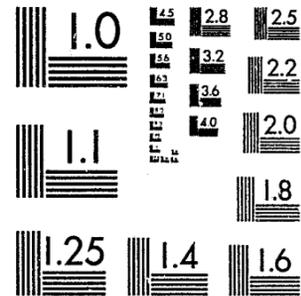


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Analysis of Two Danish Data Sets

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Terrie E. Moffitt
and
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Section V of the Final Report
of Grant 80-IJ-CX-0055-*:
Exploring Guidelines for Specific
Deterrence Theory: Early Sanctions
in the Juvenile Justice System

Malcolm W. Klein and Sarnoff A. Mednick
University of Southern California
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Abstract

This research tests the hypothesis that delinquents who desist from further delinquent acts following their first justice system contact may be different from recidivistic juvenile offenders on some biological, psychological, or social variables. If these variables discriminate the one-time offender from the non-offender prospectively (before onset of delinquent behavior) we may propose that the variables predispose the one-time offender to be more sensitive than the recidivist to the deterrent effects of negative sanctions applied by the justice system.

Study 1 used a birth cohort of 4,267 Danish males to examine the relationship of perinatal factors to the one-time offender recidivist dichotomy. We hypothesized that one-time offenders would have suffered more perinatal complications than recidivists, because perinatal complications have been shown to relate positively to autonomic nervous system (ANS) sensitivity, and ANS sensitivity may predispose children to be susceptible to the deterrent effects of punishment. Results did not disconfirm this hypothesis. In addition, analyses of constructed scales reflecting motor development and size development by one year of age showed that the one-time offender is both smaller and more precocious in development of motor skills during early childhood than are both non-offenders and recidivists.

Using a subset of 129 males from the Danish birth cohort, Study 2 examined the differences between one-time and recidivist offenders on a number of variables measured during preadolescence. Family status, school adjustment, IQ, empathic ability, neurological status, EEG measures of CNS activity, and skin conductance measures of ANS

responsiveness were considered. One-time offenders were significantly different from recidivists in family status, school adjustment, WISC verbal IQ, WISC full IQ, Feffer Empathy, and one subtest of the neurological examination. It is also noted that the one-time offenders scored "better" on family status, school adjustment and empathy, and had more neurological abnormalities than did non-offenders, as well as recidivists. A regression model constructed of these variables yielded significant R of .48, but replication may reduce this R value.

In terms of our original hypothesis, the results of Study 1 and Study 2 suggest that an individual who desists from delinquent behavior after one justice system contact shows more evidence of characteristics associated with sanction sensitivity than both the recidivistic offender and the non-offender. The report culminates with suggestions for future investigation, including replication of the present results and examination of the interactions between biological and social variables in producing sanction sensitivity.

Analyses of Two Danish Data Sets

Introduction

Most researchers are of the opinion that the juvenile justice system's sanctions are not effective in controlling crime. They point out that 50% of initial offenders go on to commit additional offenses. From the same data, however, it could also be hypothesized that the juvenile justice system's sanctions are actually quite effective; after all, one might assert, 50% of offenders are so affected by initial justice system sanctioning that they desist from additional offenses. It could be instructive to consider ways in which the assertion that the justice system works relatively effectively might be put to empirical test. If we assume, for the moment, that the 50% of first offenders who go on to remain offense-free, are being responsive to interventions by the justice system, what mechanisms might we posit for this effectiveness? Assuming (for the purpose of discussion) a rather even-handed application of the justice system to first-time delinquents, the reasons that half of the first-time delinquents desist from further illegal activity may lie with characteristics they share or the interaction of such characteristics with the behavior of the justice system. Delinquents who are deterred from further offending after an initial encounter with the justice system may bring to the encounter some early experiences or personal characteristics which render them more sensitive to the negative sanctions applied by the justice system than are similarly treated delinquents who continue to offend.

One approach to examining our "assertion" is to compare one-time offenders with recidivists on variables theoretically related to sensitivity to sanctions. It is necessary that such characteristics be assessed prior to the delinquents' initial encounter with the justice system. When differences are found between one-time offenders and recidivistic offenders on variables assessed after the subjects' arrests we cannot rule out the possibility that such differences have resulted from dissimilar amounts of contact with the justice system. In the context of two prospective longitudinal studies of Danish birth cohorts we were able to hypothesize certain subject characteristics that might make it more likely that delinquent subjects will be impacted by the actions of the justice system. This report compares, on a number of these variables, delinquents who offended only once with delinquents who reoffended. The relative status on these variables of a third group, non-offenders, is also presented for purposes of comparison with the two delinquent groups.

Two studies will be separately described in this report. Study 1 examines the differences between one-time offenders, recidivists, and non-offenders on some variables from early childhood. Study 2 investigates differences between these groups on a number of variables which were assessed in early adolescence. Within the Methods sections of both studies, brief rationales explaining our interest in (and hypotheses about) each variable will precede description of the procedures used in measuring the variable. The report culminates in a joint discussion of the conclusions and implications from the two studies.

Study 1: Variables From Birth and Early ChildhoodMETHOD

Subjects. In 1959 a prospective longitudinal study began which included all 9,125 infants delivered between September 1, 1959 and December 31, 1961 at the University Hospital (Rigshospitalet) in Copenhagen, Denmark (Zachau-Christiansen and Ross, 1975). Extensive data were recorded concerning the prenatal social and health status of the subjects' mothers, the birth process, and physical and neurological status of the subjects.

Because of the special facilities available at Rigshospitalet, and because of its location in the center of the city, the mothers of subjects in the cohort were more often referred to the hospital for problem pregnancies, were of lower social class and more often unmarried than the general population of Danish mothers. Delinquency is relatively rare among the female offspring of the cohort; the present study includes only the 4,267 male live births. This study reports on the relationships between perinatal measures recorded in the period from 1959 to 1962 and registered delinquency assessed in 1978.

Variables. The following variables were used in Study 1.

a. Delinquency. The number of dates recorded in the Danish National Police Register upon which each subject was charged with an offense serves as the measure of delinquency. There is no juvenile justice system in Denmark, and official recording of offenses begins at the fifteenth birthday. In addition to the

date of each violation, the paragraph of Danish law which was violated is recorded, allowing for classification by types of offense. Subjects were categorized by whether they had no record of offenses, a record of only one offense, or a record of two or more offenses. Only subjects who had spent at least six months offense-free between their single offense and the time of data collection were included in the one-time offender group. This criterion assured that the juveniles included in the one-time offender group had experienced sufficient time in which to reoffend.

b. Perinatal factors.

b.1. Rationale for study. Neurological problems have been reported to be more frequent among delinquents than non-delinquents in some studies (Thompson, 1953, 1961; Stott, 1969). It has been suggested that the relationship found between neurological dysfunction and delinquency may be the result of impaired capacity for modulation and control of behavior by the brain (White, 1964). Perinatal complications can be an important source of neurological dysfunction (Stott, 1962), and retrospective studies exist which have found delinquents to have suffered more pregnancy and birth complications (PBC) than non-delinquents (Pasamanick and Knobloch, 1960, 1966; Drillien, 1964). It should also be noted that no PBC/delinquency relationship was found in a 1954 study by Pasamanick. There are implications from a PBC/neurological dysfunction/delinquency hypothesis for the one-time offender. If PBC-induced neurological dysfunctions impair

the brain's capacity for modulating behavior, including responses to justice system actions, we might expect recidivistic offenders to have more PBC's in their perinatal histories than one-time offenders, whose response to correction is more appropriate.

