1-1-1967

Extraversion, neuroticism and autonomic activity in delinquent and non-delinquent adolescent girls.

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EXTRAVERSION, NEUROTICISM AND AUTONOMIC ACTIVITY IN DELINQUENT AND NON-DELINQUENT ADOLESCENT GIRLS

by

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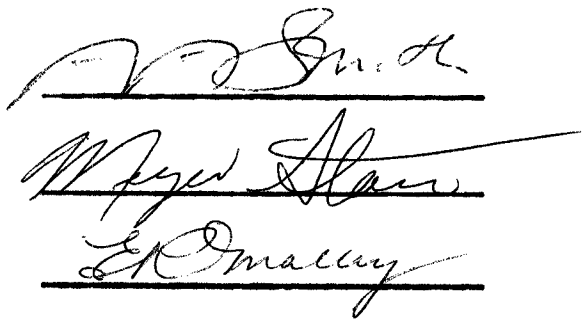
B.A., McMaster University, 1964

A Thesis
Submitted to the Faculty of Graduate Studies through the
Department of Psychology in Partial Fulfillment
of the Requirements for the Degree of
Master of Arts at the University
of Windsor

Windsor, Ontario, Canada
1967

APPROVED BY:



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ABSTRACT

This study attempted to differentiate institutionalized delinquent, adolescent females and non-delinquent, adolescent females with regard to the personality dimensions, extraversion-introversion and neuroticism. The relationships between three GSR indices and these two personality dimensions were also investigated using three subject groups, institutionalized delinquent, adolescent females; non-delinquent, adolescent females; and adult females.

In both parts of the study, the Maudsley Personality Inventory was administered as a measure of extraversion-introversion and neuroticism. The MPI scores of 330 non-delinquents were compared with those of 211 delinquents, the criteria for delinquency being committal to an Ontario Training School. For the second part of the study, the three subject groups, each having 30 subjects, were divided twice into three equal groups on the basis of ranked extraversion scale scores and ranked neurotic scale scores. Three GSR measures were taken for each subject; rate of spontaneous GSR emissions during rest (Variability), reactivity to an auditory stimulus (Reactivity), and mean basal skin resistance level over the experimental conditions of rest, spelling syllables, and auditory stimulation while spelling syllables.

Tests of equality of mean MPI scores showed that the delinquent group of Part A was significantly more neurotic but less extraverted than the non-delinquent group. In the GSR study (Part B), analyses of variance failed to show statistically significant relationships between psychometric measures of either extraversion-introversion or neuroticism and any of the GSR measures. Some significant differences were found between the three subject groups on the three GSR indices.

PREFACE

After working in the Reception and Diagnostic Centre at the Ontario Training School in Galt, my interest in theories of delinquency was further stimulated by Eysenck's theory of crime and personality.

This study was made possible through a fellowship awarded by the Ontario Department of Reform Institutions and the kind assistance of the staff of the Ontario Training Schools of Galt and Lindsay, as well as the Windsor Board of Education and staff of the Windsor YWCA. The author wishes to express her appreciation to Dr. J. Callagan and Dr. A. Smith under whose guidance this study was undertaken. To the many subjects who participated in the study, the author is also deeply indebted. I should also like to express my appreciation to my readers, Mr. Myer Starr and Father O'Malley.

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CHAPTER I

INTRODUCTION

Part A: Extraversion-Introversion, Neuroticism and Delinquency

Eysenck (1964a) has outlined a system of personality description utilizing relatively independent dimensions which he integrates with learning theory and constitutional factors to create a stratified system of causally related levels (Franks et al., 1961). Constitutional factors in interaction with the environment result in observable behaviour patterns which can be described quantitatively by assigned values on continua or dimensions. Factorial studies of personality have established three main dimensions which are relatively orthogonal to each other, Neuroticism, Extraversion-Introversion, and Psychoticism (Eysenck, 1964a).

This paper is in part, concerned with a comparison of the descriptions of the personalities of institutionalized delinquent, adolescent girls with those of non-delinquent, adolescent girls in terms of the dimensions of Extraversion-Introversion and Neuroticism, as measured by a self-rating questionnaire, the Maudsley Personality Inventory (MPI). No attempt was made to define delinquency with regard to the type or number of offenses; rather the criterion for delinquency was committal by a juvenile or family court under the

Training Schools Act or the Juvenile Delinquents Act (Canada) to an Ontario Training School of the Ontario Department of Reform Institutions.

These two factors, Extraversion-Introversion (E) and Neuroticism (N) account for most of the variance in personality inventories. Neuroticism refers to maladjustment, emotional overresponsiveness, general emotional instability, and predisposition to neurotic breakdown under stress. Extraversion refers to outgoing, impulsive, uninhibited and sociable inclinations. An introvert is characterized by the opposite traits and tendencies. The following descriptions of extreme extraversion and introversion are given by Eysenck (p.35-36, 1964b).

> The typical extravert is sociable, likes parties, has many friends, needs to have people to talk to, and does not like reading or studying by himself. He craves excitement, takes chances, acts on the spur of the moment, and is generally an impulsive individual. He is fond of practical jokes, always has a ready answer, and generally likes change; he is carefree, easygoing, optimistic, and likes to 'laugh and be merry'. He prefers to keep moving and doing things, tends to be aggressive and loses his temper quickly; his feelings are not kept under tight control and he is not always a reliable person.
>
> The typical introvert is a quiet, retiring sort of person, introspective, fond of books rather than people; he is reserved and reticent except with intimate friends. He tends to plan ahead, 'looks before he leaps', and distrusts the impulse of the moment. He does not like excitement, takes matters of everyday life with proper seriousness, and likes a well-ordered mode of life. He is reliable, somewhat pessimistic, and places great value on ethical standards.

Eysenck (1957) postulates causal relationships between constitutional factors and these two dimensions, linking neuroticism to the Autonomic System and extraversion-

introversion to the Central Nervous System. Theoretically, neurotic individuals are predisposed to give stronger autonomic reactions to certain stimuli. Eysenck also theorizes that introversion is related to the relative ease of arousal of cortical excitation and dissipation of cortical inhibition and extraversion is related to lowered cortical excitation and heightened cortical inhibition. These theoretical assumptions, together with another, that cortical inhibition depresses conditioning and facilitates extinction, permit the prediction to be made that introverts condition better than extraverts given a similar learning situation.

Eysenck (1960) maintains, "Delinquent behaviour, i.e., the tendency to act out immediately and without restraint one's instinctual impulses, whether sexual, aggressive, or predatory, is surely the natural way to act for animals and for young children." Moral values or a conscience are acquired in the form of conditioned fear or anxiety responses built up during an individual's formative years by the pairing of socially undesirable behaviour with punishment. If this socialization process is mediated as Eysenck suggests, by the process of conditioning, then individual differences in conditionability should result in different degrees of socialization. The extreme introvert subjected to a standard process of cultural indoctrination should become oversocialized while the extreme extravert subjected to the same process would become undersocialized as compared to the average person (Eysenck, 1957, p. 210).

Psychopaths consistently manifest antisocial behaviour although they can verbally express the existing values of a society. Eysenck's theory explains this in terms of their being extreme extraverts and consequently difficult to condition as they require more pairings of conditioned and unconditioned stimuli than non-psychopaths before the conditioned response is acquired. Laboratory studies have generally supported this hypothesis (Lykken, 1957; Eysenck, 1957). Hare (1965a,b,c) has demonstrated that psychopaths have difficulty in developing and retaining conditioned fear responses and that such responses, once acquired are less generalized by psychopathic individuals.

Although differences in conditionability due to constitutional factors underlying extraversion-introversion, may determine in part the antisocial or socialized behaviour of individuals, all criminal behaviour cannot be accounted for by a single factor theory. Strength of drive and amount of conditioning received by any individual must also be considered. Environmental factors constituting the conditioned and unconditioned stimuli in the socialization process are not identical for every person. Although no simple equation of extraversion and criminality can be made, Eysenck does make the general deduction that, "People who commit crimes and other antisocial acts would, on the whole, be more extraverted than people who refrain from carrying out such acts." (Eysenck, 1964b, p.121).

It is also reasonable to suggest that criminal or delinquent groups would score higher than the normal population on tests designed to measure maladjustment, general emotional instability or neuroticism. According to Eysenck, a high degree of emotionality or neuroticism is important in the process of becoming the psychopath and the criminal in the sense that it provides a higher drive for the person concerned to carry out his crimes or misdemeanors. (Eysenck, 1964b, p.111).

Studies have generally shown criminal and delinquent groups to be more neurotic than non-criminal or normal groups. However, there is some controversy over the prediction that criminal groups should be more extraverted than normals. Figure 1 shows the Neuroticism (N) and Extraversion-Introversion (E) scale scores on the MPI of various criminal and neurotic groups (Eysenck, 1964b, p.42). In this figure, neurotic groups display a high degree of introversion while criminal and psychopathic groups score high on the extraversion scale. Both neurotics and criminals have high neuroticism scale scores.

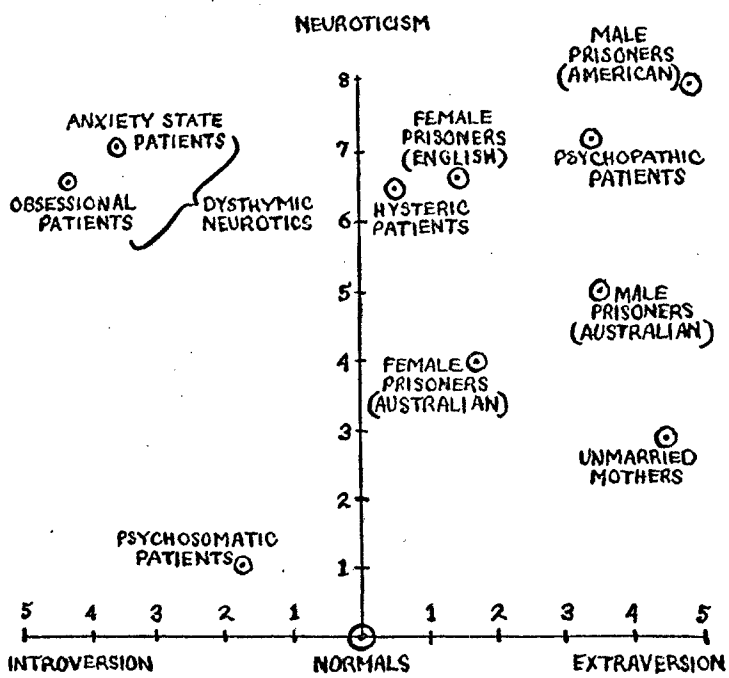


Figure 1: Neuroticism and Extraversion-Introversion scale scores on the MPI of various neurotic and criminal groups.

