1}$$

For the purpose of investigating to find possible relationships between measures of reactive retino-cortical inhibition and the personality dimensions, the inhibition scores will be correlated to the introversion-extraversion, and neuroticism scores obtained by using the Pearson product moment coefficient of correlation.

Finally, the convict and normal groups will be compared for significant differences for each trial's means and standard deviations, and for differences in basal and inhibition scores. The formula for the "critical ratio" test for uncorrelated groups will be used:

$$\underline{CR} = \frac{D}{\sigma}$$

$$\text{where } \sigma_{DM_1 - M_2} = \sqrt{\sigma_{M_1}^2 + \sigma_{M_2}^2}$$

$$\text{and } \sigma = \frac{\sigma}{H - 1}$$

$$\text{where } \sigma_{D\sigma_1 - \sigma_2} = \sqrt{\sigma_{\sigma_1}^2 + \sigma_{\sigma_2}^2}$$

$$\text{and } \sigma_{\sigma} = \frac{\sigma}{\sqrt{2N}}$$

The following chapter will present the nature of the experimental design used in this research study.

## CHAPTER III

### RESULTS AND DISCUSSION

This chapter contains the report of experimental results followed by a discussion of the findings and their possible implications for the theory of cortical inhibition. There will be six sections, the first of which is devoted to presenting the coefficients of reliability for the NAIT test raw scores and inhibition scores. Section two presents the estimate of the significance of the algebraic scores. Section three reports the coefficients of reliability for the MPI. Section four presents the coefficients of correlation between the MPI test scores and the NAIT test scores with remarks on further investigations for additional relationships. Section five compares NAIT test scores of normals with those of the sample of convicts, and section six contains a discussion of results with respect to the NAIT test and its relationship to introversion-extraversion and neuroticism followed by further discussion of the phenomenon of reactive cortical inhibition.

#### 1. The Reliability of the NAIT Test.

Test-retest coefficients of reliability were calculated on raw scores for the reliability group sample of twenty-nine convicts, and for the inhibition scores of the

six trials in both testing sessions. The obtained coefficients were .339, .598, .604, .602, and .313 respectively. The coefficients for trials two, three, four and five were found to be significant at the .01 level of confidence, while the correlations for trials one and six failed to reach significance. Two of the subjects of the reliability group, whose motivation at the time of retest appeared highly suspect to the writer, seem to account for the lack of reliability on trials one and six. Elimination of their anomalous scores and recalculation of the coefficients of reliability for trials one and six resulted in correlations of .604 and .509 respectively, both significant at the .01 level of confidence.

The inhibition scores denoting the algebraic sum of increments of the six trials for test and retest sessions were found to have a reliability coefficient of .195, lacking significance at either the .05 or .01 levels. As previously stated, elimination of the questionable scores of the two non-motivated subjects and recalculating the coefficient of correlation for the inhibition scores resulted in a correlation of .316, significant at the .01 level.

## 2. Significance of the Algebraic Score.

The algebraic score denotes the sum of increments of inhibition in raw scores accumulated between trials one and six, with the score of trial one interpreted as the basal score. The algebraic score is derived by summing the scores, trial by trial, algebraically, or subtracting the first score of trial one from the score of trial six. If the increment between the first and last scores could be attributed to chance fluctuation, the interpretation of the increment as reactive retino-cortical inhibition would not be applicable.

The  $t$  test of independence for correlated groups was applied to the difference between the scores for trials one and six. A significant  $t$  ratio of 8.523 was obtained. Thus, the phenomenon interpreted as retino-cortical inhibition, demonstrated as a rise in scores from trial one through trial six, is seen not attributable to chance fluctuation. Table I on the following page presents this data.