An opposing hypothesis, that one-time offenders have experienced more PBCs than recidivists, is also possible. In earlier studies, Mednick (1970) has noted a positive relationship between number and severity of PBCs and level of autonomic nervous system (ANS) responsiveness. Level of ANS responsiveness has been shown very reliably to predict to, and be positively associated with, law abiding behavior. A theory has been proposed that links specific aspects of ANS responsiveness with aptitude to learn inhibition of antisocial behavior (Mednick, 1977). Those with high levels of ANS responsiveness have an aptitude for learning to avoid antisocial behavior if they receive contingent punishment (from parents, peers, or the criminal justice system) for such acts. We may predict that those with higher levels of PBCs would have more responsive ANSs, be more affected by official sanctions, and be more likely to desist from delinquent behavior following a single contact with the juvenile justice system.

b.2. Perinatal item variables. A total of 1,734 items were recorded for each subject in the course of documenting the parents' social and civil status, maternal reproductive history, maternal health and prenatal care, pregnancy and delivery complications and procedures, infant's condition at birth, results of physical and neurological examinations at one day and five days

of age, medical care, accidents and illnesses experienced during the first year, and physical, neurological, and motor development status at one year of age.

b.3. Perinatal Composite Scores. In order to reduce these data to a more manageable group of variables, 8 sets of symptom composite scores were developed with the collaboration of American and Danish obstetricians and pediatric neurologists. Each set includes three scores. A "frequency" score is a count of the number of problem symptoms noted. The "problem of highest severity" score provides a measure of the magnitude of the subjects' most severe symptom. Values for this second score ranged from 1 (denoting mild level of severity) to 5 (denoting serious level of severity). Third, the "weighted score" for each scale was calculated accounting for severity of the symptom noted. Each symptom was given points for severity ranging from 1 to 5 and these points were added for all symptoms to give a score for each subject. The eight sets of three composite scores are labelled:

- predisposing factors
- pregnancy complications
- delivery complications
- neonatal physical status
- neonatal neurological status
- one-year physical status
- one-year neurological status
- one year motor development status

These sets of composite scores have been used in previous research (Mednick, Mura, Schulsinger, and Mednick, 1971; Mednick, 1977). See Appendix A for a description of these scores.

RESULTS

Perinatal Composite Scores. Table 1 shows the mean perinatal composite scores for boys having zero, one or more than one offense date. Only those scores are reported for which analysis of variance yielded Fs significant beyond the .01 criterion. The Predisposing Factors score primarily reflects the mother's social conditions prior to onset of the pregnancy. The mothers of recidivists experienced a greater mean number of these adverse conditions than did mothers of one-time offenders, who in turn experienced more predisposing factors than did mothers of non-offenders. Results for all remaining scales indicate that birth, neonatal status, and status at one year of age were relatively less stressful for recidivists than for one-time offenders, who had experienced fewer of these early difficulties than the non-offender group.

Confounding variables. The possibility was investigated that confounds might exist in these results from certain variables known to relate to delinquency. Because of the nature of Rigshospitalet policy, a relatively large proportion of the mothers in the cohort were unmarried at the time of their pregnancies. The unmarried mothers were somewhat more likely to be young, and to have delinquent sons, than the married mothers of the cohort. Age of mother is positively related to perinatal problems in this cohort. It was possible that the relatively positive perinatal status found among the delinquent groups was partly the result of the youth of these unmarried mothers. Ana-

lyses of variance were performed for the perinatal composite scores controlling for effects of the mother's age. All differences shown in Table 1 remained significant ($p < .01$).

Because the Predisposing Factors score represents a number of items concerning the social environment of the mother, we inquired to what extent Predisposing Factors scores were related to the perinatal composite scores shown in Table 1. No significant Pearson correlations between Predisposing Factors and these variables were obtained.

Finally, it was proposed that some number of individuals may have been handicapped by perinatal damage to the extent that they were physically unable to engage in delinquent acts, therefore inflating the amount of perinatal symptomatology reported for the non-offender groups. All boys ($N = 112$) were identified whose perinatal histories included record of symptoms, diseases, or perinatal injury judged by Mednick to be severe enough that delinquent involvement would be improbable. When these subjects were excluded from analyses, all differences reported in Table 1 remained significant.

Insert Table 1 about here

Individual item analysis. We wished to determine which of the original individual perinatal items were contributing to the differences found for the groups on the composite scores listed in Table 1. The individual perinatal items which had composed the composite scores for Predisposing Factors, Delivery Condi-

tions, Neonatal Physical Exam, Neonatal Neurological Exam, One-Year Neurological Exam, and One-Year Motor Development were selected for chi square analysis across the three subject groups. Fifty-two of these items yielded chi square values significant beyond the .01 alpha level. (See Appendix B for a list of these items.) Factor analysis of these items was attempted, but distribution problems made such an approach fruitless. This lack of success matches an earlier experience with these same data (B. Mednick, in press).

Constructed perinatal scales. As an alternative approach, two scales were constructed which represent rate of motor development and size development assessed at one year. Scale construction was conducted using one randomly selected half of the subjects, and cross validation was conducted with the remaining subjects. Items judged to represent physical development were selected from the large pool on a rational basis, and then subjected to an item analysis which attempted to maximize coefficient alpha (Cronbach, 1951) by emphasizing biserial correlations between items and scale totals. This analysis allowed us to drop items from the scales which did not maximize alpha. The final scale for rate of motor development includes the months at which each subject began to sit up, crawl, stand, and walk. The size development scale consists of weight, height, chest circumference, and number of teeth present at the time of the one-year examination. For the four-item motor development scale, Cronbach's coefficient alpha, a measure of the internal consistency

(reliability) of the scale, was .74. For the size development scale, with four items, alpha was also .74. The scale scores were standardized, with a mean of 0 and a standard deviation of 1, so that group means reflect group deviation from the population mean. Group means and results of analyses of variance for these two scales are presented in Table 2. (Scale construction and analysis of variance were successfully replicated using the remaining half of the sample. Results presented in Table 2 are from the initial analyses). For the measure of development in size during the first year, the one-time offenders were smaller on the average than the non-offenders. Recidivists were the group most greatly developed in size by age 1. Means for motor development show that the one-time offender displayed motor skills such as crawling, sitting, standing, and walking a good deal earlier in their first years than did recidivists and non-offenders. Thus, the average future one-time offender seems to be both smaller and more precocious in motor behavior during early childhood than are the average future non-offenders and recidivists.

The scales of motor and size development were submitted to discriminant analysis of the one-time offender and recidivist offender groups. This attempt yielded a 49% error rate in discrimination, suggesting that these variables are not of practical significance in predicting which individuals will desist from further delinquent involvement following their first offense. It is, however, notable that these perinatal variables do predict delinquency, despite a 15 to 20 year time span.

