LONGITUDINAL STUDY OF SOCIAL AND BIOLOGICAL FACTORS IN CRIME

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Executive Summary
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EXECUTIVE SUMMARY

Preface

The purpose of the Longitudinal Study of Social and Biological Factors in Crime was to examine the registered criminal behavior in a subsample of a Danish birth cohort of an average age of 21 years. The total study focused on two sets of predictors of crime (independently and interactively): (1) familial and social factors; and (2) individual characteristics, specifically ANS responsivity and EEG readings.

Subjects

The subjects constituted a subsample of a Danish birth cohort. In 1959, a prospective longitudinal study was initiated in Copenhagen; 9,125 consecutive hospital deliveries were included. As part of this study, the subjects were examined pre- and perinatally and the total group was again seen by the original investigators at age one year. The one-year examination constituted the last examination of the total cohort. Since then however, a series of follow-up studies has been carried out on different subsamples of the cohort. Two such subsamples, followed up at 11-13 and 18-20 years respectively, form the subject groups, for the present set of studies.

Intensive Assessment Study

At 11-13 years of age, 263 children underwent an intensive assessment including computer-scored EEG and ANS examinations, cognitive and intellectual assessment, personality testing, a detailed 1 1/2 hour neurological examination, and a psychological interview. Of the total 263 subjects, 144 had parents who were deviant or psychopathic, and 121 had normal parents. All parents took part in a lengthy home interview relating to the familial and social conditions of the home, parental attitudes and characteristics, and life history data of the subject. In addition, the social worker who conducted the interviews evaluated aspects of the home environment and the personal

characteristics of the mother according to a predetermined set of criteria.

Family Study

When the cohort reached age 18-20 years, another subsample consisting of a 10 percent random sample of the total cohort was included in a follow-up study (N = 857). The purpose of this study was to investigate the long-term consequences for the child of a set of family structure variables and of selected descriptors of maternal characteristics. The follow-up procedures involved an intensive mother interview conducted in the home. The interview dealt with family stability and compatibility, characteristics of members of the household, social factors influencing the family, maternal education and attitudes, etc. The social workers who conducted the interviews completed a set of ratings similar to those described under the Intensive Assessment Study.

The follow-up procedures of the Family Study also involved accessing information from the National Population Register concerning the moves the family had made, the sex and birthdates of siblings, and parental marital history. Data on parental criminal behavior was obtained from the Danish National Police Register.

General Objectives

In January 1981, the cohort ranged from 20-22 years of age. At that time, information was collected on the registered criminality of the subjects in both the Intensive Assessment and the Family Study samples.

In the aggregate, this set of studies analyzed the relationships between and among different categories of information previously collected on these two samples and the current 1981 criminality data. The analyses reported were carried out in two successive parts: (1) Identification of antecedent social and familiar variables which predict to later criminal behavior. These analyses included the subjects previously studied in the Family Study. (2) Replication, insofar as possible, of Part 1 analyses using the Intensive Assesment sample; and analyses of the relationship between the individual characteristics (e.g., ANS, EEG) and the dependent measures of antisocial and criminal behavior. From the Part 2 analyses inferences

are drawn about the interactions between the social/familial and biological variables in explaining the etiology of criminal behavior.

I. Social Correlates of Male Adolescent and Young Adult Crime

Introduction

The follow-up sample referenced previously as the Family Study was used to analyze the contributions of a selected set of familial and social factors to the prediction of criminal behavior. At the time of the Police Register search, 27 of the 857 Family Study subjects were lost due to death, immigration, etc., leaving a total of 825 subjects for this study. While specification of the familial and social variables was a reasonably straightforward task, definition of what constitutes criminal behavior was not. As will become clear, there are problems associated with defining criminal patterns or specializations that hold up across studies and contexts. Thus, in developing an inquiry strategy that is both sensitive and responsive to the issues involved, the criminal outcome measures were defined in several ways as the inquiry progressed.

The Outcome: What Is a Criminal Offender?

Danish National Police Register

All police contacts and court decisions are recorded in the Danish National Police Register. Police officers are legally required to report all cases; if they have a suspect they are not permitted to make personal judgments. They are regarded as being incorruptible (Christiansen, 1977). The reliability and validity of the Danish record keeping system are viewed as almost beyond criticism, the criminal registry office in Denmark is probably the most thorough, comprehensive, and accurate of the Western world (Wolfgang, 1977). Thus, for the purposes of this set of analyses, an individual was defined as criminal if he or she appeared in this Police Register. "Hidden criminality" was not analyzed due to unavailability of information and the relatively strong evidence that the hidden criminal is the less serious, less recidivistic criminal (Christie, Andenaes, & Skerbaek, 1965; Hindelang, Hirschi, & Weis, 1979; West & Farrington, 1973). Table 1 presents a list of the offenses included in each of the conventional police register categories.

Table 1

Criminal Offenses By Category and Severity[1]

Violence

robbery*
armed robbery*
domestic fight
public fights
threats
violence*
keeping other person prisoner*
attempted murder*
murder*
cruelty to animals
rape*
illegal removal of child

Uncontrolled behavior: Vandalism

drunkenness, loitering
warning from police
irresponsible behavior
destruction of property
arson*
drunken driving*
irresponsible driving, speeding
violations against specific conditions

Thievery and Property Offenses

joy riding
minor thievery
buying and selling of stolen goods
thievery
breaking and entering*
larseny
fraud forgery*
crimes in public office*
blackmail
counterfeit money

License Violations

driving without a license
violation of specific laws
gambling
weight class violations
false identity perjury
false accusation
weapon laws

Minor Traffic, etc.

traffic 1
traffic 2
minor violations against military law

Treason

Narcotic Law

Major Traffic

manslaughter
involuntary causing harm to others

Sex Crimes

[1] offenses marked by an asterisk (*) indicate those judged to be "severe" (see Note 1).

