SPATIAL ABILITY AND CRIMINALITY

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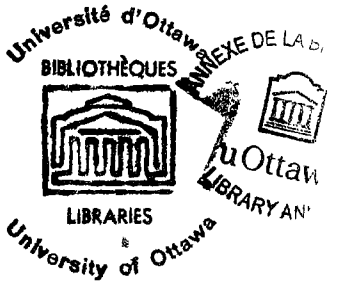

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INTRODUCTION

Eysenck postulated that criminality is a function of the kind and amount of conditioning a person is exposed to in the early years of his life. The conditioning is received through the interaction of the child with his parents, teachers and peers. This conditioning essentially determines whether a person will act in a law-abiding fashion.

A review of the literature suggests that there is a lack of support for Eysenck's contention. The reason is claimed to be the result of the use of inappropriate instruments to measure conditionability. In view of this controversy, this study proposes to use a measure of spatial ability, obtained from the Prognostic Test of Mechanical Abilities, as an index of conditionability. In addition, Willcock's self-report scale as revised by Gibson is used as a measure of criminality. Following this, the general hypothesis to be tested is: Spatial ability is a good predictor of criminality. Included with these two instruments are three control variables--age, sex and Shipley's abstract thinking test.

Chapter I reviews the literature on Eysenck's theory of criminality, spatial ability and conditionability, and self-report criminality, giving the basis and rationale

for the hypothesis tested in this study. The methodology is presented in Chapter II. The presentation of results and conclusions are contained in Chapter III. The Appendix, containing the instruments used and the data collected in tabulated form, completes the thesis.

CHAPTER I

Criminality and Conditionability

Eysenck (14) used a conditioning model in order to explain why individuals do not commit crimes. He suggested that socialized behaviour was essentially conditioned behaviour with the conditioning applied during a person's childhood by his parents, peers and teachers. The individual's conduct in later years, he contended, is very much determined by the quality of the conditioning received in the early stages of his life, with the strength of the conditioning dependent upon a) the conditionability of the subject and b) the exposure to the kind and amount of conditioning received.

Eysenck's (14) theoretical argument is that personality is made up of two orthogonal components--extroversion-introversion and emotional stability-instability--which are affected differently by the process of conditioning. Eysenck (14) defines the extrovert as one who is more outgoing, active and sociable. The introvert, on the other hand, keeps more to himself and is less active. The emotionally unstable person is characterized by excessive anxiety and worry, while the emotionally stable person exhibits less anxiety and worry. According to Eysenck (14) offenders are more extroverted and neurotic

than non-offenders.

Eysenck (14) postulated that there is a relationship between the personality attribute of extroversion and Pavlov's notion of cortical fatigue (cortical inhibition). Pavlov in his classical experiments on conditioning found that there was a differential response to conditioning among his subjects (14). Pavlov attributed this reaction to cortical fatigue or inhibition, which builds up during conditioning trials and dissipates with rest. The essential function of this inhibition process is to counteract excitation. The concept of excitation refers to

> . . . some incoming stimulus that has succeeded in firing the neurons which link the sensory surfaces to the cortex and that this now stimulated neuron passes on its excitation to other neurons through a system of links, or synapses . . . which connect the different neurons throughout the body (14, p. 80).

Eysenck (14) believes that extroverts build up cortical fatigue more quickly than introverts.

As extroverts, Eysenck (14) claimed, build up cortical inhibition more rapidly, they are less affected by the stimulation experienced. Consequently they will be more difficult to condition than introverts. Hence extroverts and introverts who are raised in similar environments will differ in their degree of socialization. If the

internalization of norms is thought of as a conditioning process, introverts would be found to internalize the norms to a greater extent than extroverts.

Eysenck's (14) position is that the internalization of norms is a conditioned reflex and since extroverts condition poorly, they have not been adequately socialized. The poor conditionability of the extrovert, Eysenck suggests, is because time passes more slowly for the extroverts than for the introverted. Hence they become easily bored and seek frequent and rapid change in stimulation (including excitement). Just the effect of conditioning stimulation on the individual affects the individual's degree of internalization of norms. This influence expresses itself in the individual's degree of conformity to rules.

Eysenck (14), in reality, is propounding a theory of morality. He argues that human beings are generally inclined to behave hedonistically, but that such behaviour is inhibited by a system of conditioned responses commonly called 'conscience'. Eysenck (14) considers that conscience develops from socialization, which is essentially a process of conditioning. Behaviour, according to this theory is a necessary conditioned reflex. Faced with the choice of law-abiding or law breaking behaviour, the path the

individual will choose, according to this theory, is dependent on the strength of prior conditioning. This is based upon the strength of the conditioned response and the assumption of the consistency of individual behavioural patterns. The consistency of individual behavioural patterns makes it possible to predict that when an individual is exposed to tempting unlawful acts and refuses to engage in them, he would also in the future continue to display such behaviour. However, as the same situation seldom, if ever, occurs twice, the concept of stimulus generalization must be evoked to account for the process that keeps people indulging only in lawful behaviour. This process, it can be expected, produces a fairly general reaction of fear and autonomic unpleasure which becomes associated with all antisocial activities.

In 1972 Passingham (27) reviewed the literature on Eysenck's theory and found little evidence in support of it. Most of the studies had used inappropriate scales or scales of small practical importance to test the theory upon groups with only trivial differences between them. During this period most of the evidence against the theory came from studies using Eysenck's own tests. Since then, however, more tests have been conducted. In 1972 Burgess (6) compared an experimental group of 29 inmates from a maximum

security penitentiary in British Columbia with a control group of laboratory assistants, hospital orderlies and students from a summer school and found the criminals to be both more extroverted and more neurotic. In a second study he compared a group of 26 inmate volunteers from the Pentonville prison, an institution for short term recidivists, with a group of 41 volunteers from Grendon Underwood Prison, an institution oriented towards the treatment of inmates with behavioural disorders and with a control group of 82 employees of British Rail. The study gave support to the hypothesis that criminals were more extroverted and more neurotic. In a third study, in which the experimental group was 62 consecutive admissions to Oxford Prison serving a term of at least two years, and the control group was 74 normal individuals, further support for the hypothesis was forthcoming. As a result of his studies, Burgess (6) contended that one of the main drawbacks in the testing of Eysenck's theory was that the wrong null hypothesis was being tested. He contends

> What is tested is an indirect inference that if one looks at criminals, they should have higher mean scores on Extroversion and Neuroticism and this would only follow from the theory if a) no factors apart from those suggested by Eysenck were conducive to the development of criminality and therefore most criminals could be expected to be neurotic extroverts; b) if

> most individuals who were neurotic extroverts, and therefore presumably under socialized, tended to end up as convicted criminals. Eysenck would clearly not support either of these propositions, and so evidence based on the means and variances of populations cannot be considered as offering a crucial test of what the theory really predicts (6, p. 75).

He went on to say "that only an analysis of the distributions with respect to criminality of the individuals simultaneously high on both dimensions can be so considered" (6, p. 76). With the argument that group mean data is not a fair test of the theory one must concede that the theory is far less general in its application than is sometimes thought. However, the actual proportion of criminal behaviour accounted for by Eysenck's theory must remain problematical. Burgess (6) concluded that in future studies, he hopes that extroversion becomes of minimal importance and that the neuroticism dimension offers the most promising solution to the problem of criminal behaviour.

Buikhuisen and Hemmel (4) compared two experimental groups, 105 convicted of drunk driving and 50 economic offenders, with two control groups, 102 in control group for drunk driving offenders and 46 in control group for economic offenders. They chose specific offenders because they believe that the concept of delinquency is too broad. It produces too heterogeneous a group for meaningful testing

of the theory because of the possibility that Eysenck's theory could explain the behaviour of some types of offenders and not others. They relied on an operant conditioning paradigm in which verbal statements were used as reinforcers to make subjects respond in a specific manner. Their results confirmed the hypothesis that delinquents are more extroverted than non-delinquents, but failed to support the theory under the areas of 'conditioning and extroversion' and 'delinquency and conditionability'.

Eysenck (15) pointed out that Buikhuisen and Hemmel's (4) study tested a theory of criminality, which deals with classical conditioning, with a paradigm of verbal operant conditioning and suggested that this may not have been a proper test. Eysenck (15) also pointed out that it was vital, in experiments such as that reported by Buikhuisen and Hemmel (4) that the researcher(s) ascertain the degree of awareness in the subject. In addition they should run correlations or make group comparisons only for homogeneous groups of aware or unaware subjects. Eysenck (15) contended that

> . . .in view of the greater sociability of extroverts, and their likely greater tendency to please other persons, one might expect them to play up to the assumed wishes of the experimenter and

> "condition" better (i.e. consciously give the expected responses) (p. 184).

Throwing together both the aware and the unaware subjects, almost ensures that the results would be impossible to interpret and unlikely to be statistically significant.

Buikhuisen and Hemmel (5), however, maintain their results could not confirm Eysenck's hypothesis regarding the relationship between crime and operant conditioning, even if the criticisms were valid.

Eysenck and Eysenck (16) conducted a study on 603 prisoners (experimental group) from four prisons in England. The subjects were all male, with a mean age of 22.1 years and the majority coming from the working class; they had three control groups. Control group I was composed of 532 male non-prisoners, predominantly working class, who were selected in the course of an investigation of the relation between personality and sport in children. Their mean age was 44.6. Control group II was composed of 422 university students whose mean age was 22. Control group III was composed of 185 industrial apprentices, whose mean age was 17.9. The prediction tested was that the prisoners would differ from the control groups with respect to three personality variables: psychoticism, extroversion and neuroticism. Their results strongly supported the

hypothesis that prisoners have a higher psychoticism score than the controls; moderately supported the hypothesis that prisoners would have higher neuroticism scores; and weakly supported the hypothesis that prisoners would have higher extroversion scores. Their results are in accord with those of Burgess (6) and favour Burgess's (6) suggestion that the neuroticism dimension is the most promising in our understanding of criminality.

Black (2) examined, in a review of the empirical evidence obtained from studies carried out principally in Britain, Australia and New Zealand, Eysenck's statement that criminals and neurotics tend to have high neuroticism scores and to be respectively extroverted and introverted (14). Black (2) concluded that this hypothesis is not adequately supported by the studies he reviewed. However, he suggested there is evidence, on the whole, that psychopaths may be extroverted neurotics.

Hoghughi and Forrest (23) reviewed several studies that are applicable to Eysenck's theory of criminality. They concluded that persistent young offenders are significantly more introverted than normative samples or selected control groups. They suggested that the hypothesized tendency of offenders to be greater on the extroversion dimension is the cornerstone of Eysenck's theory.

As the experimental evidence supported the theoretical position inverse to Eysenck's, they concluded that Eysenck's theory of criminality has been falsified. However, the results of the studies of Burgess (6), of Buikhuisen and Hemmel (4), and of Eysenck and Eysenck (16), do not support the conclusion of Hoghughi and Forrest (23).

Passingham (26), Burgess (6) and Buikhuisen and Hemmel (4) suggested that the applicability of Eysenck's theory needs to be modified to those offenders of a selected criminal disposition. There is also the suggestion in the literature that present research on Eysenck's theory is inadequate and advance can only come from improved research design. To this end it may be useful to consider the relationship between spatial ability and conditioning, with the view to using spatial ability as a measure of reactive cortical inhibition.

Spatial Ability and Conditioning

Spatial ability is an ability to perceive or recognize the structure of form of a figure as a whole as opposed to the ability to perceive details (35). Spatial ability thus is the essential ability that is required to form and retain a clear impression of a shape or pattern as a whole (35). Conditionability, is the ability to acquire

and resist extinction of all kinds (14). Poor conditioning produces extroversion (14).

Russell (31) claims that prefrontal leucotomy results in a loss of inhibitions, allowing the formerly inhibited thoughts to range more freely and making the individual concerned extroverted. Petrie (27) found that introverted subjects who had suffered brain damage and had undergone leucotomies made a significant movement from their introverted position to a more extroverted position.

Gelb and Goldstein (18) found that some brain damaged patients were able to perceive the elementary parts and details of an object or structure, but were unable to perceive simple configurations. The brain injury seemed to have destroyed or impaired the ability to perceive a configuration as a whole. Halstead (21) suggested that the differences in performance between a group of normals and a group of brain damaged individuals was quite apparent on measures of spatial ability. The brain damaged group obtained lower scores than the non-brain damaged group. He also suggested that there did not appear to be any relationship between intelligence and spatial ability.