 Insert Table 2 about here

Analyses within offense types. Analyses of variance of the perinatal composite scores were also performed on subjects of the cohort who had committed (1) only traffic violations, (2) only theft, or (3) violent offenses. Very few subjects had engaged in violence to the exclusion of other offense types. Therefore, subjects included in the one-time and recidivist violent offender group may also have committed one or more non-violent offenses. Table 3 reports these results. Only those scores are reported for which analysis of variance yielded Fs significant beyond the .01 criterion.

Table 3 shows that, although fewer significant differences were found for composite scores when groups were defined within offense types, differences found to be significant among traffic offenders and thieves were in the same direction as the differences reported in Table 1 for the whole cohort. Subjects with only a single traffic violation scored somewhat more poorly in motor development at one year of age than subjects with multiple traffic offenses. Subjects with no offenses fared even more poorly in motor development than the one-time traffic offenders. Recidivistic theft offenders appeared to be characterized by less severe conditions during their mother's pregnancies than did one-time theft offenders, who had less severe pregnancy problems than the non-offender group.

For the cohort as a whole, subgroups of traffic offenders and subgroups of theft offenders, recidivist groups have repeatedly been found to be characterized by more healthy perinatal conditions than one-time offender groups, who are in turn characterized by more healthy perinatal conditions than the non-offender groups. Results for the violent subgroups provide an exception to this pattern. Table 3 shows that recidivistic violent offenders are not more healthy at the one-year neurological examination than one-time violent offenders. Within the violent offenders, recidivists and non-offenders score similarly and relatively more poorly than do one-time offenders.

 Insert Table 3 about here

Study 2: Variables from early adolescence

METHOD

Subjects. The project began in 1972 with a group of 265 children who were intensively examined during that year (Mednick, et al., 1971). The subjects of the second study were drawn from the same Danish birth cohort used in Study 1. A group of 144 of the children were selected because they were judged to be at high risk for antisocial behavior; at least one of their parents had hospital records of deviance (schizophrenia, psychopathy, or character disorder). The remaining 121 subjects were controls; their parents had never had a psychiatric hospitalization. These controls were matched to the risk subjects for (1) sex of criterion parent, (2) sex of child, (3) race, (4) multiple birth sta-

tus, (5) pregnancy number, (6) social class, (7) mother's age, (8) mother's height, and (9) father's age. Because of the low number of females with official records of delinquency, only the 129 males were included in the present analysis. The final group of subjects consisted of 36 boys with a schizophrenic parent, 36 boys with a psychopathic father, or a character disordered mother, and 57 boys with parents who had never been admitted to a psychiatric hospital. This study reports the relationship between 1972 measures of social, psychological, and biological status and registered delinquency assessed in 1978.

Variables. Social, psychological, and biological variables were examined in Study 2.

a. Delinquency. Delinquency for individuals in the study involved primarily traffic and theft offenses, with a few instances of arrest for violent crimes. As a measure of delinquent involvement, the subjects were categorized by whether they had no registered offenses, one offense (with at least six offense-free months between the offense and the time at which the data were collected) or more than one offense registered in the Danish National Police Register.

b. Socioeconomic Status. SES was assessed by a scale derived from one developed by Svaastoga (1959), a Danish sociologist. The scale yields seven levels of SES based on the level of prestige associated with the occupation held by the subject's father in 1972.

c. Family Factors.

c.1. Rationale for Study. Among others, Reiss and Rhodes (1961) and more recently Hirschi (1969) have proposed that failure on the part of individuals to internalize adequate and appropriate sets of social norms may be a mechanism contributing to delinquency. The acquisition of such internalized standards of conduct is posited as being critical to the control of antisocial behavior. These theorists hypothesize that internalized control mechanisms are developed in the course of normal socialization and in the process of integration into conventional social groups. Thus the sociocultural environment in which an individual develops and the child-rearing techniques employed by his parents may play important roles in determining the extent to which an individual does internalize social norms. For those individuals for whom internalization of appropriate norms has been only partially successful (as evidenced by the fact that they have been apprehended once), a single unpleasant experience with the juvenile justice system may be sufficient to complete their appreciation of appropriate social rules. If parental child-rearing techniques do not include consistent delivery of contingent punishment for antisocial acts, internalization of norms may be impeded. There are a variety of factors which might be posited as restricting the consistency of parental punishment; absence of a parent, large family size, siblings very close in ages, institutional placement of the child, poor disciplinary habits of primary caretakers, and mother's employment outside the home are a few.

c.2. Scale of deviance from the ideal family. A social worker rated the family of each subject on a number of characteristics indicative of quality of the early home environment and parental supervision. In order to combine these variables into a single summary score and reduce measurement error, a scale was constructed from these characteristics which yields a single score for each subject representative of the extent to which his family was found to deviate from an "ideal" family (Gabrielli, 1981). Two judges chose 47 items reflective of this construct from the social worker's interview. A number of items were dropped from this pool because of linear dependence on other items, or because they were descriptive of less than 10% or more than 90% of the sample. Item analysis was performed using Spechts (1977) reliability program, and items were dropped if they did not contribute to the reliability of the scale through maximization of coefficient alpha. Seventeen items were retained; these are presented in Table 4.

 Insert Table 4 about here

Each subject receives a score on this scale which is standardized to have a mean of 10 and standard deviation of 1, where low scores indicate a more "socially" desirable family and high scores indicate a more deviant family. The scale has been cross-validated successfully using a second group of subjects (Gabrielli, 1981).

d. School Factors.

d.1. Rationale for Study. Hirschi and Hindelang (1977, p. 583) have stated that the significance of school variables for delinquency ". . . is nowhere in dispute and is, in fact, one of the oldest and most consistent findings of delinquency research." Advocates of strain theory and control theory have found the school experience to have an important relationship to delinquency (e.g. Elliott and Voss, 1974; Empey and Lubeck, 1971; Frease, 1973; Gold, 1963, 1970, 1978; Hirschi, 1969; Polk and Halferty, 1966; Rhodes and Reiss, 1969). The importance of school-related variables in the etiology of delinquency is firmly established. The role of the school as a variable affecting responsiveness to the deterrence actions of juvenile justice has not been so widely examined.

d.2. Scale of adjustment in school. Generally, the same scale construction procedure which was used in creating the family scale was followed in developing a scale of the teacher's assessment of subjects' school adjustment and performance (Switaj, in preparation). Questionnaires filled out by the subjects' math and Danish teachers were analyzed, yielding a final scale consisting of items presented in Table 5. The scale has a mean of 5.17, standard deviation of 3.22. Higher scores represent relatively greater evidence of positive adjustment in school and lower scores indicate less evidence.