Is There Evidence of Criminal Specialization in the Danish Sample?

Analysis of the Danish sample suggests that defining criminal "types" or patterns may be difficult, particularly when using multivariate procedures of analysis. The general description of our sample of males is shown below:

Criminal Status	Number	Percent
a. non-offenders	213	53
b. one-time offenders	70	17
c. recidivists	123	30
Total	406	100

Table 2 shows the extent of criminal activity overlap. Row I, one offense, is the only row whose cells are mutually exclusive. Obviously, then, the cells in Rows II through V do not sum to the Ns shown above. This data display illustrates the fact that recidivism in our sample reflects an overlapping and complex pattern of offenses. For example, it is impossible to define a recidivistic "thief" without acknowledging the fact that the offender probably has also participated in other types of criminal activity as well.

Using thievery as the illustration, Row II describes the offense complexity of the recidivists in the sample. Cells IIb, 1 through 5 show the number of recidivists who recorded two or more thievery offenses and who also participated in other types of criminal activity. Only seven (Cell IIB1) restricted their activity to thievery; similarly, all of the other cells with circled numbers indicate specialization in the referenced crime type. The dash recorded in cell IIa1 simply points to the fact that if only one thievery offense has been recorded the recidivism is reflected in one or more of the other types of crime. Cell IIa3 has eight people who committed one thievery offense and at least one violent offense. The remainder of the table may be interpreted similarly. What is striking about the table is that only 29 of the 123 recidivists (23 percent) restricted their criminal activity to one crime type, and 13 of the 29 were only traffic offenders.

Table 2

Cell Ns for Each Pattern of Criminality Recorded

Number of Offenses			1. Thievery	2. Uncontrolled Behavior	3. Violence	4. Traffic	5. Other
I. One only			14	19	5	30	2
Recidivists							
II. Thievery	a.	one	--	20	8	15	6
	b.	two +	(7)	41	27	26	23
III. Uncontrolled Behavior	a.	one	21	--	7	18	16
	b.	two +	40	(7)	32	33	29
IV. Violence	a.	one	13	15	--	12	8
	b.	two +	22	23	(2)	16	14
V. Traffic	a.	one	25	29	13	--	17
	b.	two +	16	22	15	(13)	13

Is There Support for Criminal Specialization in Other Studies?

Klein (1983) reviewed the findings of 33 studies examining the extent to which the offenses of juvenile delinquents tend to show specialization rather than what Klein calls a "cafeteria-style approach" to crime. Only four studies supported the specialization or patterning view of delinquency, and the rest either unequivocally supported the notion of no specialization (21 studies) or yielded ambiguous findings (8 studies). Klein's conclusion that there is lack of specialization was corroborated in a study by Collins and Cliff (1982), in which lack of specialization or patterning was shown to characterize adult criminality as well as juvenile delinquency. They subjected the complete police records of the criminal behavior committed by 28,879 Danish men from age 15 to age at follow-up (between 27 and 31 years) to factor and cluster analysis. The results did not support the criminal typologies suggested in the literature (Blumberg, 1981; Gibbons, 1965, 1975; Roebuck, 1965). Rather, the data showed one general criminality factor and one 'minor traffic offense' factor. In addition, it was found that many offenses did not belong with either of the factors.

While the above deals with the definition of criminal behavior, some studies concerned with the etiology of criminal behavior have shown differences in the configurations of environmental variables related to different types of crime, such as aggression, property offenses, incorrigibility, etc. (Johnstone, 1978; Norland, et al. 1979). However, they do not present a coherent picture and are characterized by contradictory findings. Reconcilability is difficult because of data source differences (e.g., self-report versus record data, and differences in procedures used in scoring subtypes of criminal behavior) including overlapping crime type patterns. In general, the analysis of Empey & Lubek (1971) and Wadsworth (1979) support the notion that criminality may not be a "homogeneous phenomenon." That is, while similar environmental agents may contribute to most criminal activity, they may possess differential discriminant ability across criminal types or patterns.

How Should the Criminal Outcome Variable be Defined?

Table 2 supports Klein's (1982) position that there is no crime specialization. The findings also seem consistent with the factor analytic work of Collins and Cliff (1982) in which two criminal factors were empirically supported: general crime and minor traffic offenders. To more directly confirm this with our own sample analyses were completed clustering criminal males and selected crime and family variables.

The actual number of charges for each of four crime categories was entered for each subject: thievery; violence; uncontrolled behavior; and traffic offenses. In addition, seven family variables were included.

Results of the analyses confirmed the Collins and Cliff (1982) findings. Cluster I clearly represented what Collins and Cliff (1982) called a general crime factor: (1) thievery, (2) violence, and (3) uncontrolled behavior. None of the family variables appeared in the cluster. Cluster III was a weak cluster that included traffic along with two family variables: family dissension and mothers' age. Cluster II included several family variables, but no crime variables. Although consistent with Klein (1982) our findings do not necessarily suggest that social and family variables are not related in some systematic ways to specified patterns of criminal activity; but only that they constitute separable dimensions.

Although reduction of the dependent variable to a simple indicator of amount of criminal behavior manifested may be warranted, we elected to establish an analytic framework that would be as sensitive as possible to specific types of crime (albeit overlapping). In so doing we partially avoided the premature and possibly unjustified elimination of potentially useful data detail. Also, dismissing as artifacts the findings of those studies that did yield differential prediction for different criminal types did not seem prudent.