## 3. Reliability of the MPI.

Test-retest coefficients of reliability were calculated for the MPI on the scores obtained from initial and reliability testing sessions. The coefficient of correlation for the personality dimension of introversion-extraversion was .764. Scores for the neuroticism dimension resulted in

Table I.-

Data for  $t$  Test of Correlated Variances on Negative After-Image Threshold Raw Scores Between Trials One and Six.  
 $n = 98$

Trial	$\sum(X-M)^2$	$\sigma^2$	$r_{12}$	$t$	Sign.
1	8429.82	66.91			
6	30921.56	318.77	.599	6.523	.01

a correlation coefficient of .861. Both correlations were significant at the .01 level of confidence.

#### 4. Correlations Between NAIT and MPI Scores.

Estimates of the coefficients of correlation were calculated between introversion-extraversion, and neuroticism scores of the MPI and the NAIT inhibition (algebraic) scores. The obtained coefficients for correlation between introversion-extraversion scores and NAIT scores was .043. The coefficient of correlation between neuroticism and NAIT scores was -.058. Neither coefficient attained significance at .05 or .01 levels.

Further attempts to find relationships between MPI and NAIT scores were made by isolating four criterion groups; namely, normal introverts, normal extraverts, neurotic introverts and neurotic extraverts, and corresponding scores for high and low NAIT levels. No significant relationships were discovered.

#### 5. Comparison of Normals and Convicts.

The normal and convict groups were compared for differences in means and standard deviations for each of six trials, and on inhibition scores. The critical ratio test for uncorrelated variances was applied to the data with the following results.

A significant difference in means at the .01 level was found for trial one, thus revealing a difference in basality between the two groups not attributable to chance fluctuation. Significantly different means at the .05 level were found for trial four. Significant differences for standard deviations were found at the .01 level for trials one, four, five, and six, with a significant difference at the .05 level being found for trial two.

No significant differences in means were found for trials two, three, five and six, or for the standard deviations for trial three.

The calculation of the critical ratio test for the significance of differences in inhibition scores, presuming to reflect a measure of the total increment of retino-cortical inhibition generated in each of the two groups, found a significant difference at the .05 level. Figure 1 on the following page compares the curves for the trial by trial differences in mean inhibition raw scores between normal and convict groups. The data for the applied critical ratio tests on means, standard deviations, and inhibition scores is presented in Table II, page 40.