 Insert Table 5 about here

e. Intelligence.

e.1. Rationale for Study. A number of studies have established the existence of a relationship between low IQ and delinquency (Prentice and Kelly, 1963; Eirschi and Hindelang, 1977; West and Farrington, 1973; Wolfgang, Figlio, and Sellin, 1972; Kirkegaard-Sorensen and Mednick, 1977). In addition, Moffitt, Gabrielli, Mednick, and Schulsinger (1981), Wolfgang et al. (1972), and West and Farrington (1973) reported higher IQs among one-time offenders than among recidivists. Most studies have found the largest IQ deficiency for delinquents to be in verbal IQ (see Prentice and Kelly, 1963 and Wechsler, 1958 for reviews). It is likely that relatively greater verbal intelligence will contribute to the one-time offenders' positive response to contact with the juvenile justice system. He is more likely to verbalize, and hence conceptualize and recall, the relationship between his antisocial act and its consequences.

e.2. The WISC. Five subtests of a Danish translation of the Wechsler Intelligence Scale for Children (WISC) were administered: Vocabulary, Similarities, Block Design, Object Assembly, and Mazes. Since no Danish norms existed for the WISC, American norms were used for the IQ scores, a common practice in Denmark.

f. Empathy.

f.1. Rationale for Study. A measure of the subjects' abilities to empathize with others was included among the psychological variables examined. In etiological considerations of criminality it may be hypothesized that individuals with impaired

ability to understand the impact on victims of criminal acts might be more willing to engage in such harmful acts. However, a somewhat different role may be hypothesized for empathic abilities in susceptibility to negative sanctions among first-time offenders. A boy who is high on empathic ability may be more likely to understand why agents of law enforcement are responding negatively to his delinquent act, and thus be more likely to decide to desist from further delinquency.

f.2. The Feffer Test. The measure of empathic ability used was the Feffer Test (Feffer, 1959). In this test the subject views a scene and is asked to make up a narrative describing his perception of the event that is taking place in the picture. The subject is next asked to tell a second story, describing the same situation, but from the perspective of one of the characters in the scene. Each subject receives a score (from one to three) reflecting the extent of similarity between the stories. Dissimilarity (a high score) is interpreted as reflecting a subject's ability to understand and relate events as they might be perceived by someone other than himself.

g. Neurological Factors.

g.1. Rationale for Study.

In the investigation of perinatal factors in Study 1 it was found that recidivists had experienced fewer pregnancy and birth complications (PBCs) than one-time offenders. Despite the fact that PBCs do not seem to be a source of neurological dysfunction for delinquents, such dysfunction from other sources may be

important in determining the strength of delinquent's behavioral controls. Previous studies have found neurological problems to be more prevalent among delinquents than among non-delinquents (Thompson, 1953, 1961; and Stott, 1969). We investigated the neurological symptoms detected during an examination of our subjects in early adolescence with the hypothesis that one-time offenders might evidence fewer signs of neurological impairment than recidivists.

g.2. Neurological Examination. A complete neurological examination was conducted in 1972 (Mednick and Michelsen, 1977). The examination consists partly of subtests from an adult neurological examination (Touwen and Prechtl, 1970), partly of pediatric neurological tests, and partly of motor control and development tests (Rutter, Graham and Yule, 1970; Bakwin, 1968; Stott, 1966).

h. Central Nervous System Factors.

h.1. Rationale for Study. A number of studies indicate that the EEGs of adult criminals are more frequently classified as abnormal than those of non-criminal subjects. Slowing of the EEG alpha frequency was a principal finding in these studies. In addition, Mednick, Volavka, Gabrielli, and Itil (1981) have reported that this slowing involved increased amounts of EEG slow alpha waves. The results of Mednick et al. (1981) supported an hypothesis that the EEG abnormalities noted may represent low CNS arousal among delinquents. Mednick (1977) has theorized that low arousal may attenuate the fear responses of children in discipli-

nary situations. Thus it is possible that EEG differences may contribute to the varying reactions of juveniles to justice system sanctions.

h.2. CNS Measures. Central nervous system activity was measured by electroencephalogram recording and analyses. Electrodes were placed over the right and left parietal, temporal, central and occipital areas. Eight EEG derivations were used; left and right temporoparietal, right and left central (ear as reference), right and left parietoccipital, and right and left occipital (ear as reference). The EEG used in this study was recorded while subjects were resting with their eyes closed. A Beckman Type R Dynograph was used for amplification and paper recording. Ten-minute EEG segments were also recorded on magnetic tape, and these tape records were later subjected to period analysis by Itil et al. (1974). For each of the eight derivations, the analysis yielded relative amounts (percentages) of activity in eight frequency bands (in Herz): 1.5 - 3.5, 3.5 - 5.5, 5.5 - 8.0, 8.0 - 10.0, 10.0 - 13.0, 13.0 - 18.0, 18.0 - 26.0, and above 26.0.

The frequency band associated with maturity and arousal for subjects in the age range of our subjects is the slow alpha band (8 - 10 Hz). Since the relative activity across the eight derivations within this band is essentially redundant for the purpose of this study (i.e., each measure can be taken as a separate measure of the same relative brain wave activity), a summary variable was constructed. The scores for each of the eight deriva-

tions within the slow alpha frequency band were summed to yield a single summary variable reflecting relative slow alpha EEG activity (Gabrielli, 1981). This summary variable is standardized with a mean of 10 and standard deviation of 1, where low scores suggest more slow alpha activity and high scores reflect relatively less alpha activity.

i. Autonomic responsiveness.

i.1. Rationale for Study. An incidental finding of a prospective, longitudinal study in Sweden noted that delinquents who reported being frightened by their first police contact tended to refrain from further antisocial activity. On the other hand, delinquents who stated that they were not frightened by their first police contact tended to become recidivists (Rydellius, 1981). Perhaps some personal characteristics of the first-time delinquent help determine whether he is frightened enough by his first police contact to discourage him from engaging in further anti-social behavior. The response of fear is, in part, controlled by the autonomic nervous system (ANS). We can estimate the nature of the activity of the ANS by means of peripheral indicants such as heart rate, blood pressure and skin conductance. This line of reasoning leads us to a testable hypothesis--namely, that an individual who is apprehended by the police for the first time will tend to desist from further criminal activity if his autonomic nervous system is highly responsive. That is, youths who are more easily frightened are more likely to respond to an initial police contact as an effective specific

deterrent. If such an hypothesis were supported, it would imply that, for autonomically reactive individuals, contact with the criminal justice system may be effective to some degree in preventing recidivism.

i.2. ANS measures. Psychophysiological recording was made using an Offner-Beckman Type R Dynograph using couplers built especially for this cohort. Unilateral bipolar recording was made continuously from the nondominant hand. In addition, levels were obtained from the other hand during the rest periods. The procedure involved the constant voltage method advocated by Venables and Christie (1973) using a coupler designed by them.

The stimuli consisted of 14 orientation tones each of 1 sec, 400 Hz. This was followed by a rest period of 10 minutes. After the rest period a series of 36 stimuli comprising a conditioning, generalization and extinction schedule followed.

The stimuli used were:

Conditioned stimulus 1	1 kHz 60 db 12.5 sec
Unconditioned stimulus	
(occurred only with C.S. 1)	noise 96 db 4.5 sec
Conditioned stimulus 2	500 Hz 60 db 12.5 sec
Generalization stimulus 1	1311 Hz 60 db 12.5 sec
Generalization stimulus 2	1967 Hz 60 db 12.5 sec

This procedure took approximately 25 minutes.

The ANS measures relevant to this investigation are the subject's general level of arousal, his orienting response (related to attentional factors), his responsiveness to stimuli, his ability to associate a response to the anticipation of a fear inducing stimulus (classical conditioning), and the speed with which he recovers from the stimulus-induced arousal, once the threat is removed.