However, we did elect in many of our analyses to collapse juvenile and adult offenses into a total criminal career of the subjects. This translated into an aggregate of all offenses registered between age 15 and an average age of 21. No status (e.g., truancy) offenses were included, since inclusion would distort the etiological picture when

the juvenile and adult periods were combined. While not conclusive, there is support for such a strategy. Wadsworth (1979) showed that the predictors of crime committed up to age 21 are similar to those for juvenile delinquency. Similar findings have been reported by Glueck and Glueck (1968), McCord and McCord (1959), and West and Farrington (1977). In large part, the rationale rests on the fact that a great proportion of juvenile delinquents continue to commit crimes after the juvenile period, although the motives for the crime, etc., may change (Klein, 1982).

The Predictors: Social and Family Variables of Interest

The literature strongly suggests that definitional and methodological problems have frustrated inquiry in this area. When the predictor variables possess high colinearity and definitional confoundment, searching for main effects using multivariate techniques is indeed a delicate assignment. This problem becomes clear when the relevant literature is summarized.

Family SES

Low socioeconomic status has long been accepted as an important predictor of delinquency and criminality (Johnstone, 1978; Wadsworth, 1979); especially the literature using official record data has consistently shown an effect of SES on the prevalence of crime (Douglas, 1968; Johnstone, 1978; Wadsworth, 1979). However, the importance of the relationship has been challenged by researchers working with self-report data on criminality as opposed to official police records or arrest data (Dentler & Monroe, 1961; Hirschi,1969; Nye, Short, & Olsen, 1962). These researchers, and others working with similar data, report only a very trivial impact of SES and hypothesize that the more robust relationship found in analyses of official record data is due to the fact that low SES persons are more likely to be picked up by the police and prosecuted. However, Johnstone (1978) continues to argue that familial SES status is a predictor of delinquency and crime even when the dependent variable is defined on the basis of self-report data.

The studies of West and Farrington (1973) and Wadsworth (1979) have begun to disclose the mediators of the SES relationship with criminal behavior. These studies identified a series of SES correlates known to be related to

criminal behavior, e.g., large family size, younger maternal age, and poor parental control and supervision. After controls for such variables were imposed, a reduced but still significant impact of low family income remained, indicating an impact of poor economic conditions over and above the impact of those more qualitative measures of the home. The extent to which this relationship is mediated by poorer economic conditions, lower educational level, or the higher incidence of marital breakup and instability characterizing families who started childbearing very early has not yet been established (Baldwin, 1976).

Family Intactness

The attributed importance of the nonintact (broken) home as a cause of later deviance has varied over time, with considerable disagreement concerning the etiological importance of the broken home.

Johnstone (1981) described the major problem in this area as the failure of investigators to acknowledge the great heterogeneity within groups of nonintact as well as intact families. The likelihood is that within both groups the full range of functioning adequacy will be represented (Nye, 1958). Similarity of family structure does not ipso facto imply similarity in family functioning or family atmosphere. Thus Johnstone (1981) suggests that continuing to focus exclusively on intact-nonintact comparisons will mask the effects of qualitative variables that are more likely the etiological agents of importance. For example, when nonintactness is not accompanied by parental conflict, as in the case of death, no negative consequences are observed (e.g., Wadsworth, 1979). Conversely, even in the intact families, parental conflict alone is capable of producing deviance in the offspring that is usually associated with nonintactness (e.g., Rutter, 1978). It should be emphasized that nonintact families possess heterogeneity with respect to parental conflict just as do intact families. That is, in some cases a family break-up may take place without the children experiencing prolonged parental conflict, either pre- or post-divorce. Similarly, some unmarried mothers may live quite harmoniously with their children born outside of a marriage. As implied above, if intactness as a structural characteristic is not systematically related to critical qualitative characteristics, its importance as a "marker" variable is diminished.

Another variable related to nonintactness that has received considerable research attention is timing of the break-up. However, the findings reported in this area are contradictory. Here again, this is likely due to the lack of control for other circumstances accompanying divorce. For example, Wadsworth (1978) found that divorces taking place within the first five years of the child's life were more predictive of later crime, while Offord et al. (1978) found that the timing of guardian changes had no influence. Still another question not conclusively answered relates to whether family factors such as nonintactness are related to any specific type or severity of crime. While Johnstone (1978) found family factors to predict to less serious crimes, others have found the relationships to involve more serious anti-person offenses (Chilton & Markle, 1972; Wadsworth, 1979). Wilkinson (1980) referenced a series of studies, all of which found broken homes less related to thefts than to "ungovernable" types of crimes. However, comparisons of studies are made difficult by the confoundment of definition and methodology differences.

Parental Criminality

There is extensive evidence that parental crime is associated with crime in children (Farrington, Gundry, & West, 1975; Robins, West, & Herjanic, 1975; Rutter, 1978; Wilson, 1975). Hypothesized explanations of the relationship between parental and child crime include genetic, environmental, and interaction components.

Studies by Hutching and Mednick (1977) and Mednick and Volavka (1983) have presented evidence that suggest a genetic contribution by parents to later criminality. Using adopted sons of criminal fathers, the studies indicate that higher prevalence of criminality exists in adoptees with criminal fathers than in either adopted sons of noncriminal fathers or sons raised by criminal adoptive fathers. The effect seems particularly strong for recidivistic sons. Especially interesting is the systematic delineation of genetic and environmental influence in these studies with an adoption design, since the relative contributions of nature and nurture are confounded in most transmission studies by parental contact over some period of time.