Halpin and Patterson (20) and Halpin (19) reported that individuals with brain damage gave a greater number of breakdowns in gestalt as compared to non-injured persons.

They considered that an inability to integrate patterns was a decisive characteristic of brain-injured people. Cruickshank and his colleagues (8) have concluded that the evidence available points to an association between brain injury and impaired performance on spatial perceptual tasks. Thus there appears to be a relationship between brain injury and subsequent performance on spatial tasks and a shift on the personality continuum toward extroverted behaviour.

Eysenck (14) reported that brain damaged and extroverted individuals condition much less well than 'normal' and introverted individuals, leading to the conclusion that conditionability and spatial ability are positively correlated in individuals of an extroverted nature. Eysenck (14) has also suggested that individuals who are extroverted have a greater tendency to be involved in crime. If this suggestion were correct there will be an inverse relationship between spatial ability and crime. Blum and Garner (3) studied a sample of 79 adjudicated young adult property offenders, released from the Ontario Training Centre, Brampton, a minimum security institution, during a two-year period (1962-64) and found that spatial relations was the second highest predictor of thirteen hypothesized predictors of recidivism. It accounted for 5

percent of the criterion variance. They found that there was an inverse relationship between spatial ability and future criminal involvement

General Hypothesis

According to Eysenck's theory of criminality, socialization is a matter of conditioning. If the appropriate degree of prosocial conditioning is achieved the individual is unlikely to engage in criminal behaviour. Although the notions of conditionability and criminality represent different levels of conceptualization in Eysenck's framework, the central construct of reactive critical inhibition is common to both. The empirical evidence in support of Eysenck's theory of criminality is not convincing which may, in part, be due to inappropriate measures used to estimate an individual's status on the reactive cortical inhibition continuum. On the basis of empirical findings it is proposed here that some measure of spatial visualization might be an appropriate though indirect measure of reactive cortical inhibition. Consequently, it is hypothesized that there is a negative relationship between scores on a spatial relationship test and self-reported criminality. Once a statistically significant association has been established between these, further studies can explore the relevant parameters with the hope of increasing the criterion variance accounted for.

Self-Report Techniques

Crime and criminality have been variously defined. Whatever the definition may have been, there has been a reliance on official records for the identification of criminals and delinquents. Considering them, Erickson and Empey (12) have pointed out that while these offical records might be useful in reflecting the volume of delinquency in a community by distinguishing between those who have been heavily delinquent from those who have not, they

may be reflecting only a tiny though consistently accurate portion of all offences. However, sometime later they themselves questioned the validity of the contention that official records might reflect a tiny but consistently accurate portion of all offences. They discovered that even a moderate increase in the attention paid to delinquencies by law enforcement authorities could create a resemblance of a 'delinquency wave' without there being the slightest change in adolescent behaviour, indicating that it is impossible to estimate from official records the actual amount of delinquent involvement in any one area or district (10). Notwithstanding, in 1972 Erickson (11) reported that although few violations committed by juveniles become a matter of official records, it might be possible that official records reflect in some way the extent and nature of delinquent behaviour within a given area. He concedes, however, that the actual behaviour that becomes a matter of official concern is extremely small.

Official delinquency has been defined in various ways in the literature. Hirschi and Stark (23) defined official delinquency as the count of the number of offences known to the police over a period of time. Williams and Gold (39) defined official delinquency as the identification of and response to delinquent behaviour by the police and courts.

In light of these definitions one must perhaps concede that although official statistics have their limitations, they are of some value. Erickson and Empey (13) have claimed that official statistics measure two things: the delinquent acts which official delinquents commit and the responses or reactions of society to these official delinquent acts. If one wanted a true picture of the extent and distribution of law violating behaviour, Schur (33) suggested it would be necessary to obtain behaviour data from samples drawn from the general population. He went on to suggest that this approach is necessary in order to avoid relying on the patently misrepresentative samples made up of persons who have been institutionalized or processed through the courts (33). In addition, Nye and Short (24) have pointed out that the problems of identification and measurement of the basic variables involved in juvenile delinquency have had as their cause the lack of knowledge of the unofficial dimension of delinquent behaviour. Short and Nye (34), Short and Nye (35) and Erickson and Empey (12) suggest that the exploration of unofficial delinquency through self-report measures might be helpful in understanding delinquency, in respect to its extent, the nature of the various types of delinquent conduct and its variability.

Williams and Gold (39) more recently stated that there is a necessity for the distinction between the terms 'delinquent behaviour' and 'official delinquency'. They went on to state that, in the past, studies of official delinquency have done a disservice to the understanding of delinquent behaviour. They justified their claim by pointing out that all that was known about delinquent behaviour--its official actors, its nature and its causes--was inferred until the late 1950's from the records of official delinquent and from observations of identified delinquents. They disagreed with the assumption that official delinquency is representative of the unofficial delinquent conduct.

Delinquent behaviour, as defined by Williams and Gold (39), is norm violating behaviour of a juvenile which, if detected by an appropriate authority, would expose the actor to legally prescribed sanctions. They suggest that generalized inferences made from official delinquent records violates the definition of delinquent behaviour. The reason it violates the definition is that it ignores the vast amount of delinquent behaviour which never becomes official delinquency. They pointed out that considering official delinquency as representative of delinquent behaviour naturally leads the investigator away from the

selection process that is an integral part of official delinquency and as it involves such factors as age, sex, race and social status (as perceived by the lawman), it leads to bias.

Voss (37) also cautioned against the generalizability of the official statistical data because it describes only samples of the universe of official delinquents and these samples may be unrepresentative of that universe. Erickson (11) has stated that utilization of self-report measures of delinquency commenced from the recognition that official criminal juvenile statistics are inadequate measures of the extent of lawbreaking. The main factors, cited by Erickson (11), as being involved here were: 1. There is a lack of consensus regarding the definition of criminality; 2. There is a lack of uniform methods of reporting and recording crime data; 3. There is a differential in law enforcement with respect to different racial groups, class groups and geographic regions; and 4. Perhaps the most serious limitation, is the fact that present official statistics deal exclusively with those offenders who have become involved in some way in the legal reactive process. Farrington (17) agrees that official records do not provide an accurate measure of deviant behaviour.

Self-reporting techniques aim to answer some very important questions. Arnold (1) posed examples of these questions: 1. Are undetected law breakers few or abundant? 2. Are hidden delinquents beneficiaries of discriminatory law enforcement in which their acts are overlooked because they are from a favoured social class group or because of other factors of a similar nature? and 3. What, if any, is the discrepancy between self-reported and official records of delinquent behaviour?

Some of the important findings obtained through the use of self-report measures were that everyone breaks some laws, rules and regulations, but others break them more often (25). More specifically it was found that college students committed many more delinquent acts than was commonly known and that these delinquent acts were as serious as those which brought other young people into conflict with the law (29). It has also been claimed that there has yet to be any significant evidence to reject the hypothesis that there is no significant difference in the amount of delinquent behaviour in different socio-economic strata (26; 30; 7; 10; and 38).

Nye and Short (25) stated that measures of self-reported delinquency have been used in studies relating delinquent behaviour to psychosomatic symptoms, differential

association, socio-economic status, rejection of parents, broken and unhappy homes and spatial mobility. Other studies include the testing of Cohen's theory that lower class adolescents compare their own life style unfavourably with peers in higher social classes (31), Merton's theory of anomie (40) and Matza's theory of delinquent drift (22). These studies indicate that self-report measures are now widely used in the study of delinquency.

Justifying the use of self-report methods in studies as the criterion of delinquency, Voss (37) claims that it enables one to determine better the social facts concerning legal delinquency. He points out that information concerning types of delinquent acts committed by juveniles in different segments of society are also helpful in revealing the variability of delinquent activity. In this connection Dentler and Monroe (9) state that one clear advantage of self-report measures is that they avoid socio-economic and cultural biases that are inherent in official statistics, and thus can be applied to the difficult task of determining the slope and extent of the "total iceberg of delinquency" (10). In addition to this, Nye and Short (25) point out that delinquency has generally been treated not as a variable but as an attribute, with groups and individuals treated as either delinquents or non-delinquents. They feel

that if research is to be useful, this position must be changed by the use of unofficial delinquent behavioural measures as they make it possible to treat delinquency as a variable rather than an attribute.

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CHAPTER II

Methodology

Burgess (3) suggested that Eysenck's theory of conditionability and crime (8) has not received support because it had been consistently tested with the wrong hypotheses. In addition, he indicated that the measures used to test the hypotheses needed to be changed. Our review of the literature tends to support the position taken by Burgess (3) and it has led us to conclude that spatial ability is so intricately involved in conditionability that the crime-conditionability hypothesis may even be restated: Spatial ability is negatively related to and is a good predictor of criminality. It is this hypothesis that is being tested in this study. The testing of this hypothesis requires, in the minimum, a measure of spatial ability and a measure of criminality. In the search for these measures it was discovered that Smith (28) reviewed the scientific research on a variety of tests where the major underlying factor was a type of ability. These tests were categorized as spatial tests, mechanical tests, performance tests and other non-verbal tests. In the case of spatial tests, the ability that is being tested is spatial ability. This ability, Smith (28), has defined as the "capacity to perceive and hold in mind the structure

and proportions of a form or figure grasped as a whole" (p. 6). Persons who possess this ability or aptitude in high degrees, Smith (28) suggests, analyse and judge better about concrete spatial situations than do those possessing it to a lesser degree. The others, Smith (28) concedes, may perhaps excel in dealing with more highly abstract symbols, but as far as concrete situations are concerned, those with high spatial ability will excel. Utilizing this argument, Smith (28) contended that using a spatial measure as a selector for training in mathematics, art, mechanical science and in technical subjects as engineering drawing, metalwork, woodwork, handicraft, building drawing and building geometry should increase the success rate of those who were selected. In consequence, he suggested the inclusion of a spatial measure in a battery of tests administered to prospective candidates for technical and scientific courses and occupations. A follow-up enquiry showed the test of spatial ability to be the best single predictor of success in technical courses with the other tests used in the enquiry adding little to its predictive value (28).

Smith (28) pointed out that

> . . . until fairly recently, tests of verbal ability or verbal reasoning were called intelligence tests and were believed to provide measures of 'abstract

> intelligence, ' whereas tests of spatial ability were regarded as measures of a specialized mechanical aptitude or of 'concrete intelligence' (p. 294).

Smith (28) disagrees with this view and suggests that spatial tests may be the better measures of the ability to think abstractly or to form general concepts.

Investigations other than those dealing with the prediction of success in technical and scientific areas of endeavour have also been conducted. Personality characteristics associated with spatial ability have been studied. These characteristics were found to be withdrawn schizothymia, desurgency, masculinity and low motor perseveration. High spatial ability was also found to be associated with the athetic physique or leptosomatic. In addition to these, numerous studies on brain damaged subjects revealed that a great majority of them were characterized by a marked deficiency in spatial ability.

Tests of spatial ability take several forms. One involves drawing a named object as large as the example displayed (28). A second, shape dissection, involves the cutting-up of a larger figure into smaller figures (28). A third, spatial analogies, involves identifying the correct figure to correspond with three other figures specified (28). A fourth, pattern perception, involves the recognition of two patterns of crosses, where the smaller pattern on the

left is hidden in the larger pattern on the right (28). The task here is to pick out those crosses in the right-hand pattern which form the left-hand pattern and draw a line around them (28). A fifth, inverse drawing, involves drawing the upper figure as if seen reflected in a pool of water (28). There are other tests of spatial ability. They are all similar to the ones listed above, but vary in one detail or another. One of these tests, however, is of special interest here. This test is the spatial relations measure obtained from the Prognostic Test of Mechanical Ability (34).

The Prognostic Test of Mechanical Abilities (34) is based on an analysis of the requirements for courses of study in mechanical trades. The test consists of five parts: arithmetic computation, reading drawings and blueprints, identification and use of tools, spatial relationships and checking measurements. The total score reliability coefficients (Kuder-Richardson) range from .89 to .94 for grade levels seven-twelve. Extensive norms (5268 male students in seven states) are provided for the same grade levels. Adult norms are absent, but the authors, Wrightstone and O'Toole (34), suggest that the norms for grade twelve could be used.