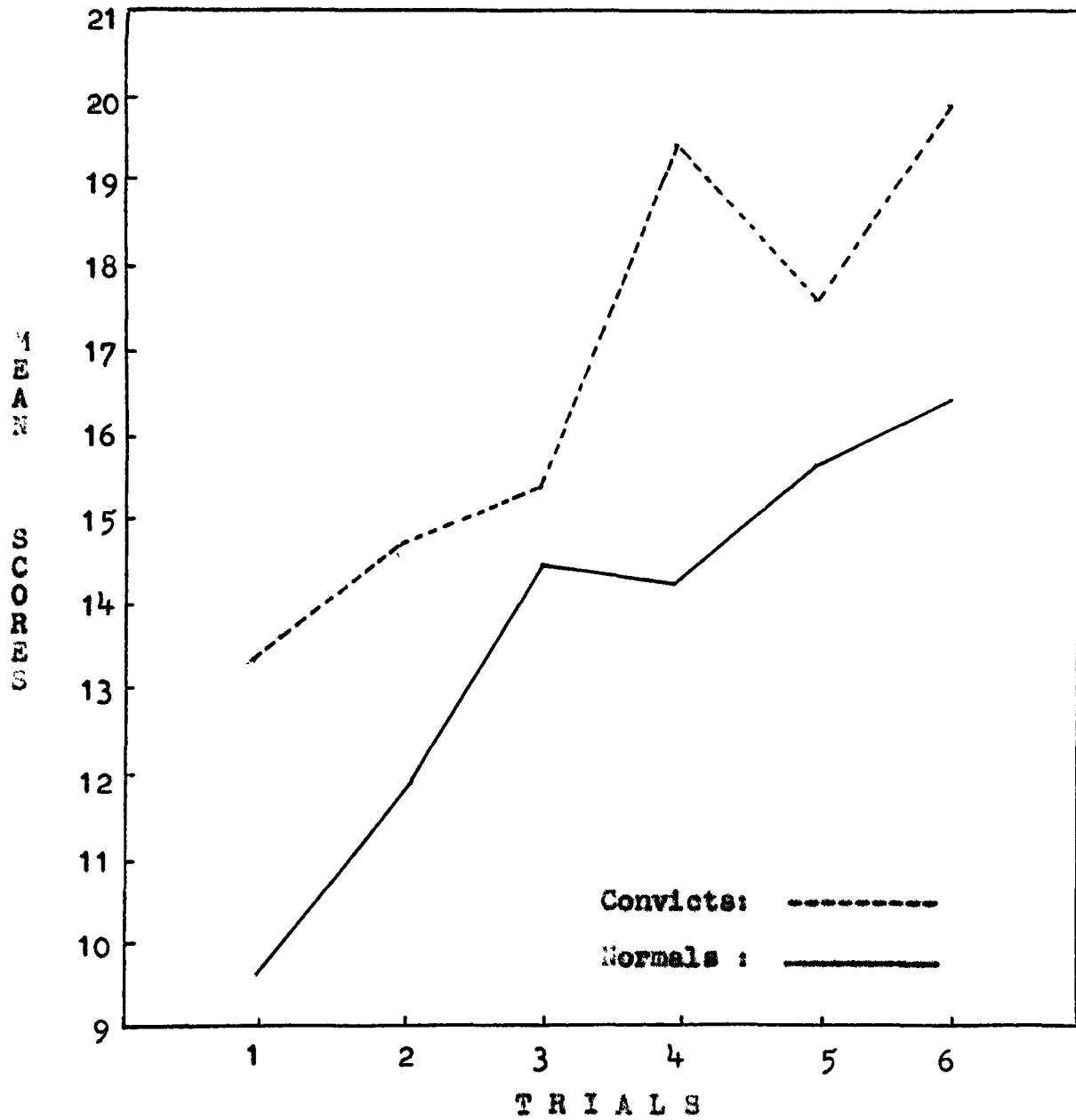


Figure 1.- Curves of Mean Inhibition Scores for Normal and Convict Groups.

Table II.-

Critical Ratio Tests of the Difference in Means and Standard Deviations on the Negative After-Image Threshold Raw Scores and Inhibition Scores of Normal and Convict Groups.

Trial	stat.	Convict N = 98	Normal N = 72	Diff.	$\sigma_d$	CR	Sign.
1	M	13.418	9.46	3.958	1.317	3.005	.01
	$\sigma$	10.563	6.467	4.076	.928	4.391	.01
	$\frac{\sigma}{M}$	1.072	.765				
	$\frac{\sigma}{\sigma}$	.755	.540				
2	M	14.622	11.99	2.632	1.485	1.772	--
	$\sigma$	10.764	8.527	1.237	1.047	2.136	.05
	$\frac{\sigma}{M}$	1.093	1.005				
	$\frac{\sigma}{\sigma}$	.769	.711				
3	M	15.336	14.50	.836	1.636	.510	--
	$\sigma$	11.498	9.737	1.761	1.540	1.526	--
	$\frac{\sigma}{M}$	1.167	1.148				
	$\frac{\sigma}{\sigma}$	.821	.811				
4	M	19.418	14.160	5.158	2.249	2.293	.05
	$\sigma$	16.535	10.451	6.084	1.566	5.066	.01
	$\frac{\sigma}{M}$	1.882	1.232				
	$\frac{\sigma}{\sigma}$	1.324	.878				
5	M	17.551	15.69	1.861	1.946	.955	--
	$\sigma$	14.764	10.56	4.204	1.373	3.06	.01
	$\frac{\sigma}{M}$	1.499	1.245				
	$\frac{\sigma}{\sigma}$	1.055	.88				
6	M	19.939	16.43	3.509	2.304	1.522	--
	$\sigma$	16.403	11.444	6.959	1.624	4.283	.01
	$\frac{\sigma}{M}$	1.668	1.349				
	$\frac{\sigma}{\sigma}$	1.315	.954				
Inhib.	M	10.65	7.16	3.49	1.723	2.02	.05
	$\sigma$	14.291	7.427	6.864	1.996	3.41	.01
	$\frac{\sigma}{M}$	1.48	.837				
	$\frac{\sigma}{\sigma}$	1.19	.620				