Thus, it appears that parental influence on later child deviance may have both genetic and environmental etiological elements. However, little precise knowledge exists about

the ways in which parental deviance exerts its environmental influence on children. Issues of importance that require systematic attention in this regard include the importance of duration of exposure of the child to a criminal father and the critical age at which this exposure must take place in order for the child to be at risk for manifesting criminal behavior. Another issue involves a more precise identification of the direct and indirect influences parental criminality has as it is mediated or moderated by an array of social and personal conditions that define the family context, and are likely correlated with parental criminality (e.g., SES, parental attitudes, and the like).

The criminal parent's direct influence on the child might possess quite different dynamics. On the one hand the parent might have poor skills in developing and nurturing attachment behaviors, and little desire to structure and supervise the child's development. Whether or not the parent is criminal, the child could be at risk for later criminal activity. On the other hand, another parent may indeed have established an effective bonding or attachment, but unfortunately to a criminal personality and repertoire of behavior (Lyerly & Skipper, 1981). For parental criminality to be a variable of research interest the issue of exposure duration and the child's age must be addressed directly, but also in the context of the second set of issues related to more complete descriptions of the attendant familial milieu. Presence or absence of a criminal parent at specified ages of the child may not show a consistent association with later child criminality across different patterns of environmental variables. Similarly, restrictive criteria for sample selection based on a researcher's predisposition of a variable's function might mask important information. For example, Farrington et al. (1975) set a minimum level of the child's exposure to a criminal father at three years for inclusion in a study. Apparently, they wished only to determine the influence of exposure/no exposure, assuming that anything less than three years would be tantamount to no exposure. On the other hand, Robins et al. (1975) allowed exposure duration to freely vary and found that children living with their criminal father less than two years showed higher levels of sociopathy than those who lived with him a longer time. Opening up the sampling frame permitted them to speculate (however tentative) that the added stablility for the family of even a criminal father yields more protection against criminal behavior in offspring than the probably less

stable psychological and economic situation of a home without him.

To this point referenced studies of parental criminality have emphasized the father-son dyad. Farrington et al. (1975), and Robins et al. (1975), found it difficult to evaluate the effects of maternal crime in the relatively few cases which have been studied due to a tendency among criminal women to marry criminal men. Several trends have been noted. A tendency noted in the Robins study was for mothers' crime to be more strongly related to male delinquency than paternal crime. While maternal criminality appears to have an effect independent of father's crime (Farrington et al. 1975), the highest incidence of crime in offspring occurs where both parents had committed criminal acts (Farrington, 1975; Robins et al. 1976).

It is important again to emphasize the interdependency between and among the qualitative descriptors of parental figures and the other environmental variables (e.g., SES and family stability). It seems clear that all of the latter are related to criminal behavior in children, (West and Farrington, 1973), partly via their positive correlation with less than optimal parental behavior and attitudes which ultimately affect the interaction patterns in the home.

Family Size

The general tendency of delinquents and criminals to come from large families has been unequivocally established (Griffith & Rundle, 1976; Nye, 1958; Robins, 1966; Wadsworth, 1979; West & Farrington, 1973). Correlates of family size that have been suggested as active agents in the relationship between family size and criminality include: overcrowding (Ferguson, 1952 and West & Farrington, 1973); lack of internal and indirect control (Nye, 1958); low family income, social deprivation and poverty (West & Farrington, 1973); and poor parental supervision, and physical neglect (Wadsworth, 1979 and West & Farrington, 1973).

A few attempts have been made to estimate family size effects with some of these correlates held constant or statistically controlled. West and Farrington (1973) found no relationship between family size and delinquency in the least overcrowded homes. However, in their analyses of their total sample, controlling for overcrowding, family

income, parental supervision, and physical neglect, there was a reduction in the strength of the relationship between family size and delinquency, but not complete elimination. Wadsworth (1979) found family size and crime related only for the manual skills group, indicating at least in part that crime is mediated through the negative environmental correlates of larger family size (e.g., poverty, overcrowding, lack of parental supervision).

Parental Attention--A Conceptual Bridge

Across all variables previously described is a common theme: The structural elements and their environmental or social components must not obstruct the development and availability of quality interaction between parents and child. The inferred etiological import of the quantity and quality of parental attention to subsequent social development has also been recognized by both psychological and sociological theory. Developmental psychologists have long emphasized the importance of amount and quality of parent-child (or parent surrogate-child) interaction in cognitive development and emotional functioning of children. Through adequate quantity and quality of parental attention and interaction the earliest attachments are formed. These attachments in turn become major determinants of child functioning as well as of the quality of parent-child and child-peer interactions later in childhood (Ainsworth & Bell, 1974; Bronfenbrenner, 1979; Sroufe, 1979).

The importance of attachment and bonding to parental figures has also been emphasized by sociologists. Social control theory (Hirschi, 1969) posits that criminal behavior occurs when the bond between the individual and society is broken. The bond to society consists of four elements: attachment to others (parents and peers), commitment to conventional acts, involvement in conventional activities, and a belief in a set of moral values shared by conventional society. Clearly, the attachment to parents temporally precedes attachment to peers as well as the other three elements. Thus, proponents of control theory concur with developmentalists in assigning a central role to the ongoing development of interaction styles. Attachment to parents and identification with their values (conventional and criminal) influence the degree to which alternative peer group values are accepted (Hindelang, 1973, Linden & Hackler, 1973; Lyerly & Skipper, 1981). The theoretical orientation characterizing psychological research on

attachment, as well as social control theory, appears relevant to understanding the relationships between criminal behavior and the familial variables reviewed above and treated subsequently.