The spatial relations measure consists of 15 items of distinct shapes. The shapes are so arranged that one side contains whole figures, whereas the other side contains sets of two-dimensional pieces. In responding, the subject is required to identify which of the five sets of two-dimensional pieces, when assembled, will make up the whole figure. The spatial relations measure is a modification of Thurstone's Form Board Test (17), from which it differs with respect to the method of response. In the latter measure, the respondent is required to fill in his responses by drawing dotted lines in the whole figure to show how the pieces fit together; in the former measure, the method of recognition is used (17). From tests conducted on two grade 12 high school samples of 151 boys and 139 girls aged 15 to 20, Michael Zimmerman and Guilford (17) concluded that there is no significant difference between sexes on the spatial ability measure obtained from the Prognostic Test of Mechanical Ability (34).

This measure of spatial ability was chosen for use in this study because it had been used in a previous study of criminality. Blum and Garner (2) used it in their study of a sample of 79 adjudicated adult male property offenders. They found that the spatial relations measure accounted for 5 percent of the criterion variance. To measure the

offenders degree of conditionability they used Factor R (10), Factor E (8), and the Otis IQ (7). Blum and Garner (2) suggested their findings indicated that there exists a certain degree of relationship between IQ and the visual-spatial factor. Eysenck (8) has pointed out that the relationship between IQ and conditionability has never been confirmed though such may exist. Smith (28) also comes to the same conclusion, in his review of the literature on spatial ability. Therefore, in view of the uncertainty of the relationship of spatial ability to intelligence, it was felt that a measure of intelligence should also be included in order to determine its relationship to criminality and to spatial ability. The test chosen to measure intelligence is a test of abstraction that was obtained from the Shipley's Institute of Living Scale (22).

The Shipley-Institute of Living Scale is comprised of two tests--an abstraction measure and a vocabulary measure. The scale was devised in order to give psychiatry a practical diagnostic and research instrument (22). It has convenience of administration and both tests are used as related measures of intellectual impairment (23). They are both self-administering, pencil-and-paper type tests and are suitable for group as well as for individual use. Since the abstraction measure is of prime interest it will be

discussed in more detail.

The abstraction-thinking test is comprised of twenty items of the completion type. Each of the twenty items requires the subjects to induce a general principle and from it deduce a specific answer (23). The answers consist of either a few letters or a few numbers. The subjects are not to receive any assistance from anyone or from any resource and the test has a time limit of ten minutes..

If any mental impairment exists in the subjects, it is measured in terms of the abstract deficit taken in relation to the vocabulary level (23).

The scale was standardized in such a way as to render the scale useful as a measure of intelligence, as well as a measure of intellectual impairment. The scale was standardized on over 1000 normals for whom intelligence quotients were available. Mental age equivalents were then derived for each of the tests individually as well as for the two tests combined (23).

Suinan (29) generated correlation coefficients for the scores obtained on the Wechsler Adult Intelligence Scale and on the Shipley Scales. The sample consisted of 29 patients of a mental hospital. The correlations between the total score on the Shipley tests and the three scores obtained on the WAIS were: full-scale WAIS .76,

verbal WAIS .83, and performance WAIS .58. Each of these coefficients was significant at the .001 level or better. Suinan (29) concluded that the Shipley scale could be used profitably as a substitute for the WAIS when economy of administration is desired.

Sines (26) found that the abstraction measure correlated with the full scale score of the WAIS. He generated the following coefficients: .72 for the full scale score of the WAIS and the total test score on the Shipley measure (comparable to Suinan's (29) results), and .58 between the full scale score of the WAIS and the abstraction measure of the Shipley. His samples were: 99 males of the Veterans Administration Mental Hygiene Clinic, and 251 records of the above mentioned clinic. Sines (26) concluded that the Shipley measure requires no professional time for administration or scoring and that the test is a valuable brief measure of current intellectual functioning.

Horlick and Monroe (12) conducted a reliability study on two groups of army male recruits (Group A-112 and Group B-101). They investigated whether practice on the abstraction measure played a role in repeated testing on the subjects. They devised an alternative form of the original test. The items of the alternative form were an adaptation of a corresponding item from the original test. The

coefficients obtained were .79 for the repeated administration of the original (significant at .01 level) and .80 for the testing with the alternative form in place of the original test (significant at .02 level). Horlick and Monroe (12) concluded that practice has only a slight effect on subsequent administrations of the original form.

Criminality, in the present study, is considered on a continuum, rather than in the dichotomous dimension of criminal-noncriminal. The measure used to quantify the degree of criminality was Gibson's Revised Scale of Self-Reported Criminality (9).

Self-report questionnaires vary in length from 7 in Nye and Short (19) to 55 in Porterfield's (20) study. The design of self-report questionnaires varies, but the criteria fluctuates little from the outlines of Empey and Erickson (6) and Short and Nye (24). Empey and Erickson (6) designed their questionnaire in the following way: 1. defined each offence in detail; 2. asked the respondent if he had ever committed the offence; 3. asked how many times he had committed the offence; 4. asked if he had ever been caught, arrested or brought to court for the offence; and 5. if so, how many times he had been detected, arrested or brought to trial. For each question the respondent had to check one of four frequency categories:

0 times, 1-3 times, 4-6 times or 7 or more times. Murphy, Shirley and Witmer (18) asked the respondents to indicate if they had committed the offence, and if so, they were required to indicate if they committed the act rarely, occasionally or frequently. Farrington (9) suggested using specific numbers when asking the number of times someone engaged in a particular activity. He pointed out that this would lead to a greater uniformity of the interpretations used by the respondents and hence a move toward standardization of the self-report measures.

Short and Nye (24) recommended the use of 3 criteria to choose the offences to include in a self-report delinquency scale: 1. the crimes must be trivial to serious; 2. committed by an appreciable segment of society; and 3. the questionnaire must be administered under favourable conditions. The items which make up a self-report questionnaire are selected in various ways. Clark and Wenninger (5) assembled a 36 item scale of offences from other criminality scales, legal statues and from the FBI Uniform Crime Reports. Short and Nye (25) based their measures of criminal behaviour upon a list of behavioural items commonly referred to in the laws relating to criminal behaviour. Their scale was 21 items in length. Porterfield (20) developed a 55 item scale of criminality from offences

committed by 2049 alleged delinquents.

Voss (32) suggested that the use of trivial offences (referring to Short and Nye's criteria) on a criminality scale are not of value because, if detected, would not lead to prosecution. An example of such an item is: 'Riding a bicycle at night without a light.' This limitation has been recognized and in Farrington's (9) article, the scale reviewed included a measure of seriousness in an effort to overcome the criticism that self-reports do not deal with real crime.

The second criteria of Short and Nye (24),'acts committed by an appreciable segment of society,' is suggesting that acts must be committed with a certain degree of frequency in the general population. Examples of acts that do not fall under this criteria are: murder, rape and treason. Examples of acts that fall under this criteria are: break and enter, theft and assault.

Their third criteria (24) refers to those conditions that will not bias the data in a positive or negative direction. Such conditions are suggested as: anonymous reporting and neutrality of the investigator. The latter refers to the proximity of the investigator to the position of the respondents. It is assumed that if the investigator is too close, then the respondents will either under-report

their deviant behaviour or will over-report their behaviour. The explanations for this test behaviour is that the respondents will either try to make a good impression on the investigator by presenting themselves under the 'halo effect' or to exaggerate their involvement in deviant behaviour. And second, the respondents may feel threatened by answering the questions in a truthful fashion because they feel the information may be used against them in the future or that they feel guilty about engaging in such activities.

On a self-report questionnaire the items usually begin with 'Have you ever . . .' or 'During the past year have you . . .' Smith and Carwright (27) stated that when using 'have you ever,' there is a cumulative history implied. The difficulty here is that it makes current applicability less apparent and may permit considerable variation in the mental set of the respondents. For example, some 22 year olds may answer on the basis of their behaviour in the third grade, while another may answer on the basis of his nineth grade behaviour. It is hoped, however, that the respondents will review their entire history of behaviour when answering each item. In the present study "have you ever, . . ." is used in order to get an overall indication of the amount of criminal

behaviour engaged in by the respondents.

The revised scale by Gibson (11) was chosen because it is the only instrument in which recent attempts have been made to standardize its application and scoring. A self-report measure can be considered to be standardized, according to Farrington (9), when it possesses a "routine procedure for administration, objective scoring, norms for various populations, details of internal consistency, retest stability and concurrent and predictive validity" (p. 99). Farrington (9) pointed out that "Without such a technically advanced questionnaire, it is impossible to be sure that this method of measuring deviant behaviour is superior to the official records" (p. 99). His review of the literature indicates that little or nothing is known about self-report questionnaires' predictive validity or about their retest stability over long intervals.

Farrington's (9) review of the questionnaire obtained results indicating that the questionnaire was predictively valid and that admissions reflect deviant behaviour. Future official convictions were predicted significantly from the total index of deviant acts. However, this has theoretical rather than practical significance because:

> 17.3% of 307 non-delinquents admitted more than 12 deviant acts, in comparison with 47.1% of 51 late delinquents (24). In order to correctly identify 24 future delinquents, it would therefore be necessary to misidentify 53 future non-delinquents which would probably be an unacceptable social cost (9, p. 108).

The questionnaire was also shown to be concurrently valid and internally consistent. The internal consistency coefficient obtained was .89 for the index of the total variety of deviant behaviour. The subscales were less internally consistent than the full scale measure, so it was decided to concentrate on the full self-report scale score (9). The scale was also concurrently valid because

> 47 early delinquents admitted 15.5 acts on average, in comparison with only 8.9 admitted by the remaining 358 boys, yielding a highly significant biserial correlation ($r_{bis} = 0.58$, $p < .001$) (9, p. 104).

Retesting after a two year period showed a quarter of all initial admissions turned into denials. The denial rate, it was pointed out, was especially high with the more serious offences, but did not appear to be associated with any particular interviewer. Farrington (9) suggested that lie scores may be useful in the detection of those who respond inconsistently.

Sample

The sample for this study consisted of 151 students from Lisgar Collegiate, Ottawa, Ontario. There were 67 male and 84 female respondents. This sample is similar to that used by Kinsey and his colleagues (14) in their sex studies and Huff and Scott (13) in their public opinion studies. Their samples were essentially self-selected: all those who were interested in the study could participate. The sample in this study contains two self-selected steps. A teacher as Lisgar Collegiate was approached and was asked if he would allow the testing of his students during regular class time. If the teacher consented he informed his classes of the study telling them that those who wished to take part could volunteer. There were a total of six classes composed of two grade nine classes, two grade eleven classes and two grade thirteen classes. The age range of the sample is twelve to nineteen, inclusive.

The grade nine classes differed from each other--one was an accelerated grade nine (group 4) and the other was a regular grade nine (group 6). The reason for the low age of twelve can be accounted for by the accelerated grade nine factor. The age range for group 4 is twelve to fourteen inclusive. The age range for group 6 is thirteen to seventeen inclusive. The two grade eleven classes

(groups 2 and 3) were regular classes. The age range for groups 2 and 3 is fourteen to nineteen. The two grade thirteen classes (groups 1 and 5) possessed common characteristics. The age range for these classes is fifteen to nineteen.

The vast overlap of ages in the three grade levels can be accounted for by the new school system of advancing at your own level in a particular subject. Thus it is possible for a person of fifteen to be taking grade twelve courses or possibly even grade thirteen courses.

The testing of the six classes took place October 14, 1975 at Lisgar Collegiate, Ottawa, Ontario in two sessions. The first testing session began at 9:00 am and terminated at 11:40 am. During this period four classes were tested (grades--thirteen, eleven, eleven, and the accelerated nine, respectively). The second testing session began at 1:00 pm and terminated at 2:20 pm. This session was for grade thirteen and grade nine.

The measures were administered in regular class time and the respondents were assured of their anonymity. The subjects were instructed to start and stop at the command of the examiner. The instructions for each measure were read out to the classes and were also written on the questionnaire itself, enabling the subjects to read along and review the

instructions if necessary. This procedure was followed for all administrations of the questionnaire. Including the instructions on the questionnaire, it was felt, would ensure that a minimal amount of interaction would occur between the subjects and the examiner and would eliminate disruptions during the testing.