## 6. Discussion.

The section following is divided into four subsections. Subsection A is devoted to a discussion of the reliability and validity of the MAIT test as a measure of reactive retino-cortical inhibition. Subsection B deals with the MAIT test in relation to the personality dimensions of introversion-extraversion and neuroticism. Subsection C discusses the comparison of normal and convict groups with respect to differences in reactive inhibition, and subsection D suggests directions for further research.

### A. The Reliability and Validity of the MAIT Test.

The coefficients of reliability reported in this chapter demonstrate that experimental subjects consistently report the disappearance of the negative after-image by means of a motor response. Despite the questionable nature of the reliability herein reported, which appears to derive from the magnitude of judgment errors or motivational distortions of the subjects used in this experiment, the writer presumes the instrumental reliability is acceptable. Previous studies by

Barry<sup>1</sup> and Kovatch<sup>2</sup> have determined the instrumental and phenomenological reliability of the instrument on both normal and organic samples.

It should not be surprising that erratic or labile emotional behavior was observed in the group of convicts within which deviant behavioral potentials are presumed to exist. With respect to the manifestation of such behavior, its occurrence may have value in an analagous way as 'form level' variability is considered an important sign in the detection of psychological cognitive disturbance. So it may be that the incidence of unreliability, where reliability is expected, may be an important differential factor in the psychophysical measurements between normal and recidivistic individuals.

The validity of the IAIT apparatus as an instrument capable of obtaining a measure of retino-cortical inhibition is supported by the finding that the sum of increments in scores from trial one through trial six could not be attributed to chance fluctuations.

---

1 William F. Barry, An Investigation of Relationships Between Introversiion-Extraversiion and the Negative After-Image Threshold, unpublished doctoral dissertation, University of Ottawa, School of Psychology and Education, 1961, ix-80 p.

2 Joseph D. Kovatch, Intra-Cranial Pathology and the Negative After-Image Threshold, unpublished master's thesis, University of Ottawa, April, 1961, vii-44 p.

B. The MAIT Test and Introversion-Extraversion, and Neuroticism.

The null hypothesis: there will be no significant positive correlations between MPI scores and MAIT scores for a sample of male convicts, was not rejected.

The obtained results within the limits of this study do not support Eysenck's arguments for a psychoneurological basis underlying the personality dimensions of introversion-extraversion and neuroticism. The results do substantiate the findings of Rechtschaffen,<sup>3</sup> Norcross,<sup>4</sup> and Becker<sup>5</sup> who also failed to find significant relationships between reactive cortical inhibition and personality correlates as reported by the MPI.

Eysenck<sup>6</sup> has discussed the importance of response set pointing out that if hysterics (neurotics) are likely

---

<sup>3</sup> Allan Rechtschaffen, "Neural Satiation, Reactive Inhibition and Introversion-extraversion", in the Journal of Abnormal and Social Psychology, Vol. 57, No. 3, November 1958.

<sup>4</sup> Kathryn Norcross, Ronald Lipman, and Herman Spitz, "The Relationship of Extraversion-Introversion to Visual and Kinesthetic After-Effects". in Journal of Abnormal and Social Psychology, Vol. 63, No. 1, July 1961, p. 210-211.

<sup>5</sup> Wesley C. Becker, "Cortical Inhibition and Extraversion-Introversion", in the Journal of Abnormal and Social Psychology, Vol. 61, No. 1, July 1960, p. 52-60.