Selection of Family and Social Predictors for Analysis

Selection of predictor variables was based on a distillation of the extant literature with an emphasis on making an incremental contribution to the definitional and methodological concerns noted. While the main or direct effects of selected variables were central to all of the analyses, we attempted to tease out the indirect effects as functions of the attendant modifying or mediating conditions. The framework which was used to select the variables is an analog of the general theme that runs throughout the literature. Following is the frame and an annotated listing of the variables.

A. Family Structure and Socioeconomic Stress
   1. Socioeconomic status at follow-up (SES)
   2. Family size (Fam. Size)

B. Stability of Adult Configurations: Timing and Duration
   3. Number of family constellation changes after age 4 (No. Fam. Con.)
   4. Number of years with biological father (Yrs. w/Fa)
   5. Dissension in intact families (Fam. Diss.)
      Scale score summarizing marital conflicts and family problems in selected areas, e.g., mother's working
   6. Stepfather entered home, ages 0-4 (Step Fa., <4)
   7. Stepfather entered home, ages 5-11 (Step Fa., 5-11)
   8. Stepfather entered home, ages 12-18 (Step Fa., >12)

C. Maternal Characteristics Affecting Personal Interactions
   9. Educational level (Mo. Ed.)
   10. Age at birth of index child (Mo. Age)
   11. Contentment (Mo. Content)
       Scale Score: Mother's ability to function in her situation and her satisfaction with life in general

12. Orderliness (Mo. Order)
Scale Score: Degree to which home and mother's personal appearance were orderly and neat
13. Health (Mo. Health)
Scale Score: Mother's overall health based on self-report and clinical records

D. Parental Role Models
14. Father crime: recidivist (Fa. Cr. Recid.)
15. Father crime: one offense (Fa. Cr. Once)
16. Mother crime: recidivist (Mo. Cr. Recid.)
17. Mother Crime: one offense (Mo. Cr. Once)

Distinguishing Offenders From Non-Offenders by Crime Type

Outcome Definition

In the initial set of analyses the outcome variable was defined and analyzed in terms of three separate offense types: thievery, violence, and uncontrolled behavior. From Table 2 it is clear that being included in the analysis of thievery does not preclude being included in the analysis of uncontrolled behavior. The overlap among categories of offenses reflected in Table 2 was permitted in the analysis. That is, if one had committed two thievery offenses and one uncontrolled behavior offense, he would be included in both analyses.

Clearly, if the kind and amount of overlap or confoundment is essentially the same for all of the crime types being analyzed, the patterns of predictors across the crime type analyses will likely be quite similar. Thus, the two major contributions of these analyses are:

(a) Identification of patterns of antecedent variables that predict criminal behavior in general (i.e., separate criminal offenders from non-offenders); and
(b) Clarification of the differential patterns of predictors (if any) across the crime type categories as initially defined.

Procedure

Stepwise discriminant function analyses were completed in an attempt to identify a set of variables that reliably separated criminal and non-criminal groups, where the groups were defined in terms of specified crime types. Using the results of the discriminant function analyses as a base, a

subsequent set of log-linear analyses was completed. This seemed a prudent step because: (1) some of the variables possessed categorical rather than interval scale characteristics; (2) other characteristics of interest were not readily amenable to regression techniques (e.g., variables representing amalgams of birth order and family size data); and (3) some of the interval scales that seemed to contribute could be reduced to categorical variables on the basis of absolute rather than normative criteria.

The log-linear analytic approach permitted us to homogenize subgroups of the sample in terms of definable descriptive categories related to specified variables or factors. The size of our sample precluded analysis of more than three factors or variables at once. However, the prespecified series of three-factor log-linear analyses served to approximate any additive and interactive associations the predictor variables might have with the criminal-type outcomes.

Based on the literature and the results of the discriminant function analyses a set of six factors were used. The levels described for each factor were defined on the basis of preliminary analyses of required or desired sensitivity within factors.

1. Family stability: Adult changes during ages 0-4, 5-11, and 12-18.
2. Presence of Biological Father: Never present; lived at home sometime between birth and age nine; present for nine or more years.
3. Family Size: One child; two children; three or more children
4. Socioeconomic Status: Based on Svalastoga (1959), low SES (0, 1); middle SES (2, 3, 4); high SES (5, 6)
5. Father Crime: No crime; one offense; two or more
6. Mother Crime: No crime; one offense; two or more

Results and Discussion

The summary of findings that follows deals with both sets of analyses. The focus is on identifying those variables that seem to have significant main effects and those variables that tend to modify or perhaps mediate such effects. Thus, a clean variable-by-variable organization is somewhat difficult.

Socioeconomic Status

Socioeconomic status in the Danish sample was derived from a scale defined in terms of occupations rather than income. Scaling of the occupations was made on the basis of prestige; that is, the Danish populace in effect ranked the occupations according to their perceptions of importance and prestige.

Our findings confirmed other official record studies in showing that SES correlates with criminal activity (Douglas, 1968; Johnstone, 1978; Wadsworth, 1979). While they contradict West and Farrington's finding (1973) that low family income but not parental occupational status is associated with crime in boys; the results are hard to dismiss when one considers the meticulous procedures used with the Danish Police Registry. The discriminant function analyses identified four additional factors that appear to directly impact the home environment and significantly contribute to the prediction of offspring deviance: stability and size of the family, parental criminality, and maternal contentment. With the exception of maternal contentment all of these variables remained significant when controlled for SES. Where SES was entered at the first step in the equation it accounted for approximately 10 percent of the variance. When SES was entered last in the equation its additive contribution was reduced to less than 3 percent. Thus, it appears that although the association between SES and child thievery may be mediated or modified by these variables, SES contributed an additional significant amount of variance not "explained" by other familial and social variables. In the analyses predicting uncontrolled behavior, only one variable, number of changes in family constellation was significant in addition to SES.