The measures were administered in the following order: spatial relationships, abstract thinking test and the self-reported criminality scale. The spatial relationships measure and the abstract reasoning task both had time limits of eight minutes and ten minutes respectively. This accounts for administering these two measures prior to the self-reported criminality scale. The self-reported criminality measure had no time limit, but it was completed in eight to ten minutes depending on the group.

The subjects were instructed that once the time expired for the completion of a measure, it was forbidden to turn back and finish the measure. This instruction applied to the first two measures. As far as the other measure was concerned the instruction was that it must be completed in full.

The two classes tested in the second session were chosen to the test-retest reliability sample. They were chosen out of convenience for the teacher concerned, with

a time lapse of one week. In order to be able to compare the data, a number was placed in the upper right-hand corner of each booklet and each subject was asked to remember his number. The booklets were distributed in sequential order beginning from the left-side of the classroom to the right-side of the classroom. This distribution pattern was chosen after the teacher informed the examiner that the subjects had permanent positions in the classroom. Using this distribution pattern enabled the examiner to be relatively certain that the subjects not only would remember the assigned number, but also would receive the correct questionnaire.

Limited communication between the examiner and the subjects, it was assumed, would lead to greater standardization of the administration procedure. The standardization would, in turn, help to reduce any bias that the examiner may introduce through his interaction with the respondents.

Administration of Self-Report Questionnaires

There are two main issues about the administration of self-report questionnaires: 1. whether to administer them in a group situation by self-completion or in an interview setting and 2. whether to administer them anonymously or not. The concern for such decisions is

whether or not the respondents will distort their answers. This is important because the research value of the self-report data depends upon the respondents' candor in reporting their behaviour. Therefore, it is necessary to choose a method that will reduce the likelihood of distortion or of withholding the requested information.

Farrington (9) suggests that the group administration has several distinct advantages over the interview situation. The procedure of the self-report questionnaire is more objective and has a greater capacity of standardization; the relationship between the subject and the interviewer is of less importance; and the admitting of deviant acts is less embarrassing. In the interview, however, it is easier to ensure that the respondents interpret the items correctly and that they answer every question. Also in the interview, more detailed information can be obtained about specific acts, suspected deceptions can be probed and the response is not dependent on the subject's ability to read.

Short and Nye (25) and Scott (21), however, stress the importance of anonymity. According to these authors, rapport can only be obtained when the subjects have nothing to gain either by withholding or distorting information. Recent investigators agree, and most have administered their

checklists of delinquent activities anonymously (5; 1; 4; 30; 31).

Kulik, Stein and Sarbin (16), on the contrary, found for a population of 245 males drawn from two high schools, between the ages of fourteen and eighteen and a population of 137 adjudicated delinquents drawn from three institutions in the state of California, that the subjects became more guarded in admitting misbehaviours when not protected by anonymity. The change of pattern was more pronounced for slight infractions than for serious violations. Although the changes in the reporting patterns reached statistical significance, they were not great in magnitude. The results on an anonymous and nonanonymous checklist revealed that the boys received very similar ratings on the two administrations of the delinquency checklist. The total score correlation for the two administrations was .98. This correlation coefficient compares favourably with the internal-consistency of .96. The authors concluded that the practical importance of anonymity is overemphasized in research on delinquency.

Krohn, Waldo and Chiricos (15) found, for two random samples of college students responding to an interview and a self-administered checklist, that there was no statistically significant difference between the responses to the

two types of administrations. Their research provided no external validation and, therefore, it cannot be determined from their research which method will elicit more valid responses. The authors concluded that since the two groups were randomly selected and no differences in the percentage of reporting criminal acts, then there is no reason to assume that one technique is more valid than the other.

The basis on which an administrative procedure is set, does not depend, according to the literature, on whether it is anonymous or nonanonymous.

Scoring

The Spatial Ability measure consists of fifteen items and a mark of one is given for each correct answer. The maximum score obtainable on this measure is fifteen.

The abstraction measure consists of twenty-two items. A mark of one is given for each correct answer. The maximum score on this measure is twenty because the last two items were disregarded. The rationale for this approach will be discussed in the section--Alteration to Instruments.

The self-report questionnaire consisted of thirty-eight items. A mark of zero, one, two, or three is given for each response. The score depended on the frequency indicated by the respondent to each question. The scoring followed this procedure: zero was given for never; one

was given for a frequency of one to three times; two was given for a frequency of four to nine times; and three was given for a frequency of ten or more times. The maximum possible score for this measure is one-hundred and fourteen. This delinquency measure includes six subscales: minor acts; underage acts; aggressive acts; active theft acts; no category acts; and a score indicating the overall level of seriousness of the respondent's behaviour. Determining a score for the first five subscales is done simple by adding up the number of individual offences admitted. For example: "Have you ever ridden your bicycle at night without a light?" This act is considered to be minor, so if the respondent admitted to committing this act, then he would receive a score of one under the minor category no matter what his frequency of committal is. The score of one for this response is added to the other minor acts admitted to and this establishes a total score under the minor acts subscale. This process is followed for the other four subscales as well. The calculation of the seriousness score is obtained through the following process: multiplying by two the number of acts admitted to under the subscales of aggressive acts and active theft acts; multiplying by one the number of acts admitted to under the categories of minor, underage, and no category acts, then

summing both figures to get an indication of the seriousness of the respondent's behaviour.

The maximum score for the subscales are as follows: minor acts--fifteen; underage acts--six; aggressive acts--seven; active theft acts--seven; no category acts--three; and the seriousness score--fifty-two.

Alterations to Instruments

The spatial relationships measure was taken from a large test battery called the Prognostic Test of Mechanical Ability. This battery contained five subtests. The Spatial subtest consists of fifteen items and has a time limit of eight minutes. The items were not altered and the directions used were from the subtest itself.

The abstraction measure was taken from the Shipley Institute of Living Scale for Measuring Intellectual Inpairment. The abstract measure contained twenty items in the original form, but the number used in this study amounted to twenty-two. The reason for changing the format is the lack of permission regarding the use of the measure. This necessitated invalidating the test so as not to be able to compare the results with the standardized data of the measure. The need for the test was simply to rank the subjects in order to estimate the degree of relationship between the abstraction measure and spatial relationships.

The self-report measure utilized was originally developed by Willcock (33) and revised by Gibson (11). The scale is an interview format, so alterations had to be done in order to use the scale as a self-report measure.

To each item was added 'Have you ever,' in order to put the statement into question form. Using the beginning of 'Have you ever' enabled a cumulative history of the respondents involvement in deviant behaviour. In the present study, the interest is in the overall involvement in deviant activities by the respondents, as measured by a self-report scale of criminality.

The respondents' marking procedure was altered, as suggested by Farrington (9). The original format required the respondents to indicate if they had ever committed the act. If so, they were required to indicate whether the act was committed frequently, sometimes, or once or twice. This format was changed to whether the respondents had committed the acts ten or more times, four to nine times or one to three times. The marking scheme was altered in order to reduce the variability of interpretation among the respondents, by making it clear to them what was expected.

The items altered, in order to make the measure more applicable, were: item three--changed the size of the group from ten to five in order to obtain a wider range of

group involvement; item twelve--examples were included with the question in order to give the respondents a clearer idea of what is required; item fourteen--a longer list of weapons was included to clarify the question; item fifteen--changed from attacking a rival gang to attacking a person in the street (this was done because of the lack of applicability of the original question); item twenty-six--changed from unknown person to another person (this was done to obtain a more comprehensive indication of the respondents' rate of criminality); item thirty-seven--an explanation of false pretences was added; and item thirty-eight--further examples of possible drug use were added (this was done to provide clarity and comprehensiveness to the question). Items twenty-eight, thirty, and thirty-three had the amounts of money changed from five p., fifty p., and one pound to two dollars, five dollars and three dollars, respectively. The changes were made to express the monetary value in Canadian currency and to increase the amounts of money in order to reflect present-day values.

Methods of Analysis

To analyze the data, two types of analysis were chosen: Pearson-Product Moment Correlation and Step-Wise Multiple Regression Analysis. Pearson-Product Moment Correlation Analysis was chosen to calculate the relationships

that exist between each of the variables--sex, age, spatial ability, abstract thinking and self-reported criminality--and to calculate the test-retest reliability coefficients. The level of significance chosen was .05. Step-Wise Multiple Regression Analysis was chosen because it was desired that the variables be selected in descending order of their ability to account for the variance of the predicted criterion. This process continues until no further variance is accounted for by the variables in the equation. In addition, with this regression analysis, the effect of the interaction between the independent variables and their subsequent effect on the dependent can be determined. In other words, this analysis can determine if grouping the independent variables results in accounting for more variance than single predictive methods of regression.

Test-retest reliability was used in order to obtain an indication of the degree of consistency from one testing to another on the same sample. The reliability coefficients were calculated using a Pearson-Product Moment Correlation analysis.

The methods of analysis used in this study were obtained from the SPSS manual of computer programmes.

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CHAPTER III

Presentation and Discussion of Results

This study seeks to ascertain the relationship between the independent variable spatial ability and the dependent variable self-reported criminality. The theoretical structure used as the basis of this study is Eysenck's (2) theory of criminality. His theory suggests that pro-social learning is dependent upon receiving an adequate and correct amount of conditioning. It is expected that with the use of a spatial ability measure as an index of reactive cortical inhibition and a self-report scale as a measure of criminality that the results obtained should indicate that the measures are negatively related. This is expected because, according to Eysenck's theory, the degree of conditioning that a person has received affects his disposition to criminality in a negative fashion, that is, he should experience a lower rate of criminality. Criminality refers to both adult offences, as in the case of theft and assault, and juvenile offences, as in the case of underage acts and minor acts.

In addition to the spatial ability measure and self-report scale, three other measures were included as control measures: abstract thinking, sex and age. The variable abstract thinking is used in this study as a

measure of intelligence. It has been suggested in the literature (9; 1) that a strong relationship exists between the variables spatial ability and intelligence. In addition, intelligence, as measured by Otis IQ, was used in a study as an index of conditionability (1). Therefore, in order to examine the effect of intelligence on the relationship between spatial ability and self-reported criminality and its effect on each of the variables, a test of abstract thinking was included as a measure of intelligence.

The variable sex was controlled for because of the possibility that there would be differences in performance on the measure of self-reported criminality. The results of the self-reported scale of criminality for males and females could have differed significantly because almost all of the self-report research indicates that male deviancy occurs with greater frequency and thus presents a more serious problem. In addition, the scale used to measure criminality has been developed and used almost exclusively on males. Consequently the possibility existed that it may not include offences commonly committed by females.

As suggested by the literature, it was expected that there would be little or no difference between males and females on the measure of spatial ability (6).

For the measure of intelligence, no sex differential was postulated. It is assumed that each sex possesses relatively equivalent amounts of intelligence.

Age was controlled because of the likelihood of its influence on the amount of criminality reported. The rationale here is that the older the person, the more deviant acts he would have been able to commit.

The sample, as stated earlier, consists of 151 high school students. There are 84 female and 67 male respondents. The age range is from 12 to 19 inclusive and three grade levels are represented: grades--nine, eleven and thirteen. Each class was tested in the same manner of administration using identical instruments in all cases.

The methods of analysis chosen to analyse the data were the Pearson-Product Moment Correlation and Step-Wise Multiple Regression Analysis. Both methods of analysis were obtained from the SPSS Manual of Computer Programmes (7). The Pearson-Product Moment Correlation Analysis is used to determine the relationships between the four independent variables--sex, age, spatial ability and abstract thinking--and between the four independent variables and the dependent variable--self-reported criminality.

The Step-Wise Multiple Regression Analysis enables the computation of the relationship between the four

independent variables and the dependent variable and it also provides the possibility of computing the interaction between the independent variables and their subsequent effect on the dependent variable. The order that the variables are put into the computer for analysis is not of concern, because the computer chooses the independent variable or the interaction between the independent variables in the order in which they account for the most criterion variance. That is, the term chosen first accounts for the most variance, the term chosen second accounts for the next highest amount of criterion variance and so on.

The results for the sample on the various measures used in this study will now be discussed.