The subject's general level of arousal is measured by his basal conductance level. Although this measure is recorded for each trial (it is the conductance level at the beginning of the trial before the stimulus tone is presented), for the purposes of this investigation, the measure of the subject's basal level of arousal is taken as the mean of the basal conductance level for the first 14 (orienting) trials. Such a measure minimizes random measurement error by using multiple measurements. Basal levels from later trials were not used because these levels could be somehow influenced by a residual arousal level remaining after the presentation of the UCS.

The subject's orienting response (which should be closely related to his level of arousal) is taken as the number of the 14 orienting stimuli to which he had a measureable change in skin conductance (responsiveness to the orienting stimuli), and the number of the last orienting trial (habituation of the orienting response) to which the subject responded. The quality of the subject's responsiveness to the noxious stimulus, the UCS, is an indication of his responsiveness. The number of UCS stimuli to which he responded with a measureable change in the skin conductance level reflects his level of responsiveness. The average onset latency (after the UCS), the average peak amplitude, and the average rise time from the onset of the UCS are also measures of this characteristic. These averages were taken over the 12 trials in which a UCS was presented.

Only one measure is used for how well the subject is able to associate the fear response to the UCS with the conditioning tone to which the UCS is sometimes paired. This measure is the number of the conditioning tones in which no UCS was presented, to which the subject responded after the time the UCS would have been presented. (The maximum possible number of such responses is 12.)

The final ANS measure, reflecting how quickly the subject recovers from his fear arousal, is taken as the reciprocal of his half-recovery rate; i.e., it is the time required for the subject to recover one unit of skin conductance amplitude. This measure was chosen over half-recovery time because the time required to attain half-recovery depends upon the amount of change as well as the rate of change.

Since measurements were taken from both hands, a total of 18 measures were used in this analysis. Because of the high correlation between right and left hand measures and because traditionally the left-hand measures are used for indication of ANS activity, only the left-hand measures were used in further analyses. Because of skewness, a log (base 10) transformation of one plus the initial value was used for peak amplitude and reciprocal half-recovery rate. The transformation provided more normal distributions of these variables.

Principal-components analysis (Barr et al., 1979) of the correlation matrix for the left-hand measures revealed three eigenvalues above 1.0 with a possible break between the second and third eigenvalue. Interpretation of the eigenvalues would sug-

gest either a one-component solution or, perhaps, a two-component one. In the present context, a one-component solution was selected.

A number of rotations of the factors were completed with two-, three-, and four-factor solutions. None of these provided better interpretation than the simple unrotated solution (Gabrielli, 1981).

Perhaps the most meaningful interpretation of the results is that which relates all of the ANS measures to a single factor, the reactivity of the subject. Such a factor would reflect the basal attention, responsiveness and recovery of the subject to stimuli, and general association of the threat (UCS) to the conditioning stimulus.

An ANS summary variable was constructed by summing the nine ANS variables from the one factor solution discussed above. These variables are listed in Table 6. The summary variable is standardized to have a mean of 10 and standard deviation of 1. Low scores reflect less ANS reactivity and high scores reflect relatively greater reactivity. The procedures involved in reduction of the ANS data have been successfully replicated in another sample (Gabrielli, 1981).

Insert Table 6 about here

RESULTS

Individual variables. Table 7 presents the mean scores for non-offenders, one-time offenders, and multiple offenders for the

Study 2 variables yielding significant ($p < .05$) values for the t-test of the difference between the means of the one-time offender and multiple offender groups. Differences between the groups for SES, the ANS summary variable, the EEG summary variable, and several of the neurology examination subtests did not attain significance. In a previous report (Mednick, Volavka, Gabrielli, and Itil, 1981), EEG was found to discriminate significantly between non-offenders, one-time thieves, and offenders with multiple thefts. Analysis in the present study of EEG in subjects with 0, 1, or more than one theft offenses yielded similar significant discrimination ($F = 4.64, p < .01$). However, the focus of the present report is on the ability of variables to discern the one-time delinquent in general, so that the results of analyses conducted within offense types will not be emphasized here.

Insert Table 7 about here

For 5 of the 6 variables shown in Table 7, the status of the future one-time offender is more positive than that of the future multiple offender. That is, relative to the multiple offenders, the one-time offenders had families closer to the "ideal" family, were better adjusted at school, scored higher on intelligence, and were more able to be empathic with the viewpoints of others. For the neurological subtest of associated movements, the one-time offenders showed more evidence of neurological abnormality than the multiple offender group. In addition to these differences between the one-time and multiple offender groups, it is

useful to consider the status of the one-time offender group relative to that of the non-offender group. The one-time offenders also have more positive families, better school adjustment, greater empathic abilities, and more evidence of neurological abnormality on the associated movements test than the non-offenders.

In terms of our original hypothesis, this suggests that an individual who desists from delinquent behavior after one criminal justice system contact shows evidence of characteristics associated with greater sanction sensitivity.

Regression analysis. An SAS procedure was used which performed all possible regressions for the dependent variable; subject group (one-time or multiple offender), and the collection of all independent variables investigated in Study 2. The procedure yielded an R^2 for each model (Cuthbert and Wood, 1971). The model was selected from all the possible combinations of four variables which yielded the greatest value of R^2 . Selection was limited to those models including combinations of four variables because increases in R^2 for models combining five or more of the variables were not as large as the increase in R^2 between the three-variable models and the four-variable models.

Stepwise regression of the four-variable model selected showed that the variables were entered in the following order: (1) ANS summary variable, (2) scale of deviance from the ideal family, (3) WISC Verbal IQ, (4) Neurological examination: associated movements subtest. Note that while ANS was not one of the

variables which differentiated the offender groups in Table 7, it was an important component of the regression model. We have found frequently that biological variables can explain deviance where social variables fail in explanation. Therefore, the ANS summary variable may account for variance that is not explained by the social and psychological measures. R^2 for this model was .48 ($F = 6.07$, $p = .01$). This result must be viewed with caution because the regression procedure employed maximizes effects. It is most likely that on replication the R^2 would shrink. Replication of these results is needed before conclusions can be drawn.

Discussion

We began this report with the assertion that there may be a group of individuals who are deterred from further delinquent behavior by their initial experience with negative sanctions imposed by the juvenile justice system. The phase of study reported in this paper was limited to testing the hypothesis that an individual who commits a single offense, but desists from further offending following contact with the justice system, has characteristics that mark him as different from individuals who continue to offend, and perhaps also from individuals who have no offenses registered at all. Both Study 1, which examined variables from birth and early childhood, and Study 2, which examined variables from pre-adolescence, have demonstrated that a number of characteristics do exist which distinguish the one-time offender from the non-offender and multiple offender. In addition,

these are characteristics which were assessed six years prior to the onset of offending, so that differences found between offender groups do not reflect the results of differential amounts of delinquent involvement or justice system contact.

Results from Study 1 did not lend support to the hypothesis that perinatal and birth complications are a source of neurological dysfunction which impairs the brain's capability for appropriately modulating responses to punishment. Both one-time offenders and multiple offenders (especially multiple offenders) had experienced fewer and less severe problems during birth, neonatal development, and the first year of life than did the non-offender group. These results did not disconfirm the alternate hypothesis that perinatal complications are positively related to responsiveness of the ANS, which is positively associated with the ability to benefit from punishment. Analyses of size and motor development indicate that the one-time offender is quite different from the recidivistic offender on these measures (see Table 2).