The log-linear analyses presented further evidence concerning a suggested interaction of SES with the other antecedent variables. Whereas SES remained a significant predictor of both thievery and violence when control for father's criminality was imposed, the interactions between the two predictors differed in the two analyses. In the thievery analysis a strong influence of paternal crime was observed in all three social (SES) groups. In the analysis of violent offences an association with paternal crime was observed in the low and middle SES groups only. Thus, in the prediction of violent crimes high SES appears to function as a buffer or protector against the effects of a

criminal father. The analyses also indicated that low SES is more strongly related to thievery than to violence.

In the analyses of thievery it was found that the low SES groups with non-criminal fathers showed an incidence of thievery comparable to that of the middle and high SES groups who had criminal fathers. Thus, it seems that where a non-criminal father in the high SES category apparently can provide the wherewithal (money, modeling, supervision) needed to reduce the risk of child crime, such is not the case with the non-criminal father in the low SES category.

In the log-linear analyses of uncontrolled behavior the independent association of SES was washed out when paternal crime was controlled. This finding seems incongruous with the results of the discriminant function analysis of uncontrolled behavior, in which parental crime did not reach significance. This apparent difference in results is likely due to the slightly different subject selection procedure used in the log-linear analyses (i.e., the zero crime group included only cases with no recorded crimes of any type). When maternal crime was controlled, SES remained a significant predictor of all three offense categories. In all three analyses SES reflected a moderate and linear relationship with number of offenses in the cells without maternal criminality. In the cells with criminal mothers SES showed a strong and linear relationship with thievery and uncontrolled behavior. There was a rather high incidence of violence within the low and middle SES groups of boys with criminal mothers (40% and 38% response level); while no violence was recorded in the high SES group. SES remained significant when family stability was controlled in the prediction of thievery; however, SES washed out in the violence and uncontrolled behavior analyses, when family stability was controlled.

In summary, the robustness of the SES influence is especially obvious in the prediction of child thievery, even when controls for other variables were imposed. In predicting violence and uncontrolled behavior when controls were imposed for the paternal crime and family stability variables the independent effect of SES that was observed tended to disappear. Thus, at least when SES is the pivotal variable, there is some support for the notion that there may be differential patterns of predictors for the different crime categories.

Parental Criminality

The discriminant function analyses of thievery showed parental criminality effects which were similar to those reported by Farrington et al. (1975) and Robins et al. (1975). Both paternal and maternal criminality predicted to offspring deviance, with the latter the stronger of the two. While entering SES first reduced their contributions, both remained significant predictors; the latter is consistent with the findings of West and Farrington (1975). As mentioned previously, the discriminant function analyses predicting to uncontrolled behavior did not reflect a significant contribution by the paternal crime variables.

The log-linear analyses confirm the general importance of paternal crime as a predictor of child crime. They also suggest a number of other correlates that help to clarify more specifically the patterns of social and family conditions that may define a child at risk for criminality.

In the multivariate analyses as well as the log-linear model testing with controls, the robustness of father crime masked what appears to be an interaction of father crime and father presence. If the father is never present, his criminal status appears to make no difference in the incidence of child crime. However, the lack of difference in crime rate between the group with never-present fathers who were criminals and those with never present non-criminal fathers is not only due to the absent criminal father having less of a criminogenic influence, as compared to a criminal father who is present, but also to a heightened incidence of crimes in the non-criminal father group. This may be due in part to the higher instability of the family resulting from a never present father. The three analyses that included the exposure to father variable did not tend to support a genetic transmission of criminality hypothesis. When the groups with criminal fathers were compared it was clear that the groups who spent no time with the criminal father manifested fewer criminal offenses.

When analyzed, controlling for combinations of other predictors, parental crime remained significant for all three types of child crime. In general, paternal crime had the effect of increasing the incidence of crime within each of the cells defined by the other predictor variables analyzed. However, the analyses involving family size and family stability deviated somewhat from the pattern. In the

family size analyses it was found that only children as a group did not reflect a lower incidence of criminality, as was reported by other investigators (Rahav, 1980). It did however appear that being an only child provided some protection against the negative influence of having a criminal father.

The apparent immunity of only children to the effects of paternal criminality is not readily explainable on the basis of the literature. One possible explanation for this is that the only-child category includes a disproportionate number of never-present fathers (38 and 36 percent for the father crime and no crime cells respectively, as opposed to 14 percent for the total sample). This would account for both the elevated crime rate in this group and for the apparent lack of influence of paternal recidivism. Living in any unstable family environment during adolescence seemed to generate a negative influence sufficient to negate the otherwise beneficial influence of having a non-criminal father available. Both maternal and paternal crime showed a clear additive contribution. Absence of criminality in either parent did not neutralize the influence of crime in the other parent on the criminal tendencies of the child. If both parents had a background involving criminal activities, the incidence of criminality in sons was dramatically increased. Sixty-two percent of the subjects with criminal records for both parents had themselves committed thievery; 58 percent had engaged in uncontrolled behavior, and 50 percent in violent criminality.

The log-linear analyses showed uncontrolled behavior to be relatively uninfluenced by maternal crime. Thievery was the crime type most influenced by maternal criminal behavior. The maternal crime variable was significant when controls were imposed for all of the other antecedent variables. The analyses that included maternal criminality and SES deserves special mention. In the cell representing low SES and maternal criminality, 75 percent of the subjects had committed a thievery offense, as compared with 38 percent in the low SES and no maternal crime group. In the middle SES and some maternal crime group, 33 percent had committed a thievery offense. Thus, SES and maternal crime seems to yield additive effects similar to those described for maternal and paternal crime. With the exception of SES, the relationship between maternal crime and violent offenses held up when controls were imposed for the other antecedent variables.