Age, listed as age at last birthday, indicates that there are no significant differences between the males and females on this variable ($r = .09$, $p < .11$), (refer to Table 4). The mean for the total sample is 15.88 with a standard deviation of 1.62 (refer to Table 1). The mean for the female portion of the sample is 16.02 with a standard deviation of 1.64 (refer to Table 2). The mean for the male portion of the sample is 15.70 with a standard deviation of 1.59 (refer to Table 3). This suggests that the sample selected on the variable age is equally distributed for the male and female subjects.

Table 1--Means and Standard Deviations for Males and Females.

Variable	Mean	Standard Deviation	Cases
Age	15.881	1.629	151
Sex	1.556	0.498	151
Spatial Ability	8.543	2.274	151
Abstract Thinking	15.358	2.770	151
Self-Reported Criminality	23.179	16.468	151

Table 2--Means and Standard Deviations for Females.

Variable	Mean	Standard Deviation	Cases
Age	16.024	1.650	84
Sex	2.000	0.000	84
Spatial Ability	8.667	2.315	84
Abstract Thinking	15.262	3.006	84
Self-Reported Criminality	16.845	11.528	84

Table 3--Means and Standard Deviations for Males.

Variable	Mean	Standard Deviation	Cases
Age	15.701	1.596	67
Sex	1.000	0.000	67
Spatial Ability	8.388	2.229	67
Abstract Thinking	15.478	2.458	67
Self-Reported Criminality	31.119	18.279	67

Table 4--Correlation Coefficients between Variables--Males and Females.

	Age	Sex	Spatial Ability	Abstract Thinking	Self-Reported Criminality
Age	1.000	0.099	-0.202*	-0.305*	0.003
Sex	0.099	1.000	0.061	-0.039	-0.432*
Spatial Ability	-0.202*	0.061	1.000	0.207*	-0.348*
Abstract Thinking	-0.305*	-0.039	0.207*	1.000	0.079
Self-Reported Criminality	0.003	-0.432*	-0.348*	0.079	1.000

* significant at .05.

The results on the spatial ability measure indicates that there are no significant differences between males and females ($r = .06$, $p < .22$), (refer to Table 4). This supports the research conducted by Michael and Zimmerman on various spatial measures. They found that there were no appreciable differences between the measure of spatial ability and sex. The mean for the total sample is 8.54 with a standard deviation of 2.27 (refer to Table 1). The mean for the female portion of the sample is 8.66 with a standard deviation of 2.31 (refer to Table 2). The mean for the male portion of the sample is 8.38 with a standard deviation of 2.22 (refer to Table 3). These results are important because they suggest that males and females are distributed equally as well across the dimension of spatial ability for one sex as they are for the other sex. This indicates that the measure of spatial ability, if it is related to self-reported criminality, may predict the latter variable equally as well for both sexes.

For the variable abstract thinking, the results indicate that there are no significant differences between the sexes ($r = -.03$, $p < .31$), (refer to Table 4). The mean for the total sample is 15.35 with a standard deviation of 2.76 (refer to Table 1). The mean for the female portion of the sample is 15.26 with a standard deviation of

3.00 (refer to Table 2). The mean for the male portion of the sample is 15.47 with a standard deviation of 2.45 (refer to Table 3). This result supports the premise that there are no significant differences between the sexes on the variable intelligence, that is, if abstract thinking is measuring intelligence in this study.

The results for the measure self-reported criminality indicates that there are significant differences between the males and the females on this variable ($r = -.43$, $p < .001$), (refer to Table 4). The mean for the total sample is 23.17 with a standard deviation of 16.4 (refer to Table 1). The mean for the female portion of the sample is 16.84 with a standard deviation of 11.52 (refer to Table 2). The mean for the male portion of the sample is 31.11 with a standard deviation of 18.27 (refer to Table 3). This result indicates that the males have a much larger distribution of scores than the females. As compared to the males, the females appear to be more concentrated in the lower score area of the distribution. The range of scores for the female sample on the self-report measure is from 0.0 to 43.0 (refer to Table A12), with a mode occurring at score 11.0 (6 people). The range of scores for the male sample on the self-report variable is from 1.0 to 91.0 (see Table A8), with the greatest frequency occurring

at 18.0 and 25.0. The highest frequency, however, is 4.0 and the lowest frequency is 1.0. The remainder of the frequencies are mostly 1.0 in number. This suggests that the range is evenly distributed over the entire spectrum of the scores for the male subjects. There is one gap that occurs between the scores, but it is only for one score. This occurs at the upper end of the distribution. The second last score is 63.0 and the last score is 91.0. This spread in the score distribution does not affect the mean of the distribution significantly when calculated without the score of 91. The total score mean for the males is 31.11 and the mean when the score of 91.0 is removed is 30.21.

The results, obtained for the relationship between sex and the measure of self-reported criminality, indicate that there are significant differences between the sexes on the latter variable. It appears that the variable self-reported criminality is highly related to the male portion of the sample studied. This may be due to an actual non-involvement of females in criminality, but before such a conclusion is regarded as definitive, more research is required. Two reasons exist for this. The first is that criminality, as measured by a self-report scale, may not be measuring female criminality. The scale of criminality

had been used almost exclusively on male subjects prior to its use in this study. Therefore, the list of acts may not include acts commonly committed by females. The second is that cultural and biological differences between males and females influence the manner in which males and females are reared. As a result of these differences, the expectations of society vary for each sex. Females are expected to act in a 'lady-like fashion' which includes the absence of criminal activity. Males, on the other hand, are to act in a masculine manner and they are expected, to some extent, to exemplify their masculinity in acts that can be considered daring to commit. In society, due to the expectations of each sex, not only may there be a greater potential and more opportunity for males to commit deviant acts than for females, but when females do commit deviant acts, the acts could be committed in a less detectable manner (8) and females may be less willing to admit their commission.

Correlations Between the Variables

The correlation coefficient obtained for the variables spatial ability and self-reported criminality reached the level of significance. The correlation coefficient for the total sample is $r = -.34$ ($p < .001$), (refer to Table 4). The correlation coefficient for the females did not reach significance. The coefficient generated is

$r = -.16$ ($p < .06$), (refer to Table 5). The correlation coefficient for the males is $r = -.53$ ($p < .001$), (refer to Table 6). It appears that when the data is analyzed as a whole, the correlation is significant because the high coefficient obtained for the males. When analyzed separately, the male correlation increases ($r = -.34$ to $r = -.53$) while the females is reduced significantly ($r = -.34$ to $r = -.16$). The relationship between sex and self-reported criminality, previously discussed, is of interest here to note that the correlation coefficient is in the predicted direction ($r = -.16$, $p < .06$).

It can be concluded from these results that they are in support of the hypothesis being tested which is that: Spatial ability is negatively related to and is a good predictor of self-reported criminality.

The correlation coefficients obtained for the relationship between age and self-reported criminality did not reach the level of significance ($p < .05$). The correlation coefficient for the total sample is $r = .002$ (refer to Table 4). The correlation coefficient for the females is $r = -.03$ (refer to Table 5). The correlation coefficient for the males is $r = .12$ (refer to Table 6). Due to the fact that older people have more opportunity to commit deviant acts, there is a greater likelihood that

Table 5--Correlation Coefficients between Variables--Females.

	Age	Spatial Ability	Abstract Thinking	Self-Reported Criminality
Age	1.000	-0.238*	-0.317*	-0.038
Sex	99.000	99.000	99.000	99.000
Spatial Ability	-0.238*	1.000	0.304*	-0.169
Abstract Thinking	-0.317*	0.304*	1.000	0.084
Self-Reported Criminality	-0.038	-0.169	0.084	1.000

* significant at .05.

Table 6--Correlation Coefficients between Variables--Males.

	Age	Spatial Ability	Abstract Thinking	Self-Reported Criminality
Age	1.000	-0.171	-0.284*	0.125
Spatial Ability	-0.171	1.000	0.062	-0.534*
Abstract Thinking	-0.284*	0.062	1.000	0.061
Self-Reported Criminality	0.125	-0.534*	0.061	1.000

* significant at .05.

they will have committed more deviant acts and this should result in a positive relationship between age and self-reported criminality. This may be especially true of the males of the sample studied, because self-reported criminality was strongly related to sex. The correlation coefficient of $r = .16$ for the male subjects indicates that the relationship is in the suggested direction, but it is extremely low. The range of ages for the sample is large enough (12 to 19 inclusive), (refer to Table A1) to indicate a relationship between age and self-report criminality. This result, however, may be due to the sample studied. Other possible reasons include that people tend to forget the acts they have committed. Another possibility is that the scale used to measure the deviant acts committed was not inclusive enough to tap the type of acts that may have been committed by the subjects of the sample.

The relationship between the variables abstract thinking and self-reported criminality did not reach a level of significance ($p < .05$). The correlation obtained for the total sample is $r = .07$ (refer to Table 4). The correlation obtained for the female portion of the sample is $r = .08$ (refer to Table 5) and for the males of the sample $r = .06$ (refer to Table 6). If abstract thinking is indicative of

the respondents' level of intelligence, then it can be concluded that intelligence has no effect on whether or not an individual engages in criminal activity.

Relationship Between the Independent Variables

Variables can be considered independent of each other when there is an increase or decrease in one variable and no corresponding change in another variable (3). This is the criterion used in the present study, in order to establish whether the variables chosen are independent of each other. It is assumed, when variables are chosen to be entered into the regression equation, that they are independent of each other. If the variables are not independent of each other, then, depending on the strength of the relationship, the variables may be measuring the same criterion. If this is so, it is necessary to remove one of the variables in order to avoid duplicating measures in the regression equation.

The correlation establishing the relationship between spatial ability and abstract thinking is .20 ($p < .005$), (refer to Table 4). There appears to be some degree of relationship between the two variables. The two variables share 4 percent of the variance of a common criterion. Thus the effect of abstract thinking (intelligence) on spatial ability as a predictor of self-reported

criminality will be minimal. This assumption is also supported with the results from correlating the variables abstract thinking and spatial ability with self-reported criminality. Spatial ability and self-reported criminality for the total sample is $r = -.34$ ($p < .001$), (refer to Table 4) and abstract thinking and self-report criminality for the total sample is $r = .07$ ($p < .16$). These results indicate that spatial ability is significantly correlated with self-reported criminality and that there is no relationship between the variables abstract thinking and self-reported criminality. Thus the variables can be considered to be independent.

The relationship between spatial ability and age is represented by the correlation coefficient $-.20$ ($p < .006$), (refer to Table 4). There appears to be some degree of relationship between the variables, but they only share 4 percent of common criterion variance. This suggests that the variables are only slightly related, and that the relationship is so small that the variables can be considered independent of each other. The correlation coefficient for the variable age and self-reported criminality is $r = -.002$ (refer to Table 4). And for the variables spatial ability and self-reported criminality it is $r = -.34$ ($p < .001$), (refer to Table 4).

It can be concluded from these results that there is no interaction between the variables. Hence they are considered to be independent of each other.

The correlation coefficient generated for the relationship between spatial ability and sex is $r = .06$. This coefficient failed to reach a level of significance. The results indicate a lack of relationship between the variables and can be considered independent of each other. This result is in support of previous research (6) which indicated a lack of relationship between various measures of spatial ability and sex.

The correlation coefficient for the variables abstract thinking and age is $r = -.30$ ($p < .001$). This result suggests that an inverse relationship exists between age and intelligence, provided that the abstract thinking test measures intelligence. The results obtained indicate that, from the relationship between the variables, as a person ages the score he will receive on an intelligence measure will decrease. Since the measure used in this study is also employed for the detection of intellectual impairment, it might be concluded, in lieu of this fact, that this finding is valid. However, the age range is not sufficiently large enough to determine conclusively such a relationship. In addition, the sample studied was not a

clinical sample so the test might be measuring another criterion that correlates negatively with age.

The correlation coefficient for the variables abstract thinking and sex is -.03. The coefficient failed to reach a level of significance and thus there appears to be no relationship between these two variables. It can be concluded, therefore, that the variables are independent of each other.

To recapitulate, of the four variables chosen that were considered independent of each other, only two of the variables are considered to have a relationship to the degree that their independence is questionable. These variables are abstract thinking and age. Due to the questionable nature of this relationship, it is suggested that future research be conducted.