Measures from early adolescence. In Study 2, a number of variables measured in early adolescence were found to distinguish the one-time offender from non-offenders and multiple offenders--verbal intelligence, school adjustment, family characteristics, ability to empathize with the viewpoints of others, and neurological dysfunction as evidenced by the subtest for associated movements. For each of these measures the one-time offender groups scored "better" than the multiple offender group.

We proposed that one-time offenders might be expected to have greater verbal ability than multiple offenders if good verbal skills enable them more to easily label, conceptualize and recall the contingency between their delinquent acts and the sanctions they received. Aronfreed (1968, p. 72) has stated that verbal communication abilities may serve "the most crucial function of cognitive representation in the socialization process, the mediation of the temporal gap between the child's behavior and its punitive consequences." (See Section II of this report, "Relevance to delinquency/deterrence of the learning theory model of punishment," for further explanation of the role of verbal intelligence in deterrence.) Results from analysis of Verbal IQ in Study 2 do not disconfirm this proposal.

The data also supported our hypothesis regarding the role of the family in offenders' responses to sanctioning. The sociocultural milieu in which a child develops and the approach of his parents to their child-rearing responsibilities are crucial determinants of the extent to which the child internalizes behavior norms. Individuals with relatively more positive family backgrounds may be expected to respond well to sanctioning. While situational factors might lead a well-socialized child to commit a delinquent act, a single unpleasant experience with the juvenile justice system may be sufficient to complete the process of norm internalization for these children. Children with less stable family backgrounds would probably need more than a single unpleasant sanction to complete their internalization of the

importance of social rules and should therefore be more likely to join the multiple offender group.

The one-time offenders we studied were rated by their teachers as better adjusted in school than the multiple offenders. It is possible to interpret this result in the context of Hirschi's (1969) version of control theory. Children who experience more positive adjustment in school may be more likely to be more committed to the educational goals of school and also may be more involved in school-related activities than are children who are less well adjusted in school. In Hirschi's view, individuals who are committed and involved are less likely to engage in delinquent acts. It is also possible that, when a child who is committed and involved at school does offend, he will desist from further offending as soon as he learns that official sanctions can jeopardize his positive relationship with the school. He has stakes in conformity.

We proposed that individuals who are characterized by impaired ability to empathize with the viewpoints of others might have greater difficulty than individuals with empathic talents in understanding why the agents of the juvenile justice system respond negatively to their delinquent acts. We hypothesized that the one-time offender group would have a greater mean score on the Feffer test of empathic ability than the multiple offenders, and the data fulfilled this hypothesis.

Sanction sensitivity. The intention of this initial analysis was to examine the general hypothesis that the one-time

offender displays unique characteristics which make him more sensitive to a juvenile justice system aversive contact. The general hypothesis could not be rejected by our observations. A variety of factors which seem intuitively reasonable and which are in accordance with earlier literature findings indicate that the one-time offender may be better (family) socialized, more intelligent, more empathic, and display better school adjustment than either the multiple offender or the non-offender. Our hypothesis concerning sanction sensitivity seems worthy of further study.

Suggestions for future directions. First and foremost is the need for replication of these results in other longitudinal cohorts. A proposal for such an investigation is currently being submitted. A second and related interest is more intensive examination of the biosocial interaction terms as they are related to one-time offender status. We tested one such interaction to determine whether the one-time offender would be high in ANS responsiveness and high on family stability. An interaction term was created by simply multiplying the ANS sensitivity score by the family deviance scale score. The highest score (indicating the worst family and least responsive ANS) was obtained by the multiple offender; next was the non-offender. The one-time offender had a significantly lower interaction score than either of the other two groups. They included the most sensitive ANS and the most stable families.

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We have been assuming that the fact that the one-time offender can be distinguished by antecedent characteristics reflects a special sensitivity to punishment. Our results could also be interpreted as a purely etiological effect. That is, perhaps these characteristics simply relate to severity of delinquency. The one-time offender is different from the multiple offender because he is simply less severely delinquent. Arguing against this, however, is the fact that on a number of the variables examined, the one-time delinquent evidences less delinquency-associated characteristics than does the non-offender. A definitive study might examine the relationship between sanction sensitivity variables and degree of recidivism at different levels of juvenile justice system sanctions. Those high in sanction sensitivity should only receive mild punishments to attain the same level of inhibition of delinquent acts as severe punishment levels in those low in sanction sensitivity.

Table 1

Mean perinatal composite scores for non-offenders, one-time offenders and multiple offenders in Study 1

Higher scores indicate relatively less desirable status.

Perinatal Composite Score	Number of offenses			F	P
	None (N=3123)	One (N=572)	2 or more (N=572)		
Predisposing Factors, Frequency Score	2.35	2.48	2.59	7.68	<.01
Delivery Conditions, Frequency Score	2.85	2.60	2.54	12.45	<.01
Delivery Conditions, Weighted Score	6.33	5.75	5.62	9.89	<.01
Neonatal Physical Exam, Frequency Score	3.32	3.10	3.07	4.87	<.01
Neonatal Physical Exam, Weighted Score	5.64	5.11	5.03	7.21	<.01
Neonatal Neurological Exam, Weighted Score	16.98	16.33	15.78	5.65	<.01
One-Year Neurological Exam, Frequency Score	0.84	0.75	0.67	4.98	<.01
One-Year Neurological Exam, Problem of Highest Severity	0.78	0.69	0.60	7.75	<.01
One-Year Neurological Exam, Weighted Score	1.23	1.06	0.92	5.48	<.01
One-Year Motor Development, Frequency Score	1.85	1.63	1.46	13.66	<.01

Table 2

Mean Z scores on constructed perinatal scales for non-offenders, one-time offenders, and multiple offenders in Study 1

Positive scores indicate greater development.

Scale	Number of offenses*			F	P
	None (N=1040)	One (N=182)	2 or more (N=168)		
Size Development	-.166	-.218	.578	4.41	.01
Motor Development	-.199	.638	.152	4.86	<.01

*Ns for Table 2 differ from those of Table 1 because these analyses were conducted (and replicated) using split halves of the cohort. Means reported are from the half of the sample analysed initially; results from the replication were also significant.

Table 3

Mean perinatal composite scores for non-offenders, one-time offenders, and multiple offenders within crime types in Study 1

Higher scores indicate relatively less desirable status.