On the basis of the log-linear analyses it appears that whereas exposure to a criminal father seems to be associated with the increases in all three types of crime, exposure to a criminal mother is especially related to increased incidence of theft in the offspring.

Family Stability

The family stability variable was defined differently in the discriminant and the log-linear analyses. In the discriminant analyses it was represented by simply the total number of family constellation changes experienced by the child (a constellation change was recorded every time a change occurred in the adult configuration living in the home. Institutionalizations and hospitalizations lasting over three months were also counted a change). In the log-linear analyses the stability variable was defined to reflect the child's age during unstable periods. Preliminary analyses identified eight stability groups; these were defined in terms of whether the home was stable during the following three age periods: 0-4, 5-11, 12 on. Each period was assigned a dichotomous rating--either stable or unstable; then combining the scores for each period in all possible ways yielded 8 different stability patterns. After the preliminary analyses it was found that the age period 0-4 had virtually no sensitivity to criminal behavior. Thus, for the final analyses only stability/instability during infancy and adolescence were taken into account. The following four groups were included:

(1) Unstable 5-11, stable 12 on
(2) Unstable 5-11, unstable 12 on
(3) Stable 5-11, unstable 12 on
(4) Stable 5-11, stable 12 on

The discriminant function analyses found the total number of constellations experienced by the child to predict both thievery and uncontrolled behavior.

When family instability was introduced into the log-linear analyses, it was clear that early adolescence is the most vulnerable period for the possibility of increased child crime. Instability during the earlier period was not directly associated with increased child crime. This is <u>not</u> consistent with the findings of other studies (Wadsworth, 1979). The strong relationship between family instability

and child criminality supports the idea that instability that characteristically follows most divorces may mediate the broken home and crime relationship. The Danish Study reveals considerable variability with respect to post-divorce conditions among the nonintact families studied.

Interestingly, the father's non-criminal status is associated with decreased risk of later child crime only if there is stability during the adolescent period. This is probably related to the fact that the father was not present during part or all of this period, resulting in considerable uncertainty and stress for both mother and child during a time when the child needs systematic attention, supervision, and support. Our findings support and emphasize the importance of a more qualitative understanding of the family's stability associated with pre- and post-divorce (Hetherington et al. 1979). The strength of stability as a predictor of criminal behavior in offspring is underscored by its robustness across all three outcomes.

Family Size

Family size was among the significant predictors, albeit weak, in the discriminant analyses. However, it did not reliably show an independent effect in the log-linear analyses. When family size did approach significance, it was usually reduced to non-significance when the models were tested with controls for the other predictors.

Increased family density in the presence of negative conditions could serve to exacerbate the danger of risk beyond the effect of the negative condition itself. Its importance lies in more thoroughly describing how the effects of other negative conditions might interact with and be magnified by specific family structures and family size. The findings and interpretations seem consistent with those represented in the literature reviewed.

Analyses Within Intact Families

The literature review identified family discord as a possible mediator of the negative influence of parental divorce on child criminality. In addition, empirical evidence was presented supporting the view that the patterns of prediction of criminal behavior differ between intact and nonintact family situations. In view of this, discriminant

function analyses were completed predicting thievery and uncontrolled behavior of males from the two family types. In the thievery analyses within the intact subsample, mother's recidivism, family size, family discord, and SES (in this) order turned out to be significant predictors. Thus, the notion that family discord is a mediator of the alleged negative consequences of divorce seems indirectly supported. That is, considerable family discord is likely to precede divorce; and since family discord in intact families is associated with increased child criminality, it seems plausible that discord followed by divorce would have similar negative consequences.

The discriminant function analyses of predicting to thievery in nonintact families mirrored the results reported above for intact families. However, none of the predictors reached significance in the analysis of uncontrolled behavior in the nonintact group. On the other hand, the analyses predicting to uncontrolled behavior in the intact group yielded a substantial function (Wilks = 71). In these analyses family dissension turned out to be the strongest predictor, accounting for 13 percent of the variance; mother's recidivism accounted for 12 percent, and mother's age for 4 percent. The younger the mother the more uncontrolled behavior was recorded for the offspring. These results lend further support to the notion that family discord is of central importance in the association between non-intactness and criminal behavior. Unlike the results of the analyses predicting to thievery, the results of the analyses of uncontrolled behavior were more consistent with the findings of Offord et al. (1973). Similar to the Offord et al. findings, the analyses showed a generally lower predictability of crime in non-intact families and indicated that parental crime is predictive of criminal behavior only in males from intact families.

In summary, the results reported here generally confirm and extend the literature by demonstrating the additive and interactive character of the predictor variables. The common denominator across the significant predictors seems to be that the development of pro-social behavior in teenagers and young adults is dependent upon how the predictor variables influence the general quality of the adult interaction and identification. In this regard it should be further emphasized that paternal criminality has its greatest negative impact on criminality of the offspring when the criminal father is present and in continuous

contact with the offspring. Further, it appears that while there is great similarity in the patterns of variables that predict to the different overlapping criminal types, there are differences in their order and magnitude that could possibly be further clarified if better separation of the criminal types could be achieved.