Step-Wise Multiple Regression Analysis

The results of the Step-Wise Multiple Regression Analysis indicated that of the four independent variables and their interactions, one interaction term accounted for the most criterion variance. This interaction term is spatial ability and sex. The correlation computed for the relationship between spatial ability--sex and self-reported criminality is $r = -.48$ (refer to Table 7). This result accounts for 23 percent of the criterion variance. It

Table 7--Summary Table of Step-Wise Multiple Regression Analysis--
Males and Females.

Dependent Variable--Self-Reported Criminality

Summary Table

Variable	Multiple R	R Square	RSQ Change	Simple R	B	Beta
Sex Spatial	0.482	0.233	0.233	-0.482	3.285	1.161
Abstract	0.502	0.252	0.020	0.079	4.628	0.778
Spatial Abstract	0.514	0.265	0.012	-0.254	-1.713	-4.700
Sex	0.604	0.364	0.100	-0.432	-87.790	-2.657
Spatial	0.608	0.370	0.005	-0.348	-5.411	-0.747
Age Spatial Abstract	0.609	0.371	0.002	-0.246	0.100	4.170
Age Sex	0.622	0.387	0.016	-0.405	3.039	1.582
Age Abstract	0.624	0.390	0.003	0.092	-0.172	-0.474
Age Sex Spatial Abstract	0.625	0.391	0.001	-0.410	-0.039	-3.767
Sex Spatial Abstract	0.628	0.394	0.003	-0.411	0.598	3.737
Age	0.630	0.397	0.003	0.003	-6.961	-0.688
(Constant)					190.040	

Sex-Spatial Ability--$F_{1, 149} = 45.19$ ($p < .001$)

Abstract Thinking-- $F_{2, 148} = 24.96$ ($p < .001$)

suggests that males, who score low on a spatial ability measure, can be expected to have a higher degree of criminality provided the higher score on a self-reported scale of criminality indicates more criminality than a lower score. The finding that spatial ability is a good predictor of self-reported criminality was expected and it supports the hypothesis being tested in this study. The variable spatial ability, however, is not of significant value when attempting to predict female self-reported criminality.

The variable that accounted for the next highest amount of variance is abstract thinking. It accounted for an additional 1.9 percent of the criterion variance (refer to Table 7). This result supports the statement made earlier in this chapter, that abstract thinking was not expected to be a significant predictor of the dependent variable self-reported criminality.

The interpretation of the variables not yet discussed cannot be interpreted because the variables sex and spatial ability are repeated throughout the remainder of the table.

In addition to the analysis discussed, the data for the males and females was analyzed separately using the three variables spatial ability, abstract thinking and age.

The variable sex was omitted because it could not be computed.

The results for the male subjects indicated that spatial ability was the best predictor of the variables in the equation. Spatial ability accounted for 28 percent of the criterion variance (refer to Table 8). Abstract thinking improved the amount of variance accounted for, but only .009 percent over and above the amount accounted for by spatial ability. The variable that accounted for the next highest amount of variance in the equation is age. It accounted for an additional .004 percent. It can be concluded, therefore, that spatial ability is by far the best predictor of the dependent variable self-report criminality.

The results for the female subjects indicated that spatial ability was the best predictor of self-report criminality. However, it accounted for only .028 percent of the criterion variance (refer to Table 9). The variable that accounted for the next highest amount of criterion variance was abstract thinking. It accounted for an additional .02 percent. The last variable in the equation, age, accounted for an additional .001 percent of the criterion variance. All of the variables--spatial ability, abstract thinking and age--failed to reach a level of

Table 8--Summary Table of Step-Wise Multiple Regression Analysis--Males.

Dependent Variable--Self-Reported Criminality

Summary Table

Variable	Multiple R	R Square	RSQ Change	Simple R	B	Beta
Spatial	0.534	0.285	0.285	-0.534	-4.341	-0.529
Abstract	0.542	0.294	0.009	0.061	0.844	0.113
Age	0.546	0.298	0.004	0.125	0.766	0.067
(Constant)					42.441	

Spatial Ability--$F_{1, 65} = 25.8$ ($p < .001$)

Abstract Thinking--$F_{2, 64} = 13.3$ (not significant)

Age--$F_{3, 63} = 8.9$ ($p < .001$)

Table 9--Summary Table of Step-Wise Multiple Regression Analysis--Females.

Dependent Variable--Self-Reported Criminality

Variable	Summary Table: Multiple R	R Square	RSQ Change	Simple R	B	Beta
Spatial	0.169	0.028	0.028	-0.169	-1.101	-0.221
Abstract	0.220	0.048	0.020	0.084	0.520	0.136
Age	0.224	0.050	0.002	-0.038	-0.331	-0.047
(Constant)					23.745	

Spatial Ability--$F_{1, 82} = 2.39$ (not significant)

Abstract Thinking--$F_{2, 81} = 2.06$ (not significant)

Age--$F_{3, 80} = 1.41$ (not significant)

significance. In total the three variables only accounted for .05 percent of the criterion variance. It can be concluded that further research is necessary if one is to attempt to predict female criminality, because the variables for the group studied did not adequately predict the dependent variable for the female subjects.

To summarize, of the four variables chosen to predict the dependent variable self-reported criminality--spatial ability, abstract thinking, age and sex--only two of the variables are required. These variables are sex and spatial ability. The results of the analysis indicate that they are in support of the hypothesis being tested. The results, however, are only in favour of the male subjects. It appears that spatial ability is intricately related to criminality and when found in certain degrees, as measured by a spatial ability test, proves itself to be a good predictor of self-reported criminality.

Test-Retest Reliability

The reliability measure used in this study was test-retest reliability. Test-retest reliability can be defined as the measuring of the same set of objects over and over, with the same measuring device and obtaining the same or similar results (Kerlinger, 1973). This notion of reliability suggests that the instrument must be stable

over time in order for someone to have confidence in the use of the instrument.

The reliability coefficients generated for the three instruments are: spatial relationships .79, abstract thinking .58 and self-report criminality .96. The coefficients generated for spatial relationships and abstract thinking might be accounted for by the nature of the tests. Each requires a certain amount of guess-work, due to the degree of uncertainty each item possesses. Hence the respondent's interpretations of the items may fluctuate and reduce the coefficient of reliability. The correlation for the abstraction measure differs from that obtained by Horlick and Monroe (1954) for a sample army recruits (N = 112). They obtained test-retest reliability of .79. The differences between the coefficients might be accounted for by the samples used, American versus Canadian culture, and the time of administration.

Conclusions

The hypothesis postulated for the relationship between spatial ability and self-reported criminality was supported for the male and not for the female subjects of the sample studied. The results of this study are in support of Eysenck's theory that crime is a function of conditioning through the process of socialization.

Future research is required to verify the authenticity of the relationship between spatial ability and criminality. Especially helpful would be research conducted on various sample populations. Studies using different types of spatial measures would also be useful, as they would aid in refining the concept of spatial ability. A third area in which further research is required is that of self-report criminality. Instruments used to study self-reported criminality should be reviewed with a view to improving the comprehensiveness of the offences included. In addition, it may be helpful to ascertain the influence of a number of other independent variables such as: socio-economic class, grades in school, number of detentions due to misbehaviour and personality.

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APPENDIX

Table A1--Age Frequencies--Males and Females.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
12.00	2	1.3	1.3	1.3
13.00	10	6.6	6.6	7.9
14.00	20	13.2	13.2	21.2
15.00	31	20.5	20.5	41.7
16.00	29	19.2	19.2	60.9
17.00	33	21.9	21.9	82.8
18.00	20	13.2	13.2	96.0
19.00	6	4.0	4.0	100.0
Total	151	100.0	100.0	

Table A2--Spatial Ability Frequencies--Males and Females.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
0.00	1	0.7	0.7	0.7
3.00	1	0.7	0.7	1.3
4.00	4	2.6	2.6	4.0
5.00	11	7.3	7.3	11.3
6.00	12	7.9	7.9	19.2
7.00	19	12.6	12.6	31.8
8.00	18	11.9	11.9	43.7
9.00	25	16.6	16.6	60.3
10.00	30	19.9	19.9	80.1
11.00	19	12.6	12.6	92.7
12.00	10	6.6	6.6	99.3
13.00	1	0.7	0.7	100.0
Total	151	100.0	100.0	

Table A3--Abstract Thinking Frequencies--Males and Females.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
6.00	1	0.7	0.7	0.7
8.00	5	3.3	3.3	4.0
9.00	1	0.7	0.7	4.6
10.00	2	1.3	1.3	6.0
11.00	7	4.6	4.6	10.6
12.00	5	3.3	3.3	13.9
13.00	11	7.3	7.3	21.2
14.00	12	7.9	7.9	29.1
15.00	25	16.6	16.6	45.7
16.00	24	15.9	15.9	61.6
17.00	21	13.9	13.9	75.5
18.00	26	17.2	17.2	92.7
19.00	8	5.3	5.3	98.0
20.00	3	2.0	2.0	100.0
Total	151	100.0	100.0	

Table A4--Self-Reported Criminality Frequencies--
Males and Females.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
0.00	2	1.3	1.3	1.3
1.00	4	2.6	2.6	4.0
2.00	4	2.6	2.6	6.6
3.00	3	2.0	2.0	8.6
4.00	3	2.0	2.0	10.6
5.00	4	2.6	2.6	13.2
6.00	2	1.3	1.3	14.6
7.00	5	3.3	3.3	17.9
8.00	3	2.0	2.0	19.9
9.00	2	1.3	1.3	21.2
10.00	4	2.6	2.6	23.8
11.00	6	4.0	4.0	27.8
12.00	4	2.6	2.6	30.5
13.00	2	1.3	1.3	31.8
14.00	3	2.0	2.0	33.8
15.00	4	2.6	2.6	36.4
16.00	3	2.0	2.0	38.4
17.00	4	2.6	2.6	41.1

Table A4--Cont'd.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
18.00	7	4.6	4.6	45.7
19.00	3	2.0	2.0	47.7
20.00	3	2.0	2.0	49.7
21.00	2	1.3	1.3	51.0
22.00	6	4.0	4.0	55.0
23.00	4	2.6	2.6	57.6
24.00	2	1.3	1.3	58.9
25.00	8	5.3	5.3	64.2
26.00	3	2.0	2.0	66.2
27.00	3	2.0	2.0	68.2
28.00	2	1.3	1.3	69.5
29.00	1	0.7	0.7	70.2
30.00	4	2.6	2.6	72.8
31.00	4	2.6	2.6	75.5
32.00	1	0.7	0.7	76.2
34.00	2	1.3	1.3	77.5
35.00	3	2.0	2.0	79.5
36.00	4	2.6	2.6	82.1
37.00	2	1.3	1.3	83.4
39.00	1	0.7	0.7	84.1

Table A4--Cont'd.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
40.00	2	1.3	1.3	85.4
41.00	2	1.3	1.3	86.8
42.00	1	0.7	0.7	87.4
43.00	2	1.3	1.3	88.7
45.00	1	0.7	0.7	89.4
46.00	1	0.7	0.7	90.1
48.00	1	0.7	0.7	90.7
49.00	1	0.7	0.7	91.4
50.00	1	0.7	0.7	92.1
52.00	2	1.3	1.3	93.4
54.00	1	0.7	0.7	94.0
55.00	1	0.7	0.7	94.7
56.00	1	0.7	0.7	95.4
58.00	1	0.7	0.7	96.0
59.00	1	0.7	0.7	96.7
61.00	1	0.7	0.7	97.4
62.00	2	1.3	1.3	98.7
63.00	1	0.7	0.7	99.3
91.00	1	0.7	0.7	100.0
Total	151	100.0	100.0	

Table A5--Age Frequencies--Males.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
13.00	7	10.4	10.4	10.4
14.00	9	13.4	13.4	23.9
15.00	15	22.4	22.4	46.3
16.00	13	19.4	19.4	65.7
17.00	14	20.9	20.9	86.6
18.00	7	10.4	10.4	97.0
19.00	2	3.0	3.0	100.0
Total	67	100.0	100.0	