Fine (1963), in studying traffic violations, reports that extraverts had significantly more accidents and were also guilty of more traffic violations than were the intermediates or the introverts. It was found by Eysenck and Eysenck (1962) that unwed mothers were more extraverted and neurotic than married mothers. Eysenck (1964b,p.123) quotes unpublished results of Syed which indicate high scores on extraversion and emotionality for a hundred female criminals incarcerated in a London prison. Another study noted

by Eysenck (1964b,p.123-4) is that of Warburton who found that the most recalcitrant prisoners in an American penitentiary had elevated scores for extraversion and neuroticism on the Cattell Personality Scales. A Texas longitudinal study of over five hundred children (Michael, 1956) reports that five percent of the introverts, eleven percent of the ambiverts, and twenty-five percent of the extraverts eventually had a record of delinquent and/or criminal behaviour.

However, Bartholomew (1959), in comparing MPI E-scale scores of adult male first offenders, recidivists and normal controls found the only significant difference to be between first offenders and recidivists, the latter group obtaining the higher mean score. No significant differences were obtained between first offenders and the normal group whose scores fell between those of the two criminal groups; or between recidivists and the normal group. Both first offenders and recidivists had higher mean neuroticism scores than the normal group. Jensen (1958) presents E-scale scores on the MPI of adult male recidivists that were no higher than those of normal adult males although their N-scale scores were as high as hospitalized neurotics. Fitch (1962) also found no direct association between extraversion-introversion and recidivism in male adult offenders or adolescent offenders although significant associations were found between high E and variables suggestive of early failure in socialization.

The association between neuroticism and recidivism was confirmed however. Two studies by Blum (1963, 1965) using the Guilford-Zimmerman Temperament Survey measure of extraversion and relating it to recidivism in young male offenders, have conflicting results. In one study (1963), the hypothesis that the proportion of extraverted offenders who became recidivists was not greater than the proportion of introverts was rejected. In his later study (1965), Blum failed to find support for the relation of psychometric measures of extraversion to the prediction of recidivism.

In a study of male juvenile delinquents, Little (1963) reports higher N-scale scores but no higher E-scale scores when delinquents were compared with non-delinquents on the MPI. Hammond (1961), using as measures of E, the MPI and performance on the track tracer, investigated the relationship between extraversion and psychopathy, family dissension, verbal conditioning, and performance on the Porteus Maze Test, for male juvenile offenders. She found the measures of extraversion did not correlate significantly with one another. The only significant relationship was between speed-accuracy on the track tracer test and psychopathy. Pierson and Kelly (1963) report delinquent boys to have high extraversion scores but low anxiety scores on Catell's High School Personality Questionnaire.

Minnesota Multiphasic Personality Inventory (MMPI) studies (Hathaway and Monachesi 1953) have consistently

shown delinquent girls to differ from non-delinquent girls on the Pd or psychopathic deviate scale. Eysenck feels high scores on this scale may indicate extraversion (Eysenck, 1964b, p.123). Carrigan (1960), however, states the Pd loadings on extraversion-introversion factors are somewhat inconsistent, although Pd does tend to be related to both extraversion and maladjustment. A more recent MMPI study of delinquent girls by Jurjevich (1963) concluded that delinquents were more anxious, less repressive, and less self-controlled than normal adult women.

There may be several reasons why questionnaire studies have not shown significant differences in extraversion scores between criminals or delinquents and normals. Prison is a restricting environment which does not allow an individual to answer an inventory or questions in a psychiatric interview without some reference to his immediate predicament. This fact must influence the answers to items high on sociability or neuroticism for a prisoner cannot describe his normally gregarious behaviour or everyday freedom from anxiety when he has been confined to a cell for months or years and is uncertain of his future.

The two personality scales of extraversion-introversion and neuroticism on the MPI, the test used in many of the studies mentioned, may not be truly orthogonal. Negative E-N correlations, especially for neurotic groups (Jensen, 1958) suggest that extraversion-introversion may

not be independent of adjustment. Bartholomew (1959) suggests that in his study the neuroticism loading may have been so high for recidivists that they failed to record higher scores on the extraversion axis. Carrigan (1960) argues that social extraversion represents well-adjusted extraversion, whereas lack of self-control or impulsivity reflects maladjusted extraversion. This has been supported by a study by Eysenck and Eysenck (1963) which indicated the possibility of a "dual" nature of extraversion, the two traits of extraversion being sociability and impulsiveness. They found that sociability had a slightly positive correlation with adjustment while impulsiveness had a slight negative correlation. These findings were based on a collection of items many of which are not included in the MPI, the test used in this study as well as in most of the studies noted earlier. The MPI has been found to be primarily a measure of social extraversion, or sociability rather than impulsivity (Jensen, 1958; Eysenck & Eysenck, 1963). Eysenck and Eysenck (1963) report a negative correlation between neuroticism and their sociability trait which they feel explains the repeated association on the MPI between introversion and neuroticism.

The MPI was not designed for use with adolescents and norms are not given for this age group. Some of the vocabulary used on the MPI is quite probably beyond the comprehension of many adolescents, especially the delinquents

many of whom are functioning at a much lower academic level than non-delinquents of the same age.

Fitch (1962) has found a significant inverse relationship between age and E-scale scores. A random sample of the general population of women showed a significant decline with age of both the N and E scale scores on the MPI (Coppen and Kessel, 1963). These findings suggest the prediction that the E and N scale scores of female adolescents would be higher than those of adult females given as norms for the general population of women. It follows that adolescent delinquent scores on the MPI should be compared with those of normal adolescents rather than with adult female norms.

The first part of this study will attempt to test the hypothesis that delinquent adolescent females are, on the average, more extraverted and neurotic than non-delinquent girls of a similar age, extraversion and neuroticism being defined as high E and N scale scores on the MPI.

Part B: Extraversion-Introversion, Neuroticism and GSR Measures

The second part of this study is concerned with whether autonomic responsivity, represented by the Galvanic Skin Response (GSR), is related to the two dimensions, Extraversion-Introversion and Neuroticism, as measured by the MPI in three groups of females; delinquent adolescents,

non-delinquent adolescents, and adult university summer-school students. These three groups of subjects were selected because it was felt they should display contrasting patterns on GSR measures as they differed in age and theoretically in Extraversion-Introversion scores and Neuroticism scores on the MPI. Part A of this study predicted that delinquents would score, on the average, higher than non-delinquents on both scales of the MPI. It was also suggested that both adolescent groups should score higher on these two dimensions than an adult group.

The Galvanic Skin Response is a drop in the electrical resistance of the skin to the passage of an applied current. According to some experimenters, the GSR is attributable solely to an increase in sweat gland activity mediated by the sympathetic cholinergic nerve supply to the skin (Montagu & Coles, 1966). Others support the theory that at least two factors contribute to the GSR, the sweat glands and an epidermal element (Martin & Venables, 1966; Edelberg, 1966; Katkin, 1965). The actual physiological mechanisms of the GSR are of little importance in this study as the value of the GSR lies in its use as a representative and characteristic autonomic response which may or may not be related to the age as well as the temperament and adjustment of the individual which are represented by the psychometric measures of E and N on the MPI.

Three GSR measures, mean basal skin resistance

level, reactivity and variability were taken in Part B of this study. Reactivity is the amplitude of the momentary drop in skin resistance in response to an external stimulus. Such change scores tend to be highly positively correlated with basal skin resistance or negatively correlated with conductance which is the reciprocal of resistance (Eysenck, S.B.G., 1956) so that when resistance decreases, response amplitude decreases. Martin (1960a) found that this correlation was especially high for the first response. Basal skin resistance is an indication of the level of sympathetic activity and is inversely related to central nervous system arousal. It is considered a reliable individual measure (Silverman et al., 1959). In this study, the frequency of more shallow spontaneous fluctuations in skin resistance or background activity which seem to occur in the absence of specific external stimulation was termed "Variability". These fluctuations are sometimes called, "non-specific responses" and the index is usually defined in terms of the number of small intervals in the experimental time period which contain one or more fluctuations or deflections in skin resistance of some given amplitude. Mundy-Castle & McKiever (1953) suggest these spontaneous responses arise through lack of cortical inhibition of lower autonomic centers. Another hypothesis is that spontaneous responses may be discharges occurring at a lower or peripheral level while skin conductance changes associated with the orienting reflex are partially mediated

by the central nervous system through the epidermis (Edelburg et al., 1957, Katkin, 1965). Variability has also found to be a relatively reliable characteristic of the individual (Wilson & Dykman, 1960; Hustmyer, 1965).

One theory exploring the association between autonomic reactivity and extraversion-introversion has been put forward by Jones (1950) who explains his findings that older children give larger GSR responses than younger children in terms of a shift from outer to inner patterns of emotional response that comes with increased emotional control. He argues that extraversive, infantile emotional expressions tend to be punished whereas internal avenues of discharge are not inhibited, resulting in increased "internalization" of emotional processes with socialization. Having tested adolescents of a longitudinal study in a mild stress situation, Jones reports that high GSR reactivity correlated with motor restraint and various social traits. The high reactive group was calm, more deliberate, more cooperative, more responsible, more restrained in social behaviour. The low reactive group was irritable, easily excited, dominating, uninhibited, aggressive, attention-seeking, and less restrained in social behaviour. Jones concludes that minor maladjustments of a normal sample are more likely to be associated with an extraverted expressive pattern and with restricted physiological reactions as indicated by the GSR. He suggests that high reactives are introversive characters while low reactives

represent the psychoanalytic concept of "impulse neurosis". Jones admits that extreme inhibition of overt responses may result in damaging internal emotional tensions. However, a follow up study of the same adolescents (Jones, 1960) indicated a significantly better prognosis for high reactives as far as adjustment in the mid-thirties was concerned.

However, Oken et al. (1962) report that physiological measures on the whole did not support the notion that limitation of overt affective expression is associated with generally heightened physiological responsivity. Results generally were in the opposite direction to that hypothesized with the one exception being GSR measures whose correlations were in the right direction but not significant.

Block (1957) supports Jones' theory that GSR reactivity is related to personality structure and behaviour, but disagrees with the idea of externalization and internalization, stating that it assumes the existance of a reciprocal displacing relationship between overt motor response and cerebral or autonomic activity. He argues that GSR reactivity is an index of emotional responsiveness, not a means of reducing emotional tension. Block reports that high GSR reactivity in college students was associated with, withdrawing, passive, dependent, worrying individuals who turned their anxieties toward internal routes of expression. They were over concerned with ethical problems and displayed somatic anxiety symptoms. Low reactives, on the other hand, were more aggressively direct,

realistic, opportunistic, practical, and sceptical. They were relatively non-conforming, had difficulty with representatives of authority, and displayed visible rather than inward or covert expressions of impulses.

In a study of emotionally disturbed children, Helper, Garfield, and Wilcott (1963) report results which give some support to both Jones and Block. High GSR reactors showed less appropriate affectivity and tended to be less active motorically. They argue that this is linked with Jones' theory that high reactors are more strongly influenced by inner emotional responses than are low reactors. However, unlike Jones' normal group, with disturbed children, these inner responses tended to impair good adjustment. Helper et al. suggest Jones' concept be changed so that internalization could allow for negative consequences of inwardly determined emotional responses, depending on individual learning experiences.