Perinatal Composite Score	TRAFFIC VIOLATIONS Number of offenses			F	P
	None (N=3123)	One Traffic Only (N=409)	Two or more Traffic Only (N=106)		
One-Year Motor Development, Frequency Score	1.84	1.60	1.45	5.37	<.01
One-Year Motor Development, Weighted Score	2.98	2.54	2.27	5.15	<.01

Perinatal Composite Score	THEFT OFFENSES Number of offenses			F	P
	None (N=3123)	One Theft Only (N=131)	Two or more Thefts (N=82)		
Pregnancy, Problem of Highest Severity	2.11	1.74	1.91	6.25	<.01
Delivery Conditions, Frequency Score	2.85	2.38	2.42	7.46	<.01
Delivery Conditions, Weighted Score	6.33	5.21	5.51	5.66	<.01

Perinatal Composite Score	VIOLENT OFFENSES Number of offenses			F	P
	None (N=3123)	One Violent (N=102)	Two or more Violent (N=32)		
One-Year Neurological Exam, Problem of Highest Severity	0.78	0.45	0.71	4.73	<.01

Table 4

Items deviating from an "ideal" family

-
- The biological parents are not married to each other.
 - The child has spent less than seven years with a single family organization.
 - The child has spent time in whole day care.
 - The child has spent time in an orphanage.
 - The child has spent less than seven years with his mother.
 - The child has spent less than seven years with his father.
 - The child was not always with his mother during the first year.
 - The child's father has problems with alcohol.
 - There are not at least two adults in the home.
 - The social worker judges the home atmosphere to be inadequate.
 - The mother does not like the child.
 - The mother is judged to be immature.
 - The mother is judged to be somewhat neurotic.
 - The parents of the child fight.
 - The mother worked full-time during the first five years of the child's life.
 - The mother has been hospitalized with a psychiatric problem.
 - The mother has had a serious physical illness.
-

Table 5

Teacher's assessment of school adjustment

-
- The child attends a normal class.
 - The child's performance (in Danish or Math) is generally not of lower quality than expected from his ability.
 - The child is ambitious and wants to be among the best in the class.
 - The child is not often in fights.
 - The child does not often tease other children.
 - The child does not talk back to the teacher in a provocative way.
 - The child does not interrupt the teacher or other children when they are talking.
 - The child occupies a central position in the class.
 - The child has average or above average ability relative to the rest of the class.
 - The quality of the child's work does not vary.
 - The child does not underestimate his own abilities.
-

Table 6
Variables combined in ANS Summary Variable

--Basal level
--Number of OR responses
--Last OR response
--Number of UCS responses
--Onset latency
--Peak amplitude
--Risetime
--Number of CS1 responses
--Half-recovery

Table 7
Mean scores on social, psychological and biological variables for non-offenders, one-time offenders and multiple offenders in Study 2

Variable	Number of offenses			t	P
	None (N=84)	One (N=21)	2 or more (N=22)		
Scale of Deviance from the ideal family	10.07	10.24	9.17	2.58	<.05
Scale of adjustment to School	5.22	6.56	4.36	2.08	<.05
WISC verbal IQ	110.31	107.80	97.77	2.46	<.05
WISC full IQ	113.80	112.30	102.54	2.60	<.05
Feffer Empathy	2.53	2.82	2.40	2.38	<.05
Neurological Exam: Associated Movements*	2.23	2.00	2.40	2.45	<.05

Note: Only those variables are presented for which t-tests of the means of the one-time offender and multiple offender groups were significant beyond the .05 criterion. Means for the non-offender group are shown for comparison. Larger scores indicate relatively more positive status.

*Eight sub-tests of the neurological examination were analyzed separately. One sub-test, associated movements, yielded a significant t. This sub-test includes examination for mimic, diadochokinesia, reciprocal coordination, walking tests, and Prechl's and Fog's tests.

Appendix A

Description of Perinatal Composite Scores from Study 1

Pregnancy and Birth

Material available for investigation in the study was logically grouped into four basic sets of pregnancy and birth scores: Predisposing Factors Score, Pregnancy Score, Delivery Score, and Non-Maturity Score.

Predisposing Factors Scores: The PF composite scores consisted of items which were concerned with the mother's physical and emotional state prior to the pregnancy under investigation. Information included such material as whether the mother was married when she conceived and whether she had previously had an abortion, a miscarriage, or a stillbirth. Points on the PF Scores indicated that conditions (physical and emotional) were probably less-than-optimum for conception.

Pregnancy Scores: The P composite scores consisted of items which were concerned with the mother's physical and emotional state during the pregnancy under investigation. Information included such material as whether the mother had experienced any illnesses during the period of gestation and whether she had been exposed to radiation or taken drugs during the pregnancy. Points on the P Scores indicated that conditions (physical and emotional) were probably less-than-optimum for the period of the pregnancy.

Delivery Scores: The D composite scores consisted of items which were concerned with the mother's delivery from the beginning of labor to the evaluation of the neonate's condition at the point of birth. Information included such material as whether the mother's labor had been induced or artificially stimulated in any way and whether the fetal presentation was atypical (for example, breech birth). Points on the D Scores indicated that delivery conditions were probably less-than-optimum.

Non-Maturity Scores: The NM composite scores consisted of items which were concerned with the neonate's physical maturity at birth. Information included evaluation of three areas: whether the neonate was born before or after the optimum number of weeks of gestation, whether the neonate's birth weight was below 3000 grams, and whether the neonate was judged at birth to be premature or postmature. Points on the NM Scores indicated that at the point of birth, the neonate's physical condition was probably less-than-optimum to insure normal post-natal development.

Children's Neonatal and One-Year Examinations

Material available for investigation in the study was logically grouped into five basic sets of children's examination scores: Neonatal Physical Examination Scores, Neonatal Neurological Examination Scores, One-Year Physical Examination Scores, One-Year Neurological Examination Scores, and One-Year Motor Development Examination Scores.

Neonatal Physical Examination Scores: The NP Composite Scores consisted of items which were concerned with the neonate's physical condition during the first five days of life. Information included such material as the use of special treatment in the delivery room (for example, an incubator or an oxygen mask) and whether the neonate was cyanotic or jaundiced. Points on the NP Scores indicated that the neonate's physical condition in the first five days of life was less-than-optimum.

Neonatal Neurological Examination Scores: The NN composite scores consisted of items which were concerned with the neonate's condition during neurological examination and indications of probable brain damage during the first five days of life. Information included such material as abnormal responses when reflexes were tested on Day 1 and Day 5 of life. Points on the NN Scores indicated that the neonate's neurological condition in the first five days of life was abnormal.

One-Year Physical Examination Scores: The OP composite scores consisted of items which were concerned with the child's physical condition during the first year of life. Information came from two sources: a questionnaire which the mother filled out regarding illnesses and physical difficulties during the first year, and a physical examination which a pediatrician conducted at approximately one year of age. Information included such material as whether the child had had illnesses or surgery during the first year and whether the child's physical condition (for example, height and weight) was within the normal range at

one year. Points on the OP Scores indicated that the child's physical condition during the first year was marked by difficulties.

One-Year Neurological Examination Scores: The ON composite scores consisted of items which were concerned with the child's neurological condition upon examination by a pediatrician at one year of age. Information included head circumference outside normative values and abnormal responses when reflexes were tested. Points on the ON Scores indicated that the child's neurological condition at one year of age was abnormal (i.e., he showed signs of brain damage).

One-Year Motor Developmental Examination Scores: the OD composite scores consisted of items which were concerned with the child's motor development during the first year of life. Information came from two sources: a questionnaire which the mother filled out regarding the attainment of motor milestones (for example, crawling and sitting) during the first year, and observation by a pediatrician of the child's level of development during a one-year examination. Information included such material as whether the child was within the normal range (as judged by evaluation of attainment of motor milestones for approximately 9,000 Danish children born within the same time period as the children used in the study) when he first smiled, crawled, sat with and without support, etc. Points on the OD Scores indicated that the child's motor development during the first year of life was retarded when he was compared to a large group of peers.