<sup>6</sup> H.J. Eysenck, "Hysterics and Dysthymics as Criterion Groups in the Study of Introversion-Extraversion", in the Journal of Abnormal and Social Psychology, Vol. 57, No. 2, July 1958, p. 250-252.

to answer "yes", high scores on neuroticism would be achieved and only average extraversion scores. Inspection reveals that all neurotic dimension items on the "I" scale of the MPI are keyed "yes", while only two-thirds of extraversion items are similarly keyed. Thus, neurotic subjects prone to answer "yes" would achieve higher neurotic scores than extraversion scores.

Another point of criticism of the MPI which is pertinent to this study concerns the problem of motivation. Sigal<sup>7</sup> discussed the differences in the social desirability aspect of the introversion-extraversion items of the PI. He argued that if more introversion items than extraversion items have socially less desirable meaning, then the more neurotic subjects, or those with low self-esteem levels, would be less apt to favor items serving to create favorable self-portrayal or good impressions.

Reasoning from this, it may be that the convict subjects in this study, all of whom were serving lengthy prison terms, were characterized by feelings of low self-esteem and possibly possessed little motivation to render a favorable self-picture. Concerning the factor of the

---

7 John J. Sigal, Kohlman H. Star and Cyril M. Franks, "Hysterics and Dysthymics as Criterion Groups in the Study of Introversion-Extraversion", in the Journal of Abnormal and Social Psychology, Vol. 57, No. 1, March 1958, p. 143-148.

unidirectional "yes" keying of the neurotic items of the N scale, and the high neurotic scores attained by this group, it may be that the effects of low esteem and tendencies to answer "yes" served to increase introversion scores while simultaneously decreasing extraversion scores.

#### C. Comparison of Normal and Convict Groups.

The second hypothesis: there will be no significant differences between the mean inhibition scores of normals and a group of convicts as measured by the IAIT apparatus, was rejected.

The significant differences found between the inhibition scores and the scores of the first trials (basal score) support the contentions of Klein and Krech.<sup>8</sup> Such observed results in response levels, interpreted as inhibitory basality, support their position that individual differences exist in cortical reactivity, and that basal levels determine the degree of reactive cortical inhibition which may be generated.

Insofar as a significant tendency is demonstrated for basal levels to covary with the degree of reactive cortical inhibition generated, the findings of Becker<sup>9</sup>

---

<sup>8</sup> George S. Klein and David Krech, "Cortical Conductivity in the Brain Injured", in Journal of Personality, Vol. 21, No. 1, September 1952, p. 113-143.

<sup>9</sup> Becker, Op. Cit., p. 52-66.

and Barry<sup>10</sup> supporting the opposite position become questionable. Barry<sup>11</sup> points out that the significant difference in basal scores of his subjects in test and retest sessions may have been due to an inadequate three-minute period of time allowed between testings for inhibition to dissipate. This may be true for, in the present study, a period of ten days intervened between first and second testing periods of the reliability group whose basal scores remain almost identical.

It has been shown that the convicts and normal groups differ significantly with respect to basal levels and total inhibition generated. Comparing each group trial by trial, the scores of the convicts are seen to be significantly different in standard deviations on five of the six test trials. Such variability, consistent with Eysenckian theory, may well be reflective of still undefined psychoneurological factors which contribute to the presumed autonomic lability of those subjects seen to develop high levels of reactive cortical inhibition.

#### D. Suggestions for Further Research.

Areas for further research with the MAIT apparatus would appear to be numerous. The question of individual

---

10 Barry, Op. Cit., p. 64-65.

11 Ibid., p. 64-65.

basal differences and potentials for reactive inhibition may possibly be compared with E.E.G. patterning, as a measure of the excitatory status of the cortex, and MAIT basal values. Relatedly, the question of diurnal changes and stability of threshold values extended over a period of time, with the same individuals, should be investigated.