Ferreira and Winter (1965), on finding that palmar sweat increases from birth to seven or eight years of age at which stage it begins to decrease gradually with age, speculate that the response of palmar sweat may parallel that of fear in being a learned response which may reflect the "organization of the response of the organism to the environment, i.e., the organism's greater capacity to delay the response of 'flight or fight' in favour of cortical reflection and autonomic responses". This as well as the suggestion of Mundy-Castle and McKiever (1953) that stability of the GSR

may be a function of cortical maturity, tend to support Jones' theory to some extent. Bronzaft, Hayes, Welch, and Koltuv (1960) tested Jones' hypothesis that extraversion is related to low GSR reactivity using the MPI and a simple avoidance situation. The correlation between GSR reactivity and extraversion was negative but not significant. Lykken (1957) found that "primary sociopaths", theoretically an extremely extraverted group, displayed significantly lower reactions to a conditioned stimulus associated with shock as compared with non-sociopathic subjects. The results of Hare's study (1965c) of conditioning in psychopaths do not lend support to the hypothesis that psychopaths are any less responsive on the GSR than normals.

Hare (1965c) does, however, lend support to the hypothesis that psychopaths have a relatively low level of autonomic tension and consequently a higher mean basal skin resistance level than either non-psychopathic criminals or non-criminal controls.

According to Eysenck's prediction, introverts condition more rapidly than extraverts (Eysenck, 1957). On the basis of this prediction and using the number of conditioned responses given as the measure of conditionability in a GSR conditioning experiment by Martin (1960b), the following deductions were made concerning the relationship between the three GSR indices and the dimension, extraversion-introversion.

"Level of basal skin resistance correlated negatively

and significantly with the number of conditioned responses." In other words, when basal skin resistance is low, conditioning is greater. Deduction 1: Extraverts should display a higher mean basal resistance level than introverts.

"Spontaneous responses were counted throughout acquisition: they correlated positively and significantly with the number of conditioned responses produced." Deduction 2: Introverts should have a higher mean variability score than extraverts as they should emit a greater number of spontaneous responses than extraverts.

"Subjects giving comparatively larger unconditioned responses were those giving more conditioned responses." Although this correlation was not significant, it was in the predicted direction and suggests the possibility of a third deduction. Deduction 3: Introverts should display on the average, greater reactivity to stimulation than extraverts.

The suggestion made by Mundy-Castle & McKiever (1953) that spontaneous responses arise through lack of cortical inhibition in lower autonomic centers lends support to the second deduction since introverts, according to Eysenck's theory, do not show as much arousal of cortical inhibition as extraverts (Eysenck, 1957). From the proposal that spontaneous fluctuations are closely related to repetitive orienting, Koepke & Pribram (1966) predict that subjects displaying greater variability or "lability", should show better classical conditioning because of orienting more frequently. The

prediction that extraverts display less GSR reactivity based on the theories of Jones (1950) presented earlier in this introduction, corresponds to the third deduction.

Other studies support these deductions by demonstrating correlations between the three GSR indices which yield the patterns of greater reactivity, lower basal resistance levels, lower variability scores suggested for extreme introverts and extraverts, respectively. Silverman et al. (1959) conclude that as "arousal" increased or basal resistance level dropped, non-specific responses or variability increased while reactivity to specific stimuli increased and then decreased. The significant relationship of a high number of spontaneous emissions during rest to greater autonomic reactivity to the initial stimulus is supported by the data of Johnson's study (Johnson, 1963).

However, in the question of a negative correlation between the variability score and basal resistance level, the findings of Johnson (1963) and Wilson & Dykman (1960) do not correspond with those of Silverman et al. (1959), Martin (1960b) and Koepke & Pribram (1966). Johnson explains these conflicting results by suggesting that the inverse relationship is true during periods of relative tension while the absence of a significant relationship occurs only when the subject is relaxed and possibly familiar with the experimental procedures and surroundings.

A similar explanation is put forward for the issue of the independence of variability from reactivity. Wilson

and Dykman (1960), Koepke & Pribram (1966) and Fox & Lippert (1963) disagree with the findings of Johnson (1963) mentioned above.

The deductions that combine lower mean basal resistance with greater reactivity in a pattern for introverts conflict with the demonstrated high positive correlation of change scores with pre-stimulus basal resistance levels presented earlier in this paper (Martin, 1960a).

The prediction by Eysenck on which the GSR patterns and deductions were based, has not been well substantiated by experimental findings. Correlations of the number of conditioned responses with Eysenck's own measures of introversion and neuroticism were very low and non-significant in Martin's study (Martin, 1960b). Sloane, Davidson & Payne (1965) also found that spontaneous fluctuations were not correlated with questionnaire (Taylor Manifest Anxiety Scale and MPI) estimates of introversion, anxiety, nor with conditionability.

It appears that further investigation is necessary to clarify several issues such as the relationship of GSR indices with the dimension extraversion-introversion as well as the correlations of one GSR measure with another. This study will attempt only the former by hypothesizing that individuals in the three subject groups for Part B having high E-scale scores on the MPI would on the average, have the following pattern in GSR measures as compared with individuals obtaining low E-scale scores who would display the

opposite pattern: 1. Lower mean reactivity scores, 2. Higher mean basal resistance levels, and 3. Lower mean variability scores during rest.

The question of associations between neuroticism and GSR measures is even more confused by conflicting experimental data than the issues concerning extraversion and this autonomic response. S.B.G. Eysenck (1956) states, "It is a widely held hypothesis that neurotics are differentiated from normals by greater emotional lability and reactivity, and consequently by greater autonomic responsiveness." Her data failed to support this hypothesis. Bronzaft, Hayes, Welch & Koltuv (1960) found no significant correlations between change scores (the ratio of a subject's peak response to his basal skin resistance) and the MPI estimation of neuroticism. Describing sociopaths as characterized by an extreme lack of anxiety, Lippert & Senter (1966) report the magnitude of elicited GSRs to be similar for sociopaths and non-sociopaths or anxious controls. Sloane et al. (1965) however, showed psychoneurotic patients to be more labile in their autonomic reactions to stimulation than normal subjects.

Comparing female patients having severe anxiety symptoms and high scores on two manifest anxiety scales (Taylor MAS and Freeman MAS) with non-anxious controls, Goldstein (1964) discovered that skin conductance (the reciprocal of resistance) was actually lower in the patient group although other autonomic measures supported the hypothesis that anxious individuals are generally more autonomi-

cally reactive. He put forward the explanation that the pattern of high heart rate, high systolic blood pressure and low palmar conductance (high skin resistance) is found more frequently in psychiatric populations than among normals.

Gilberstadt & Maley (1965) conclude that the presence of anxiety, assessed in a patient population by the MMPI and psychiatric interviews, is associated with higher levels of skin conductance (lower levels of skin resistance). The following studies failed to find significant differences between high anxious and low anxious subjects on the GSR index of basal skin resistance (Katkin, 1965; Fox & Lippert, 1963; Lippert & Senter, 1966).

Fox & Lippert (1963 tested the hypothesis that variability or rate of emission of spontaneous fluctuations is a positive function of "arousal" or anxiety by measuring this GSR index under resting conditions for two groups of delinquent males who had been clinically assessed as displaying different levels of manifest anxiety. The anxious "Inadequate Personality" group exhibited a significantly greater frequency of spontaneous fluctuations than did the non-anxious, "Sociopathic" group. In an extension of this study, Lippert & Senter (1966) found that sociopaths, again described as non-anxious, had a significantly lower rate of spontaneous GSR emissions than non-sociopathic and presumably more anxious controls under conditions of shock threat stress.

An attempt was made to test the causal relationship of two levels in Eysenck's Stratification Theory, level one which is "physiologically determined" and level three, "objectively observable primary personality traits", by predicting a high positive correlation between the GSR measure of variability or "non-specifics" and the N-scale of the MPI (Burdick, 1966). Dividing the subjects into stabiles and labiles by the median GSR measure score, Burdick found that their N-scale scores did not differ significantly. He concludes that the measurement of N in level three of the theory was reliable but that "level one hypothetical construct lacks any empirical physiological basis." Other studies using the Taylor MAS, which, according to Lykken (1957), is primarily a measure of neurotic maladjustment or neuroticism rather than of anxiety level or anxiety reactivity, have discovered this questionnaire to have low, non-significant correlations with GSR variability scores (Johnson, 1963; Koepke & Pribram, 1966; Wilson & Dykman, 1960).

Many of these studies of personality and GSR cannot be adequately compared because of different instrumentation, GSR scoring and statistical analysis, experimental conditions and procedures, as well as the varying methods of diagnosing both extraversion-introversion and neurosis and the varied types of subject groups employed.

The hypothesis of this paper concerning neuroticism and the three GSR indices was taken from the hypotheses

of the studies whose conflicting results have been reviewed above. Individuals of the three subject groups scoring high on the N-scale of the MPI should present on the average the following GSR pattern in contrast to those scoring low on this dimension whose pattern should be opposite to this: 1. Higher mean reactivity scores, 2. Lower mean basal skin resistance levels, 3. Higher mean variability scores.

As the predictions for extraverts and neurotics conflict, it is impossible to predict the pattern of the delinquent group who, according to the hypothesis of Part A are both extraverted and neurotic.

CHAPTER II

METHODOLOGY AND PROCEDURE

Subjects

Part A: The Maudsley Personality Inventory was administered to 331 adolescent girls from several Windsor High Schools and a teenaged group from the Windsor YWCA. These girls were selected to correspond approximately in age with a sample of 218 delinquent girls who were also requested to complete the MPI. The girls of this latter group were described as "delinquent" by virtue of their committal to one of two Ontario Training Schools maintained by the Ontario Department of Reform Institutions. The girls were asked to participate in the testing procedure anonymously with the exception of a group of non-delinquents selected for the GSR study of Part B and a group of 64 delinquent volunteers from which delinquents for Part B were selected. Refusals to complete the inventory were accepted by the experimenter without comment in both groups. One test protocol from the non-delinquent group had to be discarded as incomplete.

Part B: Thirty-two non-delinquent adolescent girls, 38 institutionalized, delinquent adolescent girls and 35 adult females were tested in the GSR study of Part B. The results are based on the GSR recordings and MPI protocols of 30 sub-

jects in each of the three groups. The remaining GSR recordings had to be discarded for various reasons such as lack of cooperation on the part of the subject in remaining quiet when presented with the auditory stimulus, interruptions and unavoidable distractions during the experimental procedure, and malfunctioning of the GSR apparatus.

The delinquent subjects were selected from a group of 64 volunteers on the basis of availability during the time allotted by the institution for the study and also to provide an approximate cross-section of the delinquent population with regard to length of time (in months) spent in the institution. The non-delinquents were selected from the appropriate age group solely on the basis of availability and willingness to participate in the experiment. In the GSR study, a group of adult females were also included. These were drawn from the summer school Introductory Psychology course and were all elementary school teachers. They participated in the experiment upon request to fulfill course requirements to act as subjects.