Appendix B

Individual perinatal items for which chi squares across the non-offender (0), one-time offender (1), and multiple offender (2+) groups were significant beyond the .01 alpha level. Numbers in cells indicate row percents.

Items assessed prior to birth

1. Mothers marital status:

	<u>unmarried</u>	<u>married</u>
0	30	70
1	35	65
2+	41	59

2. Mother's attitude toward present pregnancy:

	<u>wanted</u>	<u>unwanted</u>
0	45	55
1	41	59
2+	32	68

3. Mother experienced genitalia-related illness prior to pregnancy:

	<u>yes</u>	<u>no</u>
0	90	10
1	86	14
2+	85	15

4. Mother's age:

	<u>14-20</u>	<u>21-30</u>	<u>31+</u>
0	26	51	23
1	34	46	20
2+	39	43	18

5. Number of cigarettes smoked daily by mother in last trimester of pregnancy:

	<u>none</u>	<u>21</u>	<u>20</u>
0	51	47	2
1	44	55	1
2+	40	57	3

6. Mother took any drug at least 5 days in succession during last month of pregnancy:

	<u>no</u>	<u>yes</u>
0	69	31
1	71	29
2+	76	24

7. Mother took diuretics in last month of pregnancy:

	<u>no</u>	<u>yes</u>
0	86	14
1	88	12
2+	91	9

8. Mother exposed to radiation during routine TB exam in last trimester of pregnancy:

	<u>no</u>	<u>yes</u>
0	95	5
1	94	6
2+	92	8

Items assessed during delivery

9. Mother experienced proteinuria following delivery:

	<u>no</u>	<u>yes</u>
0	95	5
1	97	3
2+	97	3

10. Labor was drug-induced:

	<u>no</u>	<u>yes</u>
0	91	9
1	93	7
2+	95	5

11. Birth was spontaneous and normal:

	<u>no</u>	<u>yes</u>
0	70	30
1	66	34
2+	60	40

12. Caesarian section was performed:

	<u>no</u>	<u>yes</u>
0	91	9
1	94	6
2+	96	4

13. Fetal presentation was in normal position (occiput anterior):

	<u>no</u>	<u>yes</u>
0	18	82
1	15	85
2+	12	88

14. Fetal head position was indeterminant at delivery:

	<u>no</u>	<u>yes</u>
0	93	7
1	96	4
2+	97	3

15. Anesthesia given during birth was obstetrical trilene:

	<u>no</u>	<u>yes</u>
0	62	38
1	59	41
2+	54	46

16. Anesthesia given during birth was nitrous oxide:

	<u>no</u>	<u>yes</u>
0	90	10
1	93	7
2+	95	5

17. Anesthesia given during birth was a relaxant:

	<u>no</u>	<u>yes</u>
0	91	9
1	93	7
2+	96	4

18. Anesthesia given during birth was atropine:

	<u>no</u>	<u>yes</u>
0	92	8
1	94	6
2+	96	4

Items assessed following delivery

19. Treatment given to facilitate breathing of infant:

	<u>no</u>	<u>yes</u>
0	74	26
1	77	23
2+	80	20

20. Peripheral cyanosis in infant:

	<u>no</u>	<u>yes</u>
0	94	6
1	92	8
2+	96	4

21. Infant given any drug:

	<u>no</u>	<u>yes</u>
0	85	15
1	87	13
2+	91	9

22. Infant given penicillin:

	<u>no</u>	<u>yes</u>
0	88	12
1	90	10
2+	93	7

23. Infants extremities move in a lively manner:

	<u>no</u>	<u>yes</u>
0	42	58
1	41	59
2+	33	67

24. Opacity of media seen at examination of infant's eyes:

	no	yes
0	99	1
1	100	0
2+	100	0

25. Infant's eyes uncoordinated:

	no	yes
0	93	7
1	97	3
2+	96	4

26. Plantar reflex: infant spreads toes without dorsal flexion of hallax:

	no	yes
0	47	53
1	54	46
2+	54	46

27. Patellar reflex absent:

	no	yes
0	99	1
1	98	2
2+	97	3

28. Leg movement alone seen in crawling reflex:

	no	yes
0	100	0
1	100	0
2+	99	1

29. Javar reflex is present:

	no	yes
0	30	70
1	37	63
2+	36	64

30. Hanging reflex: bilateral extension present:

	no	yes
0	83	17
1	80	20
2+	77	23

31. Neck-arm reflex: right arm normal:

	no	yes
0	99	1
1	97	3
2+	98	2

32. Moro reflex cannot be elicited:

	no	yes
0	4	96
1	5	95
2+	2	98

Items assessed at one year of age

33. Child experienced accident in fourth month of age:

	no	yes
0	98	2
1	100	0
2+	94	6

34. Child experienced accident in seventh month of age:

	no	yes
0	97	3
1	91	9
2+	93	7

35. Child had pertussis:

	no	yes
0	92	8
1	86	14
2+	87	13

36. No AD vitamins were given to child in first year:

	<u>no</u>	<u>yes</u>
0	100	0
1	99	1
2+	98	2

37. When child first began to lift head:

	<u>1st month</u>	<u>2nd month</u>	<u>2nd month +</u>
0	62	31	7
1	65	28	7
2+	71	20	8

38. When child can sit without support:

	<u>month 1-6</u>	<u>month 7-12</u>
0	18	82
1	22	78
2+	25	75

39. Child received tetanus vaccinations:

	<u>none</u>	<u>some</u>
0	27	73
1	31	69
2+	37	63

40. Child received BCG vaccination for TB:

	<u>no</u>	<u>yes</u>
0	47	53
1	51	49
2+	58	42

41. Child's height at age 1:

	<u>76 cm</u>	<u>77-78 cm</u>	<u>78 cm +</u>
0	45	24	31
1	46	23	31
2+	45	18	37

42. Child's skin was dirty at examination:

	<u>no</u>	<u>yes</u>
0	97	3
1	95	5
2+	93	7

43. Number of teeth present at age 1:

	<u>none</u>	<u>1-8</u>	<u>8+</u>
0	2	75	23
1	2	71	27
2+	0	69	31

44. Child has tachycardia with normal respiration:

	<u>no</u>	<u>yes</u>
0	98	2
1	95	5
2+	96	4

45. Positive pulse detectable in femoral artery:

	<u>no</u>	<u>yes</u>
0	21	79
1	28	72
2+	33	67

46. Abnormal skeleto-musculative apparatus:

	<u>no</u>	<u>yes</u>
0	88	12
1	92	8
2+	92	8

47. Child stands with strong support:

	<u>no</u>	<u>yes</u>
0	92	8
1	94	6
2+	95	5

48. Child able to stand independently:

	<u>no</u>	<u>yes</u>
0	48	52
1	40	60
2+	33	67

49. Child cannot walk despite support:

	no	yes
0	92	8
1	95	5
2+	95	5

50. Child walks with support:

	no	yes
0	64	36
1	66	34
2+	73	27

51. Child walks well independently:

	no	yes
0	56	44
1	48	52
2+	40	60

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