Efforts should be made to cross-validate the MAIT apparatus with various other measuring instruments purported to give measures of reactive cortical inhibition, such as the pursuit rotor and the Dimer Wallenstein apparatus.

Finally, if reactive cortical inhibition is related to hypothesized dimensions of personality, attempts should be made to further work in the area of correlating MAIT with samples clinically rated for extraverted behavior.

## SUMMARY AND CONCLUSIONS

This study has reported an investigation of possible relationships between introversion-extraversion and neuroticism, as measured by the MPI, and negative after-image thresholds. It has also reported the results of a comparison made between negative image thresholds of a group of normals and a second group of presumed extraverts. The negative after-image threshold measurements, interpreted as reactive retino-cortical inhibition, were correlated with MPI measures to test Eysenckian theory that reactive cortical inhibition is related to introversion-extraversion and neuroticism.

Related research literature was reviewed describing the Eysenckian theory and reporting previous studies. The instrument, experimental design, and procedures were presented. Measures of test-retest reliability and validity for the psychophysiological instrument and the personality test were reported.

The relationship between the MPI test and the AIT test scores were investigated using the Pearson product moment coefficient of correlation. The null hypothesis was not rejected as the results failed to uphold the Eysenckian theory relating cortical inhibition to personality correlates through inventory measurement.

Employing critical ratio tests of significant differences, the means and standard deviations were compared as well as the basal and total inhibition scores for the normal and extraverted groups. The null hypothesis was rejected. Significant differences between the normal and extraverted groups were found in basal scores and inhibition scores.

Suggestions for future research to study the phenomenon of reactive cortical inhibition were proposed. The need for comparing NAIT values for basality with measures obtained with electroencephalological techniques, and to cross-validate the NAIT apparatus with other devices purported to measure reactive cortical inhibition, was emphasized.

## BIBLIOGRAPHY

Barry, William F., An Investigation of Relationships Between Introversion-Extraversion and the Negative After-Image Threshold, unpublished doctoral dissertation, University of Ottawa, School of Psychology and Education, 1961, ix-80 p.

This research was the primary source for this study. The experimental procedures, comparison sample and the psychophysiological tool in this study are derived from his work on the after-image.

Becker, Wesley C., "Cortical Inhibition and Extraversion-Introversion", in the Journal of Abnormal and Social Psychology, Vol. 61, No. 1, July 1960, p. 52-66.

An important study which clarifies and defines the types of inhibition and tests which elicit the several sub-types of the phenomenon.

Eysenck, H.J., Dimensions of Personality, London, Hegan Paul, 1947, xi-306 p.

This book supplies the reader with the story of the original research including objective test procedures and factor analytic methods used to distinguish between the groups of abnormals being measured.

-----, "Cortical Inhibition, Figural After-effect and Theory of Personality", in the Journal of Abnormal and Social Psychology, Vol. 51, No. 1, July 1955, p. 94-106.

An important monograph in which the theory of reactive cortical inhibition is stated, explained, and related to the development of personality types.

Hamilton, Max, "On the Nature of Inhibition in the Cerebral Cortex", in Psychological Review, Vol. 59, No. 1, January 1952, p. 49-53.

A pertinent review of Pavlov's experimentation with cortical inhibition explaining the phenomenon as a generalized process which provides the indirect source from which Eysenck derives his theory.

Klein, George S., "Studies of Duration of Negative After-Image; Effect of Brain Injury", quoted by George S. Klein and David Krech, in "Cortical Conductivity in the Brain Injured", Journal of Personality, Vol. 21, No. 1, September 1952, p. 118-148.

This report states that results showed after-images of longer duration in brain-injured subjects than in normals.

Klein, George L. and David Krech, "Cortical Conductivity in the Brain-Injured", in Journal of Personality, Vol. 21, No. 1, September 1942, p. 116-148.