Psychometric Instrument and GSR Apparatus

The MPI with standard printed instructions was used to measure extraversion-introversion (E-scale) and neuroticism (N-scale) on the verbal, self-report level in both A and B parts of this experiment. This inventory consisted of twenty-four E-scale items, twenty-four N-scale items. twenty Lie-scale items and twelve "buffer" items.

For each scale, two points were given for the keyed responses and one point for the "?", giving a range of possible scores of 0 to 48 for both the E and N-scales.

A dermograph (Stoelting, Model M-24203) traced the GSR on a paper strip chart (Model M-11). A second pen on the galvanometer recorded the time of the auditory stimulus on the same chart which was fed automatically under the two pens at a uniform speed of six inches per minute. Finger electrodes were fitted to the index and ring fingers of the S's left hand after they were cleaned with rubbing alcohol and given an application of electrode jelly. The pen recording the GSR was centered for each subject at the beginning of the testing session and when necessary throughout it. A table was provided on which the subject was instructed to rest her left arm and hand throughout the experiment.

Two memory drums presented lists of 28 nonsense syllables of low associative value at the rate of one every three seconds. The second list contained the syllable LAJ ten times randomly placed among the other syllables. An audio-oscillator produced a 1000 cycle tone of approximately 80 decibels intensity and of 0.5 seconds duration which was presented binaurally through earphones to the subject. A Hunter timer controlled the duration of the auditory signal. The tone was given immediately following every second appearance of the syllable LAJ in the second memory drum as it had been hoped to also obtain a measure of classical GSR conditioning in this experiment. The onset of the tone was con-

trolled manually by the experimenter who also timed the four experimental periods with a stop watch.

Procedure

MPI Procedure

With the exception of the 30 girls used for the GSR study and 54 girls used in another GSR study, the non-delinquent girls were tested in groups during school hours with both their presiding teacher and the experimenter present. The 84 non-delinquents in the two GSR studies were given the MPI to complete individually in a room unsupervised and alone either while they waited to participate in the GSR experiment or immediately after the experimental procedure was completed. This practice was followed because, after initial difficulties in persuading subjects to participate, the experimenter discovered that the adolescent girls contacted to volunteer for the GSR study were much more willing to come to the laboratory with a friend rather than alone. Thus, while one girl took part in the GSR study, the other completed the MPI and then they changed procedures.

The girls of the delinquent sample were all tested in groups by the experimenter alone. The adult group of Part B completed the MPI alone and unsupervised while waiting to begin the GSR procedure. All subjects in Parts A and B were given the MPI with standard instructions which were read aloud at the beginning of the testing session. In addition, they were asked to give their age (in years) and when appli-

cable, grade and length of time institutionalized (in months).

The MPI inventories for all subjects were scored using a stencil only after all GSR procedures for the three groups had been completed.

GSR Procedure

The subject was seated with her back to the experimenter but forward and to the right of her so that the memory drums placed on the table before the subject were clearly in view of the experimenter. Instructions (see appendix C) were read to the subject describing the experiment as one of relaxation while a simple spelling task was being performed. She was warned that she would occasionally hear a sound through the earphones. The subject was instructed to spell each syllable out loud as it appeared in the window of the memory drum. She was then fitted with the finger electrodes and earphones. After a five minute resting period, the subject was told to begin spelling the first list of nonsense syllables and the first memory drum was turned on. This task of five minutes duration was followed by instructions to change to spelling the second list of syllables in the second memory drum. At this point, the auditory stimulus was presented with every other appearance of the syllable LAJ. This procedure continued for five minutes, providing the subject with 18 tone presentations although only the GSR reaction to the first tone was used in the results. Following this interval was an eighty-second period

in which the subject continued to spell the syllables of the second list and no tone was presented. This procedure provided four experimental periods: Period I, five minutes' rest; Period II, five minutes' spelling activity; Period III, five minutes' spelling with intermittent auditory stimulation; and Period IV, eighty seconds of spelling activity.

Three GSR measurements were taken. In the first three periods, the basal level of skin resistance was estimated to the nearest 500 ohms for each thirty second interval of time, and in the fourth period, the basal resistance level was estimated for two forty second intervals. These estimates were averaged for each period to provide four mean basal levels of skin resistance.

Reactivity was defined in this study as the amplitude of response to the first auditory stimulus of Period III and was found by subtracting the point of lowest resistance within nine seconds of noise onset from the estimated basal resistance level of the 30-second interval immediately preceeding the onset of noise, i.e., the last interval of Period II. This difference was measured to the nearest 500 ohms.

A variability score was computed for Period I only. Each 15-second interval of this five minute period containing one or more changes in skin resistance of 1000 or more ohms was scored as "1", giving a maximum possible variability score of 20 and a minimum score of 0. The value of 1000 ohms was selected arbitrarily as other studies using this GSR index differed from each other in their choice of a value.

CHAPTER III

RESULTS

Part A

The mean and standard deviation of the three MPI scores, age, and in the case of the delinquent group, the length of time institutionalized were computed for the delinquent and non-delinquent groups. These mean values, the standard deviation values and also the Z values computed in testing their equality are given in Table 1.

Table 1

Mean and standard deviation values for age, time institutionalized, and the Lie-scale, E-scale, and N-scale of the MPI for the delinquent and non-delinquent group.
Z values from the tests of equality of these means.

	Age (years)	Time (months)	Lie-scale	E-scale	N-scale
Delinquent (N=211)					
Mean	15.08	10.16	4.12	27.54	33.92
SD	0.96	8.52	2.70	8.18	9.45
Non-delinquent (N=330)					
Mean	15.00	---	5.00	29.61	29.08
SD	1.97	---	2.92	7.99	10.54
Z Values	0.930	---	-3.604**	-2.895**	5.552**

** $p<0.01$

(See Appendix A for the mean values and standard deviations for these measures for the various delinquent and non-delinquent adolescent groups tested.) From these values, it is evident that only one-half of Part A hypothesis, that delinqents would on the average, score higher on both the E and N-scale scores than non-delinquents, was supported by the data. Delinquents scored significantly higher on the N-scale score ($p<0.01$), but significantly lower on the E-scale ($p<0.01$) than the non-delinquents. Another difference which was significant ($p<0.01$) was in Lie-scale score means. Delinquents again scored lower than non-delinquents on this scale. The age range for the delinquent group was 13 to 17 years and for the non-delinquent groups, 13 to 18 years. The mean ages of the two groups did not differ significantly.

The correlation coefficient for N and E-scales was determined for both groups in an attempt to investigate the independence from each other of these two scales. Both correlations proved to be negative and significant, the non-delinquent group correlation being -0.163 ($p<0.01$), and the delinquent group correlation -0.159 ($p<0.05$). Jensen (1958) states, "A significant negative correlation obtains between E and N only in those samples which in some way represent some highly selected (and therefore biased) element of the general population, and these biased samples are generally higher on Neuroticism than the general population." As will be related later in the presentation of results, both adolescent groups did in fact score higher on the N-scale than an

adult female sample. However, the correlation of E and N for this normal adult female sample was -0.15 ($p<0.05$) (Jensen, 1958).

A prediction was made in Part A that both adolescent groups would score higher on the E-scale than adult females. Table 2 presents the normative data for normal adult females on the E and N-scales (Jensen, 1958) as well as the mean scores of other samples with whom both experimental or "adolescent" groups were compared.

Table 2

Mean and standard deviation values for E and N-scales of the MPI for samples with which the two experimental groups were compared.

Groups	Extraversion Scores		Neuroticism Scores	
	Mean	SD	Mean	SD
Normal adult females (N=200)	25.17	9.33	19.45	11.02
Canadian female undergraduates (N=804)	27.66	9.33	25.18	9.79
Neurotic female patients (N=65)	18.67	9.21	34.75	11.83
Recidivist prisoners (Male) (N=146)	24.09	9.11	30.35	10.73
Hospitalized psychopaths (Male) (N=36)	30.77	9.51	35.58	10.91

These included Canadian female university undergraduate students (Hannah et al., 1965), neurotic female patients (Jensen, 1958), recidivist prisoners (Eysenck, 1959a), and hospitalized psychopaths (Eysenck, 1959a).

The Z values computed in comparing the means of the delinquent and non-delinquent groups with those of the samples are shown in Table 3.

Table 3

The Z values computed in comparison of delinquent and non-delinquent mean E and N-scale scores with those of groups whose mean scores were given in Table 2.

Groups	Z Values			
	Delinquent		Non-delinquent	
	E-scale	N-scale	E-scale	N-scale
Normal adult females (N=200)	2.73**	14.26**	5.60**	9.91**
Canadian female undergraduates (N=804)	-0.18	11.88**	3.55**	5.78**
Neurotic female patients (N=65)	6.96**	-0.52	8.94**	-3.69**
Recidivist prisoners (Male) (N=146)	3.67**	3.24**	6.32**	-1.20
Hospitalized psychopaths (Male) (N=36)	-1.92	-0.86	-0.71	-3.41**

** $p<0.01$

Both adolescent groups scored significantly higher on both the N and E-scales than the normal adult female sample. With the exception of the delinquent group E-scale mean score, the adolescent groups also scored higher on both scales than a group of female undergraduates. There was no significant difference between the delinquent group mean E-scale score and that of the students. Compared with neurotic female patients, the two adolescent groups were more extraverted. The non-delinquents obtained a significantly smaller mean N-scale score than the neurotic patients, but the mean N-scale score of the delinquents did not differ significantly from that of the neurotic group. In comparing recidivist prisoners with the adolescent groups, Z scores of Table 3 indicate that the delinquents were more extraverted and neurotic and the non-delinquent group scored higher only on the E-scale; their N-scale mean score did not differ significantly from that of the recidivists. The final comparison was made between the adolescent groups and a sample of hospitalized psychopaths. The only significant difference found was between the non-delinquents and psychopaths on the N-scale, non-delinquents being less neurotic.

Part B

As in Part A, the mean and standard deviation of MPI scale scores, age, and length of time institutionalized (delinquent group only) were determined for the three groups, delinquents, non-delinquents and adults. Table 4 presents

these statistics. The age ranges were the following: 13 to 16 years for delinquents, 12 to 17 years for the non-delinquents, and 21 to 53 for the adult group.

Table 4

Mean and standard deviation values for age, time institutionalized, and the Lie-scale, E-scale, and N-scale of the MPI for the Part B subject groups, delinquents, non-delinquents, and adults.

Groups	Age (years)	Time (Months)	Lie-scale	E-scale	N-scale
Delinquent (N-30)					
Mean	14.80	9.51	3.67	29.00	34.07
SD	0.87	6.14	2.47	8.01	9.20
Non-delinquent (N=30)					
Mean	14.67	---	4.73	30.43	23.43
SD	1.30	---	2.54	8.15	9.01
Adult (N=30)					
Mean	27.77	---	4.47	27.53	23.73
SD	8.45	---	2.42	8.58	10.80

Results of tests of equality of means of the Part B groups and normative groups for the above means are given in Table 5.