Table A6--Spatial Ability Frequencies--Males.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
4.00	3	4.5	4.5	4.5
5.00	6	9.0	9.0	13.4
6.00	5	7.5	7.5	20.9
7.00	11	16.4	16.4	37.3
8.00	7	10.4	10.4	47.8
9.00	10	14.9	14.9	62.7
10.00	12	17.9	17.9	80.6
11.00	10	14.9	14.9	95.5
12.00	2	3.0	3.0	98.5
13.00	1	1.5	1.5	100.0
Total	67	100.0	100.0	

Table A7--Abstract Thinking Frequencies--Males.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
8.00	2	3.0	3.0	3.0
9.00	1	1.5	1.5	4.5
10.00	1	1.5	1.5	6.0
11.00	1	1.5	1.5	7.5
12.00	3	4.5	4.5	11.9
13.00	2	3.0	3.0	14.9
14.00	4	6.0	6.0	20.9
15.00	15	22.4	22.4	43.3
16.00	14	20.9	20.9	64.2
17.00	12	17.9	17.9	82.1
18.00	9	13.4	13.4	95.5
19.00	2	3.0	3.0	98.5
20.00	1	1.5	1.5	100.0
Total	67	100.0	100.0	

Table A8--Self-Reported Criminality Frequencies--Males.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
1.00	1	1.5	1.5	1.5
3.00	1	1.5	1.5	3.0
4.00	1	1.5	1.5	4.5
7.00	1	1.5	1.5	6.0
9.00	1	1.5	1.5	7.5
10.00	1	1.5	1.5	9.0
12.00	2	3.0	3.0	11.9
13.00	1	1.5	1.5	13.4
14.00	1	1.5	1.5	14.9
15.00	2	3.0	3.0	17.9
16.00	2	3.0	3.0	20.9
17.00	2	3.0	3.0	23.9
18.00	4	6.0	6.0	29.9
19.00	1	1.5	1.5	31.3
20.00	1	1.5	1.5	32.8
21.00	2	3.0	3.0	35.8
22.00	3	4.5	4.5	40.3
23.00	3	4.5	4.5	44.8

Table A8--Cont'd.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
24.00	1	1.5	1.5	46.3
25.00	4	6.0	6.0	52.2
26.00	1	1.5	1.5	53.7
27.00	1	1.5	1.5	55.2
28.00	1	1.5	1.5	56.7
31.00	2	3.0	3.0	59.7
34.00	1	1.5	1.5	61.2
36.00	3	4.5	4.5	65.7
37.00	1	1.5	1.5	67.2
40.00	1	1.5	1.5	68.7
41.00	2	3.0	3.0	71.6
42.00	1	1.5	1.5	73.1
43.00	1	1.5	1.5	74.6
45.00	1	1.5	1.5	76.1
46.00	1	1.5	1.5	77.6
48.00	1	1.5	1.5	79.1
49.00	1	1.5	1.5	80.6
50.00	1	1.5	1.5	82.1
52.00	2	3.0	3.0	85.1
54.00	1	1.5	1.5	86.6

Table A8--Cont'd.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
55.00	1	1.5	1.5	88.1
56.00	1	1.5	1.5	89.6
58.00	1	1.5	1.5	91.0
59.00	1	1.5	1.5	92.5
61.00	1	1.5	1.5	94.0
62.00	2	3.0	3.0	97.0
63.00	1	1.5	1.5	98.5
91.00	1	1.5	1.5	100.0
Total	67	100.0	100.0	

Table A9--Age Frequencies--Females.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
12.00	2	2.4	2.4	2.4
13.00	3	3.6	3.6	6.0
14.00	11	13.1	13.1	19.0
15.00	16	19.0	19.0	38.1
16.00	16	19.0	19.0	57.1
17.00	19	22.6	22.6	79.8
18.00	13	15.5	15.5	95.2
19.00	4	4.8	4.8	100.0
Total	84	100.0	100.0	

Table A10--Spatial Ability Frequencies--Females.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
0.00	1	1.2	1.2	1.2
3.00	1	1.2	1.2	2.4
4.00	1	1.2	1.2	3.6
5.00	5	6.0	6.0	9.5
6.00	7	8.3	8.3	17.9
7.00	8	9.5	9.5	27.4
8.00	11	13.1	13.1	40.5
9.00	15	17.9	17.9	58.3
10.00	18	21.4	21.4	79.8
11.00	9	10.7	10.7	90.5
12.00	8	9.5	9.5	100.0
Total	84	100.0	100.0	

Table A11--Abstract Thinking Frequencies--Females.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
6.00	1	1.2	1.2	1.2
8.00	3	3.6	3.6	4.8
10.00	1	1.2	1.2	6.0
11.00	6	7.1	7.1	13.1
12.00	2	2.4	2.4	15.5
13.00	9	10.7	10.7	26.2
14.00	8	9.5	9.5	35.7
15.00	10	11.9	11.9	47.6
16.00	10	11.9	11.9	59.5
17.00	9	10.7	10.7	70.2
18.00	17	20.2	20.2	90.5
19.00	6	7.1	7.1	97.6
20.00	2	2.4	2.4	100.0
Total	84	100.0	100.0	

Table A12--Self-Reported Criminality Frequencies--Females.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
0.00	2	2.4	2.4	2.4
1.00	3	3.6	3.6	6.0
2.00	4	4.8	4.8	10.7
3.00	2	2.4	2.4	13.1
4.00	2	2.4	2.4	15.5
5.00	4	4.8	4.8	20.2
6.00	2	2.4	2.4	22.6
7.00	4	4.8	4.8	27.4
8.00	3	3.6	3.6	31.0
9.00	1	1.2	1.2	32.1
10.00	3	3.6	3.6	35.7
11.00	6	7.1	7.1	42.9
12.00	2	2.4	2.4	45.2
13.00	1	1.2	1.2	46.4
14.00	2	2.4	2.4	48.8
15.00	2	2.4	2.4	51.2
16.00	1	1.2	1.2	52.4
17.00	2	2.4	2.4	54.8

Table A12--Cont'd.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
18.00	3	3.6	3.6	58.3
19.00	2	2.4	2.4	60.7
20.00	2	2.4	2.4	63.1
22.00	3	3.6	3.6	66.7
23.00	1	1.2	1.2	67.9
24.00	1	1.2	1.2	69.0
25.00	4	4.8	4.8	73.8
26.00	2	2.4	2.4	76.2
27.00	2	2.4	2.4	78.6
28.00	1	1.2	1.2	79.8
29.00	1	1.2	1.2	81.0
30.00	4	4.8	4.8	85.7
31.00	2	2.4	2.4	88.1
32.00	1	1.2	1.2	89.3
34.00	1	1.2	1.2	90.5
35.00	3	3.6	3.6	94.0
36.00	1	1.2	1.2	95.2
37.00	1	1.2	1.2	96.4
39.00	1	1.2	1.2	97.6
40.00	1	1.2	1.2	98.8

Table A12--Cont'd.

Code	Absolute Frequency	Relative Frequency (PCT)	Adjusted Frequency (PCT)	Cumulative Frequency (PCT)
43.00	1	1.2	1.2	100.0
Total	84	100.0	100.0	

Illustration A1

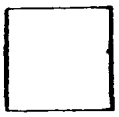
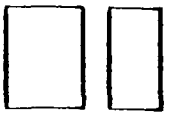
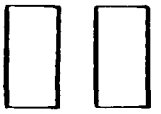
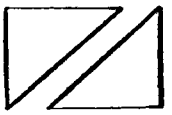
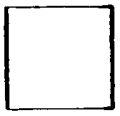
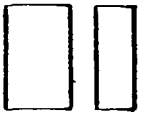
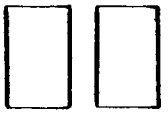
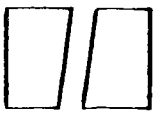
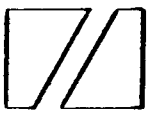
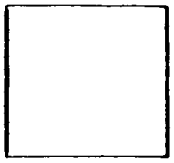
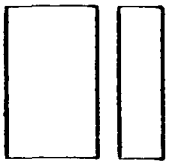
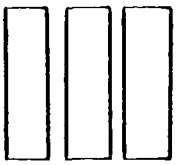
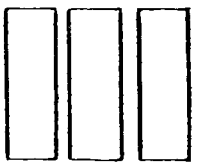
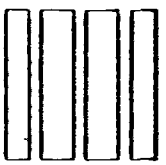
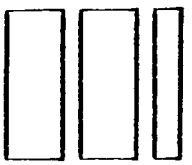
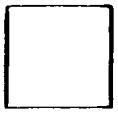
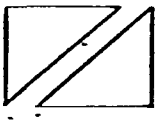
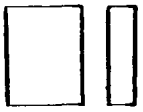
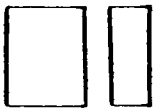
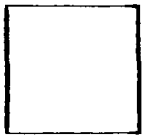
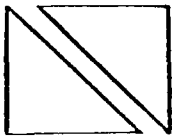
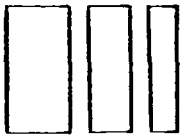
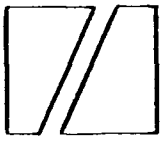
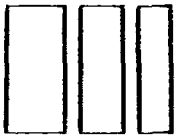
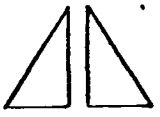
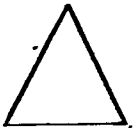
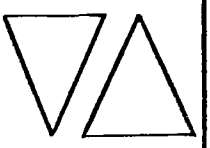
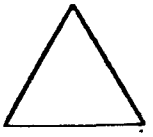
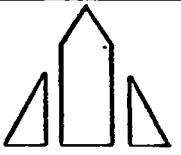
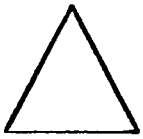
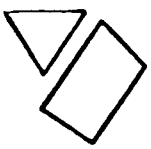
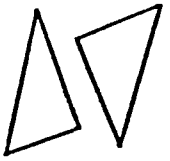
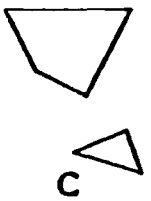
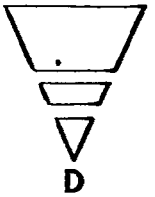
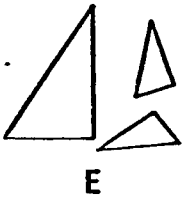
Please do not write your name. Write your age (at your last birthday) and your sex.

Age ____ Sex ____

Please do not start until instructed to do so and when instructed to stop please do so.