An extensive report on the theory of cortical inhibition with experimentation on the figural after-effect. Valuable for its discussion of the theoretical aspects of cortical inhibition than for the experimental results based on small samples and low levels of significance.

Köhler, Wolfgang and Hans Wallach, "Figural After-Effects", in Proceedings of the American Philosophical Society, 86, 1944, p. 269-357, quoted by John Krauskopf, "The Magnitude of Test Period", in American Journal of Psychology, Vol. 67, No. 4, December 1954, p. 684-690.

One of the several explanations of cortical processes advanced in efforts to explain figural after-effects. The work is theoretical and is not based on known neurological mechanisms.

Kovatch, Joseph D., Intra-Cranial Pathology and the Negative After-Image Threshold, unpublished master's thesis, University of Ottawa, April 1961, vii-44 p.

The first experimentation with MAIT apparatus on brain-damaged subjects. This work helped to extend the reliability and validity of the instrument.

Krauskopf, John, "The Magnitude of Figural After-effects as a Function of Duration of Test Period", in American Journal of Psychology, Vol. 67, No. 4, December 1954, p. 684-690.

The results of this report show that figural after-effects decrease as a function of the length of exposure to stimulation. These findings weaken the Köhler-Wallach theory of polarizability of brain tissue.

Korcross, Kathryn J., Ronald Lipman, and Herman Spitz, "The Relationship of Extraversion-Introversion of Visual and Kinesthetic After-Effects", in the Journal of Abnormal and Social Psychology, Vol. 63, No. 1, July 1961, p. 210-211.

The findings of this study and those of Becker and Rechtschaffen failed to find significant relationships between reactive cortical inhibition and personality, correlates as measured by the MPI.

APPENDIX 1

ABSTRACT OF

Introversiön-Extraversiön, Neuroticism  
and Retino-Cortical Inhibition

## APPENDIX 1

### ABSTRACT OF

#### Introversiion-Extraversiion, Neuroticism and Retino-Cortical Inhibition<sup>1</sup>

The Eysenckian theory contends that personality factors are essentially distributed along two primary dimensions of continuous variables defined as introversion-extraversion, and neuroticism. Each is determined by constitutional excitatory and inhibitory potentials of the autonomic nervous system. Such potentials are considered to be determinants of the degree of reactive cortical inhibition produced in response to repetitive afferent sensory stimulation, and are interpreted as the bases for learning and behavior expressed in varying degrees of the personality traits defined as introversion-extraversion and neuroticism.

This research attempted to investigate the Eysenckian theory by obtaining measurements of reactive cortical inhibition in the visual sense modality of a group of behaviorally extreme individuals. These inhibition measurements were correlated with introversion-extraversion and neuroticism scores of the Maudsley Personality Inventory. An additional feature of investigation was a comparison made between the

---

<sup>1</sup> Paul R. Montville, doctoral thesis presented to the School of Psychology and Education of the University of Ottawa, April 1965, viii-53 p.

reactive inhibition scores of normals and the group of presumably extraverted individuals.

The psychophysical instrument used, providing measures of the duration of the negative after-image, and the Maudsley Personality Inventory, were administered to ninety-eight convicts. Reliability for the after-image apparatus and the personality inventory was established.

Investigation for relationships between the negative after-image scores and those of the Maudsley Personality Inventory uncovered no significant relationships. The null hypothesis, there will be no significant positive correlations between MPI scores and MAI scores for a sample of convicts, was not rejected.

A comparison made between the two divergent population groups found significant differences between levels of inhibition and total inhibition generated by sensory stimulation. The null hypothesis, there will be no significant differences between the mean inhibition scores of normals and a group of convicts as measured by the MAI apparatus, was rejected.

The results of this study support the Eysenckian theory with respect to significant difference in degrees of reactive cortical inhibition generated by normals and behaviorally extreme individuals, but does not support the hypothesis that introversion-extraversion, and neuroticism, as operationally defined by the MPI performance, are correlates of the phenomenon of reactive cortical inhibition.