Table 5

The Z values computed in the comparison of delinquent, non-delinquent and adult E and N-scale score means, and means of age and time institutionalized with the mean values of Part A delinquent and non-delinquent groups and normal adult females (from Jensen, 1958).

Groups	Z Values			
	Age	Time	E-scale	N-scale
Part B delinquent with Part A delinquent	-1.94	-0.51	0.93	0.08
Part B Non-delinquent with Part A Non-delinquent	-1.58	---	0.53	-3.24**
Part B adult with Normal adult females (Jensen, 1958)	---	---	1.39	2.02*

* $p<0.05$
** $p<0.01$

In the case of the adolescent groups, the normative data was taken from Part A, with the Part B groups being compared with the larger samples of delinquents and non-delinquents. The only significant differences were in two N-scale mean scores, the adult Part B group was more neurotic than normal adult females (Jensen, 1958), and the non-delinquent Part B group was less neurotic than the larger Part A group. This latter difference had a desirable effect in making the delinquent and non-delinquent groups even more contrasting

on the dimension of neuroticism.

The hypothesis of Part A was also tested for Part B delinquent and non-delinquent groups by two one-way analyses of variance followed by Duncan's Multiple Range Test. The delinquent group scored significantly higher on the N-scale than either the non-delinquent or adult groups ($p<0.01$). This was the only significant difference. Summaries of these analyses of variance are presented in Tables 6 and 7.

Table 6

Summary of one-way analysis of variance of extraversion between delinquent, non-delinquent, and adult groups.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Between groups	2	126.156	63.078	0.895
Error	87	6130.833	70.469	
Total	89	6256.989		

Table 7

Summary of one-way analysis of variance of neuroticism between delinquent, non-delinquent, and adult groups.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Between groups	2	2199.356	1099.678	11.201**
Error	87	8541.100	98.174	
Total	89	10740.456		

** $p<0.01$

The three experimental groups were ranked by N-scale scores and again by E-scale scores and then divided into three groups of ten (high, medium and low scorers for both dimensions). Mean E and N-scale scores are given in Table 8 for these groups. Using these groupings, analyses of variance were performed for each of the three GSR measures to test their relationship with E and N. The analyses of variance also served to test between Part B subject groups differences for each GSR measure.

Table 8

Mean E and N-scale scores for the high, medium, and low scoring groups in these two dimensions for delinquent, non-delinquent, and adult groups.
Total mean E and N-scale scores for high, medium, and low scoring groups.

E-scale groups	Subject groups: Delinquent	Non-delinquent	Adult	Total Mean E of High, medium and low groups
High E scoring	36.6	39.1	36.1	37.3
Medium E scoring	29.6	30.8	29.5	30.0
Low E scoring	20.8	21.4	17.0	19.7
N-scale groups				**Total Mean N of high, medium and low groups**
High N scoring	42.8	33.8	35.9	37.5
Medium N scoring	35.9	23.1	23.7	27.6
Low N scoring	23.5	13.4	11.6	16.3

The two summaries of the two-way analyses of variance for the GSR measure, variability, are shown in Tables 9 and 10. The only significant difference was between subject groups ($p<0.05$) and a Duncan's Multiple Range test indicated that the delinquent mean variability score was significantly higher than that of the adult group but not the non-delinquent group.

Table 9

Summary of two-way analysis of variance of GSR variability between delinquent, non-delinquent, and adult groups and high, medium, and low E scoring groups.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Between subject groups	2	141.867	70.934	3.373*
Between E scoring groups	2	31.267	15.634	0.743
Interaction	4	53.466	13.367	0.636
Error	81	1703.400	21.030	
Total	89	1930.000		

* $p<0.05$

Table 10

Summary of two-way analysis of variance of GSR variability between delinquent, non-delinquent, and adult groups and high, medium, and low N scoring groups.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Between subject groups	2	141.867	70.934	3.281*
Between N scoring groups	2	23.400	11.700	0.541
Interaction	4	13.533	3.383	0.156
Error	81	1751.200	21.620	
Total	89	1930.000		

* $p<0.05$

The mean variability score of the non-delinquent group did not differ from either that of the delinquent group or adult group. None of the variance was attributable to high, medium, or low scores on the MPI scales of E or N. The mean variability scores for the groups used in the analyses of variance are given in Table 11.

Table 11

Mean GSR variability scores for high, medium, and low E and N scoring groups in the three subnect groups, delinquents, non-delinquents, and adults.
Total Mean GSR variability mean scores across E and N scoring groups and across subject groups.

	Subject groups			
E scoring groups	Delinquent	Non-delinquent	Adult	Total E scoring means
Low E	6.8	5.5	5.7	6.00
Medium E	7.9	6.5	5.3	6.57
High E	10.1	7.6	4.6	7.43
N scoring groups				Total N scoring means
Low N	8.6	7.2	5.7	7.23
Medium N	8.9	6.0	5.7	6.87
High N	7.3	6.4	4.2	5.97
Total subject means	8.27	6.53	5.20	

A similar statistical procedure was followed for the measure, GSR reactivity. Tables 12 and 13 give the two summaries of the two-way analyses of variance.

Table 12

Summary of two-way analysis of variance of GSR reactivity between delinquent, non-delinquent, and adult groups and high, medium, and low E scoring groups.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Between subject groups	2	242.017	121.009	6.158**
Between E scoring groups	2	18.350	9.175	0.467
Interaction	4	272.233	68.058	3.464*
Error	81	1591.625	19.650	
Total	89	2224.225		

* $p<0.05$
** $p<0.01$

Table 13

Summary of two-way analysis of variance of GSR reactivity between delinquent, non-delinquent, and adult groups and high, medium, and low N scoring groups.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Between subject groups	2	242.017	121.009	5.172**
Between N scoring groups	2	79.267	39.634	1.694
Interaction	4	7.666	1.917	0.082
Error	81	1895.275	23.398	
Total	89	2224.225		

** $p<0.01$

Again the variance was attributable solely to differences in subject groups and not E or N-scale scores. A Duncan's Multiple Range test was completed and it was found that the adult mean reactivity value was significantly greater than both those of the delinquent and non-delinquent groups which did not differ significantly from each other. However, there was a significant interaction between E-scale groups and the subject groups which is illustrated by Figure 2. It is interesting to note that the delinquents and adults showed similar patterns which were opposite to that of the non-delinquent group.

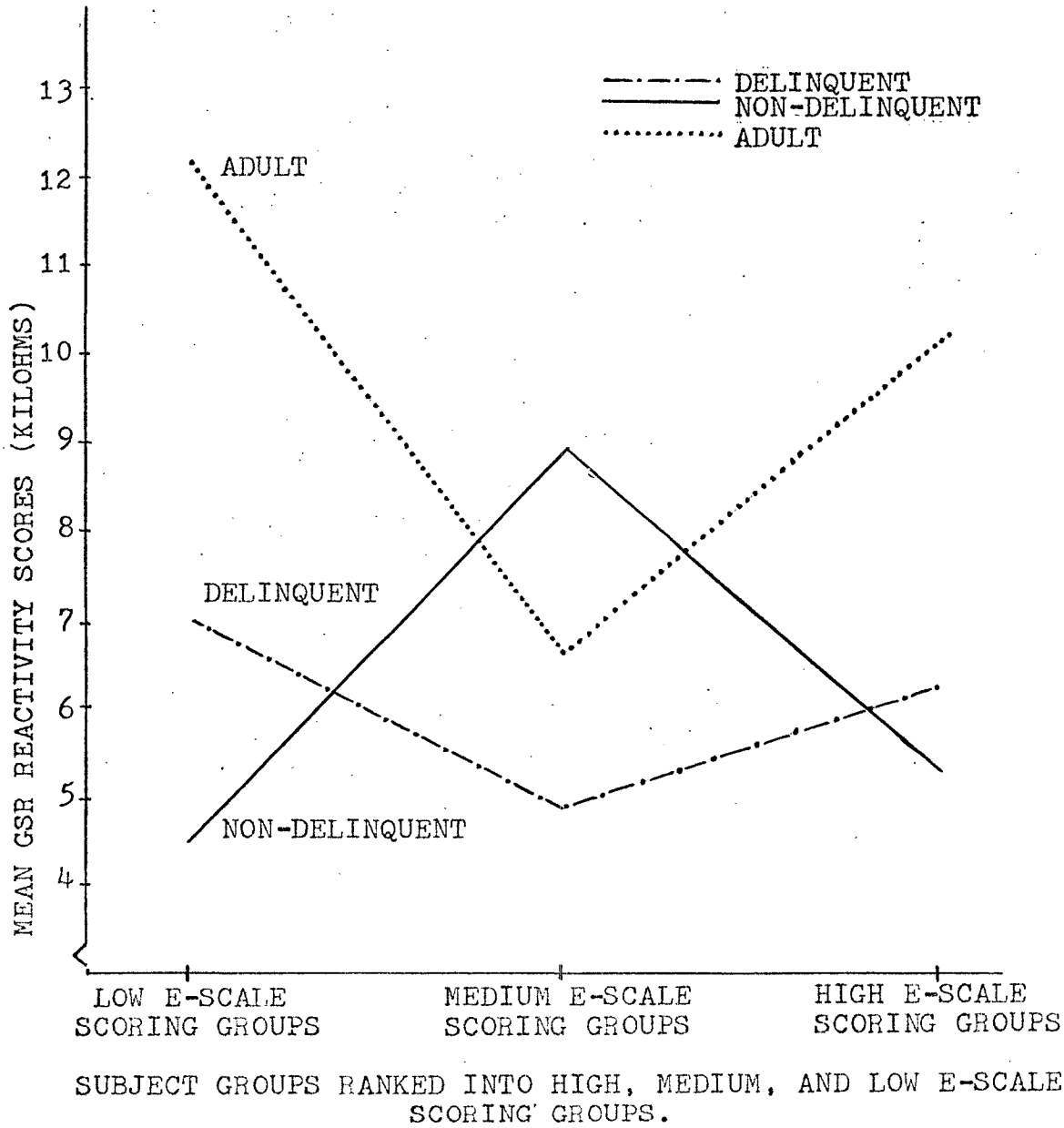


Fig. 2. Comparison of mean GSR reactivity scores of high, medium, and low E-scale scoring groups for delinquent, non-delinquent, and adult subjects.

The reactivity mean values for all groups are presented in Table 14.

Table 14

Mean GSR reactivity scores for high, medium, and low E and N scoring groups in the three subject groups, delinquents, non-delinquents, and adults, (reactivity in kilohms) Total mean GSR reactivity scores across E and N scoring groups and across subject groups.