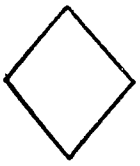
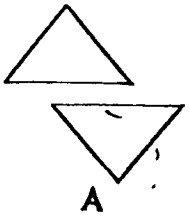
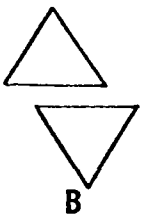
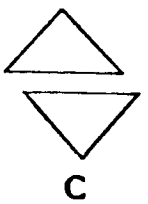
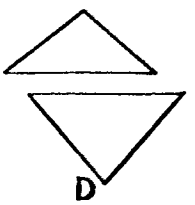
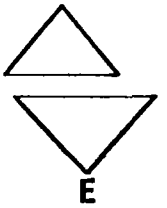
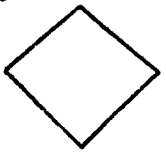
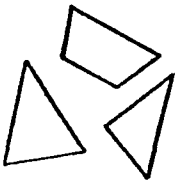
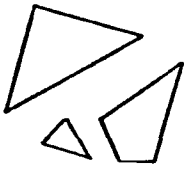
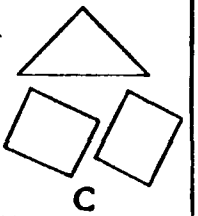
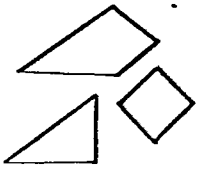
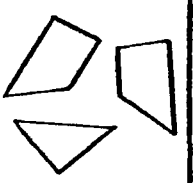
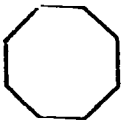
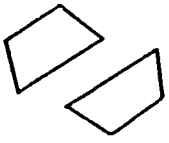
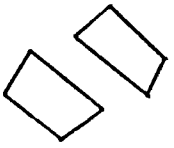
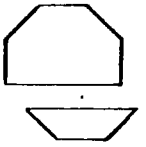
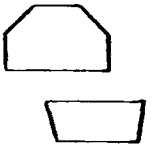
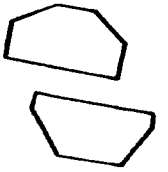
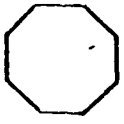
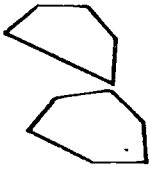
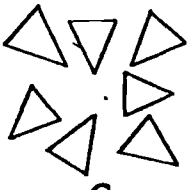
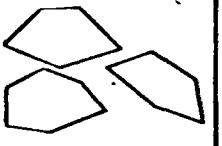
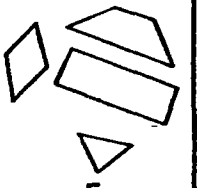
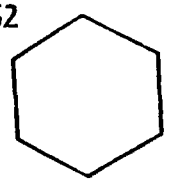
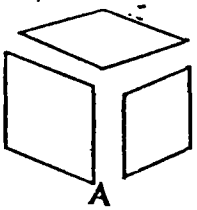
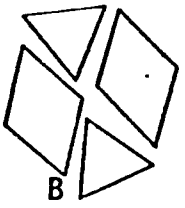
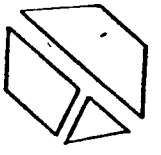
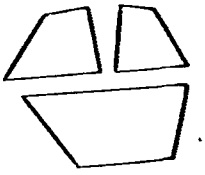
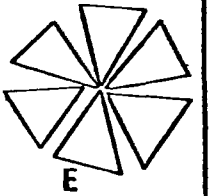
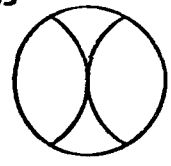
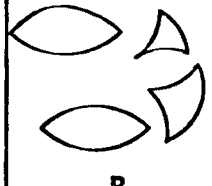
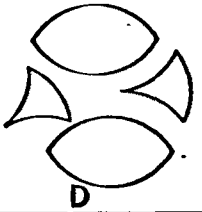
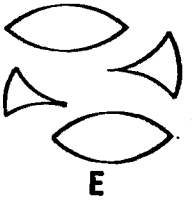
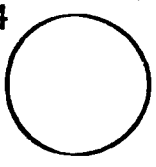
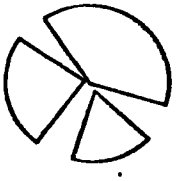
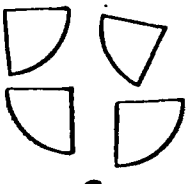
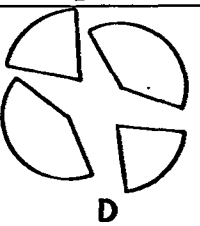
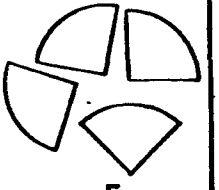
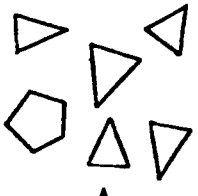
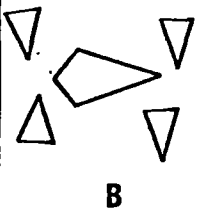
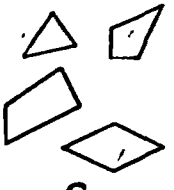
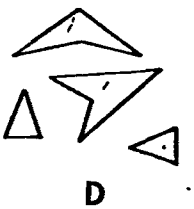
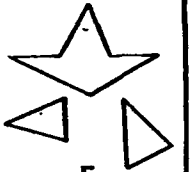
TEST IV. SPATIAL RELATIONSHIPS

51-65. DIRECTIONS: In the spaces at the right, write the letter of the group of pieces which, when put together, will make up the figure at the left. In the first section below, the pieces in space B when put together, make up the Sample Figure at the left. Therefore, the letter B has been placed on the line at the right. Do the same with the sections that follow.

 SAMPLE	 A	 B	 C	 D	 E	B
51 	 A	 B	 C	 D	 E	51
52 	 A	 B	 C	 D	 E	52
53 	 A	 B	 C	 D	 E	53
54 	 A	 B	 C	 D	 E	54
55 	 A	 B	 C	 D	 E	55
56 	 A	 B	 C	 D	 E	56
57 	 A	 B	 C	 D	 E	57

TURN TO NEXT PAGE AND CONTINUE

TEST IV. Continued

58 	A 	B 	C 	D 	E 	58____
59 	A 	B 	C 	D 	E 	59____
60 	A 	B 	C 	D 	E 	60____
61 	A 	B 	C 	D 	E 	61____
62 	A 	B 	C 	D 	E 	62____
63 	A 	B 	C 	D 	E 	63____
64 	A 	B 	C 	D 	E 	64____
65 	A 	B 	C 	D 	E 	65____

Test IV. Score (number right)_____
(Include both pages 6 and 7)

Illustration A3

EXPERIMENTAL VERSION

Complete the following. Each dash (_) calls for either a number or a letter to be filled in. Every line is a separate item. Take the items in order, but do not spend too much time on any one.

1. 1 2 3 4 5 _
2. white black short long down _ _
3. AB BC CD D_
4. Z Y X W V U _
5. 12321 23432 456_ _
6. NE/SW SE/NW E/W N/_
7. escape scape cape _ _ _
8. oh ho rat tar mood _ _ _ _
9. A Z B Y C X D _
10. tot tot bard drab 537 _ _ _
11. mist is wasp as pint in tone _ _
12. 57326 73265 32657 26573 _ _ _ _ _
13. knit in spud up both to stay _ _
14. Scotland lanscape scapegoat _ _ _ _ee
15. surgeon 1234567 snore 17635 rogue _ _ _ _ _
16. tam tan rib rid rat raw hip _ _ _
17. tar pitch throw saloon bar rod fee tip end plank _ _ _ _ _ meals

Illustration A3--Cont'd.

18. 3124 82 73 154 46 13_

19. lag leg pen pin big bog rob _ _ _

20. two w four r one o three _

21. 73 145 289 _ _ _

22. abcde bcdae cdaeb daecb _ _ _ _ _

Illustration A4

The Questionnaire contains some activities which you may have been involved in sometimes. Please answer these questions frankly and be careful to answer all of them, but please do not boast about things you have done or have not done. Your answers can in no way be traced back to you, since you do not write your name.

If you make a mistake, please change your answer by stroking out the X and place it in the proper position.

Example--Have you ever filled this questionnaire out before?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

Illustration A4--Cont'd.

ACTS

1. Have you ever ridden a bicycle without lights (or with no rear light) after dark?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

2. Have you ever driven a car, motor bike or motor scooter under the age of 16?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

3. Have you ever belonged to a group (5 people or more) who go around together, making a row, and sometimes get into fights or cause a disturbance?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

4. Have you ever played truant from school?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

5. Have you ever deliberately travelled on a bus, etc., without a ticket or paying the wrong fare?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

6. Have you ever let off fireworks in the street?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

7. Have you ever taken money from home with no intention of returning it?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

Illustration A4--Cont'd.

8. Have you ever taken an unknown person's car or motor bike for joyriding (with no intention of keeping it for good)?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

9. Have you ever smashed, slashed or damaged things in public places--in streets, cinemas, dance halls, railway carriages, buses, etc.?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

10. Have you ever annoyed, insulted or assaulted other people (strangers) in the street?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

11. Have you ever broken into a big store, garage, warehouse, pavillon, etc.?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

12. Have you ever broken into a small shop, candy store or corner grocery whether or not anything was stolen?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

13. Have you ever stolen things out of cars?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

14. Have you ever carried any kind of weapon in case it was needed in a fight: such as a knife, blackjack, bicycle chain, razor or broken bottle?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

Illustration A4--Cont'd.

15. Have you ever attacked a person (without using any sort of weapon) in a public place?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

16. Have you ever broken the windows of an empty house?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

17. Have you ever used any kind of weapon in a fight--knife, razor, broken bottle, etc.?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

18. Have you ever drunk alcoholic beverages in hotels or pubs under the age of 18?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

19. Have you ever gone into pub bars under the age of 16?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

20. Have you ever stolen things from big stores, supermarkets, multiple shops (while shop was open)?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

21. Have you ever stolen things from small shops or private tradesmen (while the shop was open)?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

22. Have you ever bought or accepted as a present, anything known or suspected of being stolen?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

Illustration A4--Cont'd.

23. Have you ever deliberately littered the streets or pavement by smashing bottles, tipping garbage cans, etc.?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

24. Have you ever planned well in advance to get into a house, flat, etc., and steal valuables (and carried the plan through)?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

25. Have you ever got into a house, flat, etc., and stolen things (do not count cases where stealing results from planning well in advance)?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

26. Have you ever taken a bicycle belonging to another person and kept it?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

27. Have you ever struggled or fought to get away from a policeman?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

28. Have you ever stolen school property worth more than two dollars?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

Illustration A4--Cont'd.

29. Have you ever attacked or fought with a policeman who is trying to arrest someone else?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

30. Have you ever stolen tools, materials or any other goods worth more than five dollars from a place where you work during working hours (do not count breaking-in here)?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

31. Have you ever trespassed (examples--railway lines, goods yards, private gardens, empty houses)?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

32. Have you ever gone to a movie that was restricted and you were under age?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

33. Have you often spent three dollars or more a week on gambling under the age of sixteen?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

34. Have you been regularly smoking cigarettes under the age of fifteen?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

35. Have you ever stolen goods or money from slot machines, telephones, juke boxes, etc.?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

Illustration A4--Cont'd.

36. Have you ever stolen from people's clothes hanging up anywhere?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

37. Have you ever obtained money by false pretences (that is by getting someone to believe something that was false, in order to get his money)?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

38. Have you ever taken LSD, mescaline, speed, marijuana, or hash?

never ___ 1-3 times ___ 4-9 times ___ 10 or more times ___

Illustration A5

CLASSIFICATION OF ITEMS ON SELF-REPORT SCALE

1.	minor	20.	minor
2.	underage	21.	minor
3.	aggressive	22.	minor
4.	underage	23.	minor
5.	minor	24.	theft
6.	minor	25.	theft
7.	no category	26.	theft
8.	theft	27.	aggressive
9.	minor	28.	minor
10.	aggressive	29.	aggressive
11.	theft	30.	minor
12.	theft	31.	minor
13.	theft	32.	underage
14.	aggressive	33.	underage
15.	aggressive	34.	underage
16.	minor	35.	minor
17.	aggressive	36.	minor
18.	underage	37.	no category
19.	underage	38.	no category

ABSTRACT

SPATIAL ABILITY AND CRIMINALITY

Contending that criminality is related to socialization, Eysenck postulated that socialization is essentially a matter of conditioning and whether a person will act in a law-abiding prosocial manner depended on the amount and the type of conditioning to which he is exposed. A review of the literature, however, indicates an insufficiency of empirical support for the thesis, probably due to the use of inappropriate measures of conditionability. The relationship between spatial ability and conditionability is such as to suggest the desireability of using spatial ability as a measure of conditionability. Following this cue, this study seeks to test the hypothesis that spatial ability is negatively related to criminality. The hypothesis is tested using the spatial relations measure, obtained from the Prognostic Test of Mechanical Ability and the Willcock scale of self-reported criminality, as reviewed by Gibson, as a measure of criminality. In addition to these two instruments, Shipley's abstract thinking test was used as a control measure for intelligence. This instrument was included because it was suggested in the literature that intelligence is strongly related to spatial ability. Controls were also made for sex and age.

The sample consisted of 151 high school students from Ottawa, Ontario. There were 67 males and 84 females. The students were tested during a regular forty minute class.

The analysis was done using two computer programmes: Step-Wise Multiple Regression and Pearson Product Moment Correlation. Both computer programmes were obtained from the SPSS manual.

The spatial ability-criminality hypothesis was supported for the male subjects of the study ($r = -.53$, p .00001). The results for the female subjects did not reach significance, however, the results were in the predicted direction ($r = -.16$, p. .06). It was found that intelligence, as measured by the abstract thinking test was not highly related to spatial ability as suggested by the literature. The result indicated that the variables shared only 4 percent of common criterion variance ($r = .20$, p .005).

Of the four independent variables--spatial ability, sex, age and abstract thinking--only two of the variables appear to be required to predict the dependent variable of self-reported criminality. The two variables are sex and spatial ability.