E scoring groups	Subject groups: Delinquent	Non-delinquent	Adult	Total E scoring means
Low E	7.05	4.50	12.15	7.90
Medium E	4.90	8.90	6.60	6.80
High E	6.25	5.35	10.15	7.25
N scoring groups				**Total N scoring means**
Low N	6.90	6.45	10.30	7.88
Medium N	5.55	7.85	8.55	7.32
High N	5.75	4.45	10.05	6.75
Total subject means	6.07	6.25	9.63	

Two three-way analyses of variance were performed on basal resistance level values and the summaries are given in Tables 15 and 16. Duncan's Multiple Range tests were also completed for the mean basal skin resistance values of the subject and the experimental period groups.

Table 15

Summary of three-way analysis of variance of GSR basal resistance level between delinquent, non-delinquent, and adult groups; high, medium, and low E scoring groups; and experimental periods I,II,III, and IV.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Between Subjects	89	33322.18		
Subject groups	2	10447.56	5223.78	20.15**
E scoring groups	2	348.91	174.455	---
Subject x E scoring	4	1521.94	380.485	1.47
Subject w groups (error (between))	81	21003.77	259.306	
Within Subjects	270	16241.849		
Periods	3	9154.82	3051.607	121.923**
Subject x Periods	6	629.89	104.982	4.194**
E scoring x periods	6	132.57	22.095	---
Subject x E scoring x Periods	12	242.52	20.210	---
P x subject w groups (error (within))	243	6082.05	25.029	

** $p<0.01$

Table 16

Summary of three-way analysis of variance of GSR basal resistance level between delinquent, non-delinquent, and adult groups; high, medium, and low N scoring groups; and experimental periods I,II,III, and IV.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Between Subjects	89	33322.18		
Subject groups	2	10447.56	5223.78	19.03**
N scoring groups	2	276.01	138.01	---
Subject x N scoring	4	369.33	92.33	---
Subject w groups (error (between))	81	22229.28	274.436	
Within Subjects	270	16241.85		
Periods	3	9154.82	3051.61	125.28**
Subject x Periods	6	629.89	104.98	4.31**
N scoring x Periods	6	173.37	28.90	1.19
Subject x N scoring x Periods	12	364.56	30.38	1.25
P x subj w groups (error (within))	243	5919.21	24.36	

** $p<0.01$

Significant differences between subject groups ($p<0.01$) and experimental periods ($p<0.01$) accounted for the variance as well as a significant interaction between these two factors ($p<0.01$). All experimental period mean basal resistance levels with the exception of those of Periods III and IV were significantly different from each other, with Period I having the highest mean resistance level followed by Period II and then Period IV and III. The three subject group mean basal resistance levels differed significantly, with the adult group having the highest mean basal resistance level followed by the non-delinquents and then the delinquents who had the lowest mean resistance level. Basal resistance mean levels are shown for subject groups and experimental periods in Table 17. Figure 3 compares the mean basal resistance levels of the three subject groups for each 30 second interval (period IV -40 second intervals) throughout periods I,II, and III.

These results fail to support either hypotheses relating Extraversion-Introversion to the GSR indices or Neuroticism to these autonomic measures. Significant differences were found in some of the GSR indices between the delinquent, non-delinquent, and adult groups.

Table 17

Mean GSR basal resistance levels (kilohms) for delinquent, non-delinquent, and adult groups in the experimental periods I,II,III, and IV.
Total mean GSR basal resistance levels across experimental periods and across subject groups.

	Periods				
Subject groups	I	II	III	IV	Total subject
Delinquent	28.47	21.92	16.99	16.93	21.08
Non-delinquent	32.09	28.34	23.07	23.53	26.76
Adult	43.76	37.44	27.78	27.97	34.23
Total periods	34.74	29.24	22.61	22.81	

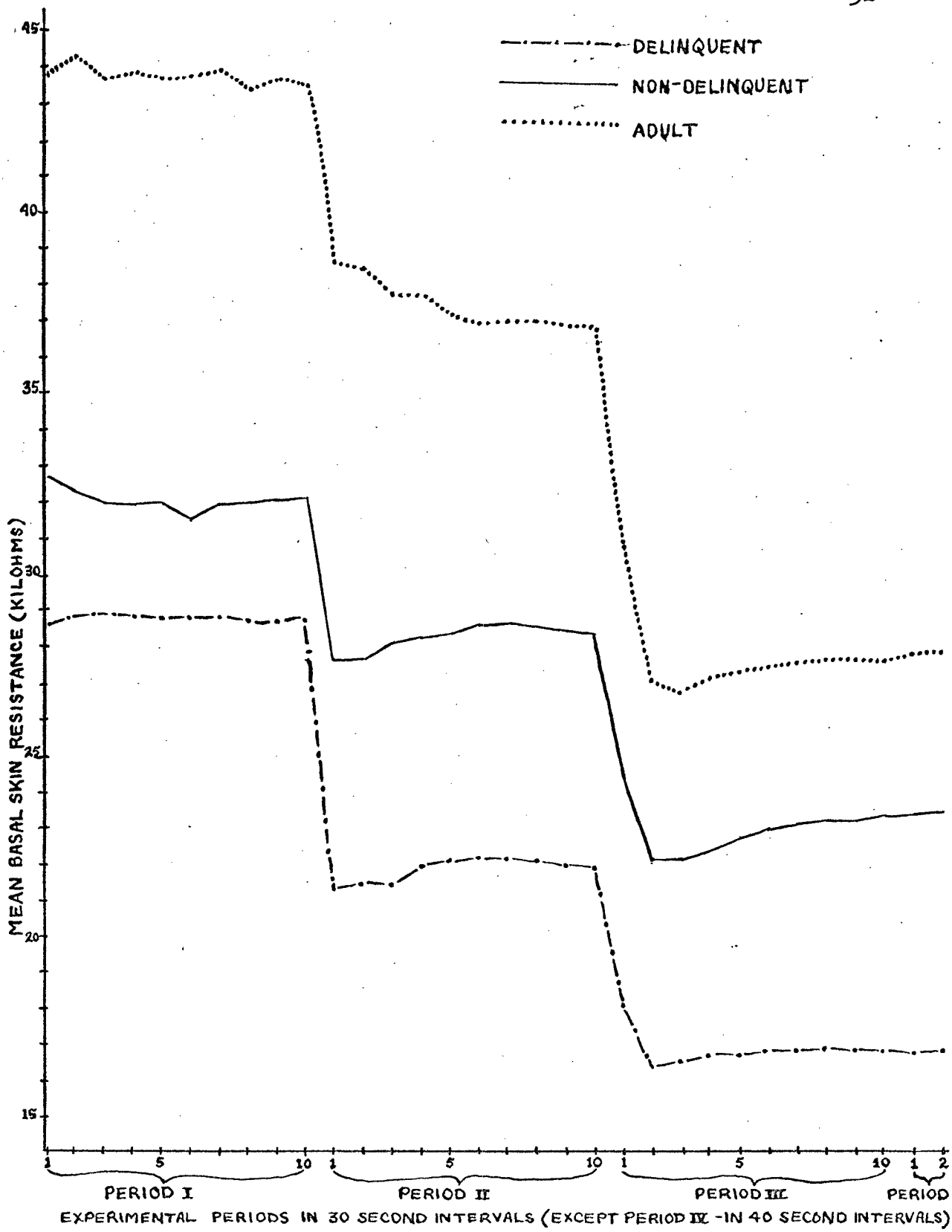


Figure 3. Comparison of mean estimated basal skin resistance levels of delinquent, non-delinquent, and adult groups for the experimental periods I,II,III, and IV.

CHAPTER IV

DISCUSSION

Several explanations might be advanced to explain the results of the questionnaire study of Part A. As suggested in the introduction, institutionalized subjects whose social life is rather restricted may well tend to answer negatively or in a more introverted manner, items high on the sociability factor. This should result in depressed E-scale scores since the MPI is highly weighted on such sociability items. This brings up the question of unidimensionality of extraversion-introversion also discussed in the introduction. It is possible that this delinquent group would score higher on E as hypothesized, if the inventory employed were more heavily weighted on items related to the factor, impulsivity, rather than sociability as is the case with the MPI, the inventory used in this study.

Comparison of the E and N scale mean scores for the Part A study with other samples indicated that the two adolescent groups were more extraverted than normal adult females, neurotic female patients, and male recidivist prisoners; more neurotic than the normal female sample, and the female students; and as neurotic as male recidivist prisoners. These

findings strongly support the suggestion that adolescent groups should only be compared with each other and not with adult groups, especially on the E-scale. If the delinquent group had been compared only with adult groups, the hypothesis of Part A would have been supported as the delinquents would have been shown to be as neurotic as female neurotic patients and as extraverted and neurotic as hospitalized psychopaths.

It might be possible that the two adolescent groups are basically or originally alike except that one group was apprehended and institutionalized and as a consequence became more introverted and neurotic.

The reports of consistently significant negative correlations between E and N which tend to be higher for more neurotic groups (Jensen, 1958) could be used to explain the depressed E-scale score of the delinquent group were it not for the fact that the correlation of E and N for the non-delinquent group was greater than that for the delinquent group.

However, Jensen's description of the effect of a "social desirability" factor which might account for this persistent correlation is quite probably applicable to the delinquent group. He states, "Subjects who have less self esteem or are less concerned with making a good impression may score higher in introversion (as well as in neuroticism) if more of the introverted than extraverted items have socially less desirable or less self-flattering connotations. Thus,

more neurotic subjects, such as hospitalized neurotics and prisoners, whose self esteem is at a low ebb and who have little incentive to create a 'good' impression in an institutional setting, would be less apt to favour the items that create the most favorable self-picture." (Jensen, 1958, p. 322).

A somewhat similar idea was tested by Blackburn (1965) who gave neurotic patients the MPI and a repression-sensitization scale which is a measure of denial-admission. He concluded that the N-scale of the MPI is "weighted against those who readily admit undesirable symptoms or traits." Delinquents, who have less reason to deny or minimize deviant personality features since they are the ones who have been "caught", would, as a result, score higher on the N-scale than non-delinquents who would wish to present a more favourable impression. Support for this explanation is found in a study by Monachesi (Hathaway & Monachesi, 1953) who, by using the MMPI, discovered that delinquent girls did not "cover up" as much and were not as defensive as non-delinquent girls. Radcliffe (1966) found that upon being instructed to "fake" the MPI to create a good impression, students portrayed themselves as being extraverted and "non-anxious-neurotic".

The finding that "liars" tend to be "normal" on the MPI while honest subjects are "neurotic" also tends to uphold these hypotheses. The Lie-scale of the MPI has been shown to have a negative but non-linear correlation with the N-scale

(Gibson, 1962). Although this relationship was found to hold only with higher Lie-scale scores in the samples Gibson studied, it is a factor which might contribute to the elevation of delinquent N-scale scores as the delinquents obtained a significantly lower mean Lie-scale score than the non-delinquents.

Franks, Holden, & Phillips (1961) raised objections to the use of self-rating inventories in abnormal populations on the basis of their results which indicated discrepancies between self-ratings and measures by external raters for such populations but not for a normal group. The findings cast doubt on the validity of the MPI as a test designed to provide objective measures of behavioural characteristics.

A question which must be considered in any experiment using only one autonomic response even though it may be measured simultaneously by different indices, is whether that modality is representative of the subject's general "activity" or "arousal". A subject may characteristically respond more strongly in another modality (Oken et al., 1962). Duffy (1957) however, contends that, "An individual who responds with intensity in one situation will on the average respond with intensity in other situations." He maintains that the degree of responding may vary but the rank order in "arousal" is preserved. In any case, other autonomic measures might be more closely related to N or E than GSR is reputed to be.

Factors in the experimental situation which were

impossible to contrd given the apparatus and groups, may have had a great effect on the results. For example, because the experimenter had to be able to see the memory drum to activate the auditory signal at the proper syllable, the subjects were not observed sufficiently to eliminate deflections in GSR caused by movement. Temperature and humidity should be controlled in GSR experiments. Venables (1955) showed a relationship between temperature above 66°F and GSR (expressed as the percentage change in conductance) only in a neurotic group of subjects. He also obtained evidence that humidity affected the basal conductance level in both normal and neurotic groups. The temperature during the testing sessions with the delinquents was sufficiently high to necessitate the window of the room remaining open even though this caused distractions for the subjects. However, no relationship between neuroticism and any GSR measure was indicated by the data.

Mundy-Castle & McKiever (1953) found a significant association between GSR and age, young people showing greater variability than older subjects. As indicated in the introduction, a relationship has been demonstrated to exist between age and a decrease in the number of active digital sweat glands (Ferreira & Winter, 1965). This suggests that adults should exhibit a higher basal skin resistance level than the younger subjects. Differences found to be significant between the adult group and adolescent groups in GSR basal resistance level and variability scores could thus be explained in terms

of age. The fact that adults also display a great reactivity to stimulus could be a result of the high positive correlation between reactivity and basal resistance level which repeatedly has been demonstrated (Martin, 1960a).

From the Part B study, one must conclude that the three groups of subjects do differ significantly in one or more GSR indices. It remains to find the reason for these differences in autonomic response, to what personality factors they are related or of which predictive. It has been demonstrated not only in this study but in others as discussed in the introduction, that the various suggested GSR patterns do not consistently correlate with neuroticism or extraversion-introversion as measured by the MPI. Future experimentation using the following suggestions might yield more significant results.

A measure of the impulsivity factor of the dimension, extraversion-introversion might yield a more significant correlation with the GSR indices.

From results of studies using it as a measure (Eysenck, S.B.G., 1956; Lippert and Senter, 1966), GSR recovery in post-stimulus periods should be considered a potential index to demonstrate differences in autonomic functioning between ansious or neurotic subjects and non-anxious subjects. According to their data which is based on different GSR measures, neurotics return more slowly to a pre-stimulus level of arousal or rate of spontaneous GSR emission.

Mundy-Castle & McKiever (1953) suggested a similar hypothesis relating GSR adaptation rate and a "temperamental factor underlying differences in excitatory/inhibitory balance". Johnson (1963) and Koepke & Pribram (1966) both explored this possibility and found that labiles (subjects with high variability scores) did not adapt to the stimulus as readily as stabiles (subjects obtaining low variability scores). A cursory inspection of the experimental Periods III and IV in Figure 3 yields the possibility of predicting a slower rate of recovery or adaptation for the delinquent group who proved to be significantly more neurotic and also to have the highest mean variability score of the three groups.

An hypothesis was advanced earlier in this discussion that delinquents as a group are less defensive or less inclined to use denial on questionnaires. According to Wilson & Dykman (1960), variability and reactivity may be more highly correlated with defensiveness as measured by the K-scale of the MMPI, than with anxiety. Acceptance of these results would yield the prediction that delinquents should obtain a lower mean variability score. The data of this study indicated the opposite to be true. However, delinquents did obtain a lower mean GSR reactivity score than non-delinquents.

CHAPTER V

SUMMARY

This study was designed to test several hypotheses based on theories of Eysenck which he advanced in creating his stratified system of causally related levels. Part A tested his prediction that two major dimensions of personality, extraversion-introversion and neuroticism, because of their origin in constitutional factors, must be present in different amounts in subjects who exhibit abnormal behaviour patterns such as delinquency, than in those subjects who are considered normal, or non-delinquent. The hypotheses tested in Part B related "objectively observable primary personality traits" of one of Eysenck's levels with the "physiologically determined" level. These were measured by the E and N-scale scores of the Maudsley Personality Inventory and three indices of Galvanic Skin Response, variability (rate of spontaneous fluctuations), reactivity to an auditory stimulus, and basal skin resistance levels during various experimental conditions. Three groups of subjects were tested in Part B, delinquent, adolescent girls; non-delinquent, adolescent girls; and adult females.

The hypotheses were as follows:

Part A: Delinquent adolescent females are on the average, more extraverted and neurotic than non-delinquent

girls of a similar age.

Part B: Extraverted individuals, as compared with introverts, exhibit the following GSR pattern: lower mean reactivity, higher mean basal skin resistance levels, and lower mean variability scores.

Neurotic individuals, as compared with normals, display the following GSR pattern: higher mean reactivity, lower mean basal skin resistance levels, higher mean variability scores.

Delinquent and Non-delinquent groups were tested with the MPI in Part A of this study with the criteria for delinquency being committal to an Ontario Training School. Their mean E and N-scale scores were found to differ significantly but not entirely as predicted by the hypothesis. Delinquents were found to be more neurotic but less extraverted than non-delinquents. The two adolescent groups were compared with various adult groups of normal females, patients, and prisoners and it was concluded that adolescent groups should be compared with each other rather than with adults especially on the E-scale of the MPI as there is an age factor affecting responses on this scale.

Several possible explanations for these results were suggested. For example, the heavy loading on the E-scale of the MPI of "sociability" items which cannot apply equally to institutionalized and non-institutionalized subjects tends to depress the E-scale of the delinquent group. Another

explanation was that delinquents are less defensive and more ready to admit having undesirable symptoms than non-delinquents. This lack of denial correlates with higher N-scale scores of a self-rating inventory such as the MPI.

Data of Part B study does not support either hypotheses. No significant relationships were found between high scores on either the E or N-scale of the MPI and GSR measures. Generally speaking, adults scored lower on the variability score, exhibited greater reactivity, and higher basal resistance levels than non-delinquents who in turn scored higher on the average on the latter two indices and lower on the variability measure than delinquents. Several of these differences were not significant but enough were significant to allow the conclusion that these three groups tend to display different GSR patterns. One can only speculate about the reasons for these differences in terms of personality factors and their relationships to autonomic measures. Age may be a factor in explaining the differences found between the adults and the two adolescent groups.

It was suggested that defensiveness might correlate with the GSR measures used in this study more significantly than extraversion-introversion and neuroticism, and that other GSR indices, such as rate of GSR recovery in post-stimulus periods and GSR adaptation rate to stimulus, might be more closely related to E and N than perhaps the three GSR measures selected for this study.

APPENDIX A

Mean Values and Standard Deviations for Age, Time Institutionalized, and MPI Scale Scores for Various Delinquent and Non-delinquent Groups.

These groups include the following:

GSR: Delinquent and non-delinquent experimental groups of Part B.

R&DC: Newly committed delinquent girls and girls under psychiatric treatment.

Galt: Delinquent girls enroled in the occupational and auxillary courses.

Lindsay: Delinquent girls enroled in the arts and science or commercial courses.

Experimental: Non-delinquent girls tested individually and used as subjects in another GSR study.

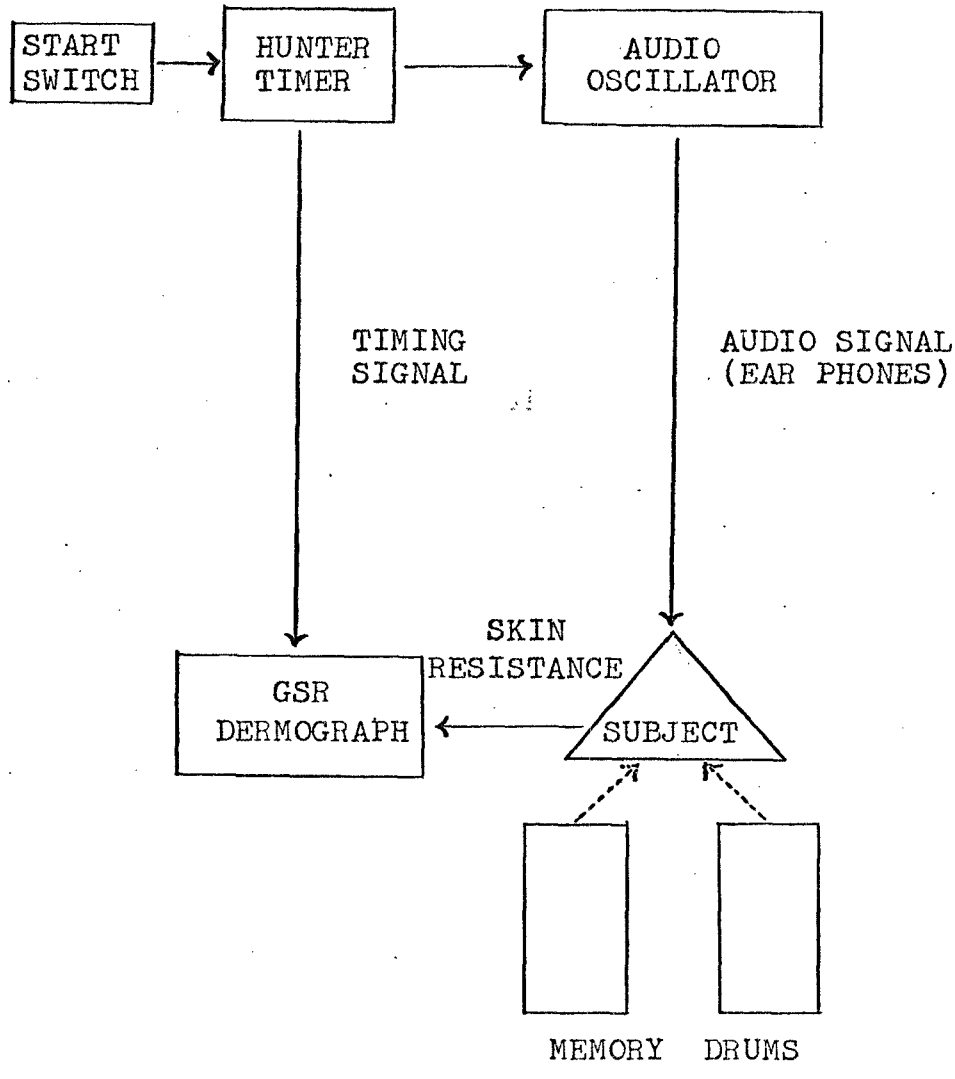
Guppy: Non-delinquent girls enroled in commercial courses.

Herman-Forester: Non-delinquent girls enroled in general Grade 9 courses.

Subjects	Time Institutionalized (Months) M	SD	Age (Years) M	SD	Lie-Scale M	SD	E-Scale M	SD	N-Scale M	SD
DELINQUENTS										
GSR (N = 30)	9.51	6.14	14.80	0.87	3.67	2.47	29.00	8.01	34.07	9.20
R&DC (N = 22)	15.81	15.75	15.09	1.27	5.50	3.45	26.32	9.95	29.59	11.35
Galt (N = 75)	8.21	8.38	15.31	0.86	4.76	2.33	25.95	7.35	34.03	8.70
Lindsay (N = 84)	10.64	6.06	14.96	0.94	3.35	2.56	28.76	8.43	34.89	9.24
NON-DELINQUENTS										
GSR (N = 30)			14.67	1.30	4.73	2.54	30.43	8.15	23.43	9.00
Experimental (N = 54)			14.81	1.07	4.44	2.70	28.50	9.22	31.26	11.22
Guppy (N = 149)			15.26	1.10	5.36	3.09	30.89	7.53	28.38	10.91
Herman-Forester (N = 97)			14.80	0.86	4.86	2.79	28.00	7.52	30.68	9.13

APPENDIX B

Schematic Diagram of the GSR Apparatus



APPENDIX C

Instructions for GSR Procedure of Part B

This is an experiment dealing with relaxation while a simple spelling task is being performed. Two wires will be attached to two fingers of your left hand to measure your state of relaxation. Occasionally you will hear a sound through these earphones which I shall place on your head before the experiment begins. From your reaction to the sound your state of relaxation can be determined. Please leave the wires and the earphones on throughout the experiment. Rest your arms on the table and try to keep from moving about.

The experimental procedure is as follows:

1. Every few seconds a different three-letter syllable will appear in the opening of this apparatus.
2. Your task is to spell out loud each of these syllables as soon as they appear, for example, "G...E...D."
3. Part of the way through the experiment, I shall ask you to switch to this apparatus, continuing to spell the syllables.
4. It does not matter if you make a mistake in spelling. Do not correct it, just go on to the next syllable.

5. Wait until I say, "Begin", before you start spelling the first syllable.

Remember, it is very important that you keep as still as you can throughout the experiment.

Are there any questions?

APPENDIX D

Ages, Grade (Non-delinquent), Time Institutionalized (Delinquents Only), and Three MPI Scale Scores for Delinquents, Non-delinquents, and Adults of Part B

Subj. No.	Age(Years) D	ND	A	Grade ND	Time Inst. (Months) D	Lie-scale D	ND	A	E-scale D	ND	A	N-scale D	ND	A
1	13	16	34	10	11.50	4	5	8	39	23	24	44	20	11
2	16	14	29	11	14.00	5	4	2	28	26	37	43	25	2
3	15	16	23	11	13.50	4	1	1	38	33	32	34	34	28
4	15	16	21	12	19.00	2	3	3	28	19	17	36	41	43
5	15	15	22	12	5.75	2	2	2	26	32	28	40	15	35
6	15	17	36	11	3.50	7	7	4	42	39	33	16	14	29
7	15	15	27	10	0.75	8	6	2	34	38	27	14	13	18
8	14	15	26	9	10.00	9	2	6	8	7	30	34	44	30
9	14	15	21	9	0.75	2	5	3	26	33	30	34	25	34
10	14	14	22	8	10.00	7	0	1	28	40	13	34	18	42
11	15	15	32	9	3.00	1	6	7	35	36	28	36	11	30
12	14	13	53	8	1.50	5	5	4	36	25	16	38	30	23
13	14	13	34	8	2.00	5	3	5	16	23	36	14	33	22
14	15	14	22	9	10.00	5	4	6	31	27	20	36	17	8
15	15	15	22	9	4.00	5	4	7	24	39	32	44	6	20
16	16	15	50	10	13.00	2	9	5	28	44	24	42	27	18
17	16	15	25	10	9.00	0	2	6	34	37	31	42	32	37
18	14	16	22	10	8.00	4	6	7	6	24	37	31	34	26
19	14	14	45	8	14.00	0	8	5	27	38	40	36	32	12
20	16	13	27	8	15.00	0	7	2	27	33	27	26	12	37
21	14	14	27	11	20.00	1	8	0	32	27	20	44	24	35
22	15	14	24	7	13.50	5	2	6	31	28	12	16	28	16
23	15	14	22	8	23.00	2	2	8	39	33	32	25	22	29
24	16	14	21	8	17.00	2	5	9	25	25	38	48	10	14
25	16	12	23	8	18.00	5	8	5	35	30	10	27	19	36
26	13	13	33	8	3.00	1	3	7	31	39	40	38	24	6
27	15	13	22	8	6.00	4	2	4	32	41	32	37	30	23
28	14	16	23	10	5.00	3	9	6	27	32	14	39	21	19
29	15	17	24	10	5.50	2	5	2	23	26	30	42	18	12
30	16	17	21	11	6.00	8	9	1	34	16	36	32	24	17

APPENDIX E

GSR Variability Scores, Mean Basal Skin Resistance Levels for Periods I,II,II, and IV, and GSR Reactivity Values for Delinquents of Part B

	Mean Basal Skin Resistance (Kilohms) Experimental Periods				(Kilohms)
Var.	I	II	III	IV	Reactivity
18	49.20	38.05	25.75	25.50	13.5
8	23.30	17.20	12.45	12.50	5.0
6	25.80	19.60	15.80	15.25	6.0
5	24.55	16.00	15.35	15.50	2.0
15	42.75	28.95	22.00	22.00	7.5
8	26.30	23.40	17.95	17.50	5.5
19	26.60	27.55	22.95	23.00	6.0
9	34.85	21.50	13.80	13.00	8.0
11	31.40	29.00	24.70	24.50	7.5
6	66.00	36.20	23.10	21.75	11.5
6	22.80	18.95	15.30	15.50	3.5
15	23.60	17.15	15.00	15.50	5.0
8	30.60	27.85	22.40	23.00	5.0
9	24.30	16.65	15.25	15.25	4.0
1	26.75	24.30	21.50	21.00	4.0
13	18.35	15.55	15.05	15.00	1.5
0	10.65	10.35	10.50	10.50	0.5
4	32.75	28.10	16.20	15.75	12.0
2	26.60	16.50	13,50	13.75	5.5
12	21.35	15.80	14.80	14.75	2.0
10	22.85	15.85	15.00	15.25	1.0
0	17.95	13.60	8.45	8.50	4.5
6	21.65	17.60	13.00	13.00	4.5
3	28.50	25.90	16.40	16.00	11.5
12	39.95	31.85	18.70	18.25	14.5
11	30.85	26.25	22.75	23.00	7.5
15	28.00	20.45	14.85	15.25	6.5
3	22.30	21.50	15.90	15.75	8.0
2	29.65	21.05	19.90	21.00	5.0
11	23.75	15.15	11.50	11.50	3.5

APPENDIX F

GSR Variability Scores, Mean Basal Skin Resistance Levels for Periods I,II,III, and IV, and GSR Reactivity Values for Non-delinquents of Part B

	Mean Basal Skin Resistance (Kilohms) Experimental Periods				
Var.	I	II	III	IV	Reactivity (Kilohms)
7	30.05	26.05	24.00	24.50	1.5
1	34.45	32.30	26.60	28.50	9.5
11	15.25	13.70	13.25	14.25	3.0
5	15.80	14.15	12.80	13.50	4.5
1	37.85	24.55	23.05	24.25	8.5
7	30.50	28.85	24.70	25.50	8.5
11	28.30	27.75	25.70	26.00	9.5
6	25.80	23.15	20.50	20.50	4.0
2	50.25	46.90	35.60	37.00	15.5
2	41.35	24.45	25.15	26.00	2.5
0	33.10	30.00	23.40	24.50	13.5
3	30.70	19.80	18.15	18.00	2.5
6	31.10	26.05	23.45	23.50	7.5
15	49.70	40.50	31.45	31.50	7.5
10	29.35	25.85	22.95	22.50	3.5
18	31.50	21.95	23.25	25.00	1.5
8	28.05	25.45	21.90	22.50	6.5
2	28.95	26.95	21.70	23.00	6.5
4	45.30	45.50	32.15	31.50	2.0
8	27.85	27.85	25.80	26.25	5.0
6	30.50	19.85	19.00	19.25	5.5
16	30.05	21.85	20.90	21.50	5.0
2	56.70	55.35	36.00	35.50	20.0
16	16.65	14.90	13.30	13.50	4.0
2	19.10	17.45	14.30	15.00	4.0
13	32.95	24.85	22.90	23.25	3.0
3	44.20	62.00	28.25	29.50	3.0
2	38.45	36.30	24.85	24.00	15.0
2	33.45	33.65	28.35	27.50	2.0
7	15.55	12.35	8.55	8.50	3.0

APPENDIX G

GSR Variability Scores, Mean Basal Skin Resistance Levels for Periods I,II,III, and IV, and GSR Reactivity Values for Adults of Part B

	Mean Basal Skin Resistance (Kilohms) Experimental Periods				
Var.	I	II	III	IV	Reactivity (Kilohms)
10	53.60	50.80	40.70	42.00	13.5
1	55.80	53.70	42.35	42.50	13.5
4	38.60	29.00	28.50	29.00	5.0
5	48.25	47.95	32.75	33.00	20.5
3	48.50	43.40	40.20	42.50	7.0
2	49.80	49.55	32.75	34.50	15.0
15	51.15	37.70	37.05	37.75	4.5
6	71.90	47.90	31.35	31.00	14.5
6	29.10	18.45	18.30	18.50	2.5
5	72.50	60.70	33.10	33.50	28.0
1	37.80	28.55	27.80	28.00	2.5
4	43.85	38.95	30.85	32.00	11.5
6	35.25	34.75	33.90	35.00	6.5
1	47.15	34.85	22.20	22.50	10.5
0	36.50	36.10	26.45	26.75	9.0
9	51.35	40.75	28.90	28.50	13.5
2	28.35	26.95	21.15	21.75	7.5
4	31.60	28.90	19.95	19.50	9.0
1	26.85	21.40	14.70	14.25	6.0
7	42.50	28.05	22.55	21.25	4.5
7	26.70	24.95	21.40	22.25	6.0
3	20.55	18.15	15.45	16.00	3.5
6	37.00	35.10	23.80	23.00	11.5
20	59.95	51.40	33.55	33.00	20.5
0	45.15	45.00	30.95	32.00	7.5
1	56.30	63.50	34.50	30.50	8.5
3	27.85	26.75	23.35	24.00	6.5
13	27.25	23.85	16.85	16.50	7.0
4	31.65	30.70	26.25	26.50	5.0
7	79.85	45.45	21.65	21.50	8.5

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