Within Criminal Offenders: Severity and Volume

Data from the Danish sample of recidivist criminals does not seem to reflect specialization in criminal profiles. In addition to the studies of Klein, Collins, and Cliff (1982), Loeber's (1982) review points to considerable empirical support for the "variety hypothesis" that "chronic adult offenders usually show a variety of delinquent acts and do not specialize in particular types of crimes." If this is the case, it might be productive to describe the outcome in terms of another organizing dimension; specifically, the number of criminal acts judged to be "severe." In consultation with Buickhuisen (1982, personal communication), the investigators starred those offenses shown in Table 1 that would be considered societally most damaging. The score recorded for each offender was the number of starred items. The correlation between the severity score and the total number of arrest dates was $r = .92$. This clearly indicates the interchangeability of "starred" offenses and the total number of arrest dates. Shannon (cited in Loeber, 1982) suggests that chronic offenders do tend to commit more serious offenses. The correlations between number of arrests and the total number of charges in each crime category summed across all arrests further justify the use of arrest dates as the variable measure:

Total Number Charges	Correlation With Total Arrests
Violence	.55
Thievery	.62
Uncontrolled Behavior	.42
Traffic	.32

In contrast with the discriminant and log-linear analyses, this analysis was concerned with prediction within the criminal group only; thus, only subjects with at least one offense were included (N = 157). Using the same set of predictors from the discriminant analyses, a stepwise regression analysis with simultaneous solution was used to

predict to total number of arrest dates. The strongest predictor was maternal non-recidivistic crime, followed by mother's contentment and mother's orderliness. Family size was the last significant variable to enter the equation. These four variables accounted for 15 percent of the criminal variance ($R2 = 0.15$).

Thus it seems that once a male has had one registered charge against him the propensity to continue to engage in criminal behavior is predicted by a pattern of variables that is somewhat different from the set that differentiates criminals from non-criminals. Our data suggest that a law-abiding and well-adapted mother who has the ability to maintain an ordered household, coupled with having a reasonably small sibship, acts as a "protector" against her one-time offender son's becoming a recidivist.

Separating Violence and Thievery Offenders

While the Danish Study generally supports a "non-specialization" hypothesis, we completed our last analysis based on more restrictive and less overlapping criminal descriptors. Our primary interest was to separate thieves and violent offenders. By allowing other criminal activity to freely vary, 84 of the 123 or 68% could be categorized into one of three groups:

(1) two or more violent offenses with no thievery offenses (N = 35);
(2) two or more thievery offenses with no violent offenses (N = 14); and
(3) one or more thievery offenses with one or more violent offenses (N = 35)

Because of zero frequencies and small cell numbers, the preferred three-way log-linear analyses could not be performed; instead, single factor descriptions were completed.

Our principal findings suggested that offenders with thievery-only offenses possess lower SES than criminals with violent-only offenses ($X^2(1) = 4.17$, $pf < .05$); and that "non-specialist" offenders (thievery and violent offenses) as compared to "specialists" (theft only or violent only offenders) possess a significantly higher proportion of "disorderly" mothers ($X^2(1) = 4.61$, $pf < .05$). While restricted by lack of analytic power, several trends with respect to comparing thievery and violence were suggested:

(1) similar age at onset of crime;
(2) similar coincidence of father crime;
(3) the violence pattern has slightly more disorderly mothers;
(4) the thievery pattern has a greater incidence of family instability during adolescence;
(5) the thievery pattern has a greater number of low SES members;
(6) the thievery pattern has a greater incidence of mother crime; and
(7) the violence pattern has a greater number of three-plus sib families.

To summarize, by way of speculation, when the competition and rivalry that result from high family density is coupled with a primary caretaker who lacks the supervisoral control necessary to establish an authority and values framework, violence could become a prepotent crime choice. On the other hand, if economic duress is coupled with a lack of stable and/or traditional adult models during adolescence the chances of adequate social control being established is reduced and thievery could well become a prepotent crime choice. Recidivists with both offenses of thievery and violence possess the worst conditions; they start their criminal careers earlier, and continue them longer.

While it is certainly far from adequately substantiated empirically (statistically), there does appear to be some evidence that if criminals who specialize at least in thievery or violence can be identified, there may be differential patterns of antecedent events associated with each. This does not counter Wadsworth's (1979) findings that both property and violent offenses are related to similar environmental factors; for they seem to be. It does suggest with Norland et al. (1979), that if sufficiently "pure" classes of offenders can be defined, different predictive patterns of the environmental factors may be identifiable; the trick is to define sufficiently meaningful criminal patterns and still have a large enough N for the power requirements of multivariate statistical analysis. In the analysis just described, if we had not permitted other criminal activity to vary (e.g., uncontrolled behavior, traffic, drugs, etc.), we would have been able to assign only nine subjects (7 percent) to the two crime patterns.

This analysis strongly suggests that the non-specialization notion remains intact and that there may

indeed be reliably definable types of criminal activity with differential patterns of associated environmental variables.

II. Biological and Social Correlates of Crime

Introduction

This section of the final report deals with our analyses of data from the Intensive Examination (IE) study. In 1972 we examined 265 children who were drawn from the same Danish Perinatal Cohort as the subjects of the Family Study (only seven subjects overlap). The purpose of this 1972 examination was to prepare the base for a longitudinal, prospective study of the origins of delinquency and criminal behavior. The examination included a variety of measures of certain individual (including biological) characteristics of the children as well as sociofamilial indices.

In 1981 when the sample was between 18-20 years of age we ascertained their arrest records from the files of the National Police Register. The purpose of this section of the report is to determine what individual factors (including biological factors) measured in 1972 predict to criminal behavior ascertained nine years hence. Because of the prospective nature of this analysis, variables which we find to be predictive may be considered among the factors which might be involved in the etiology of criminal behavior.

Psychology, Biology, and Crime

The data bank of the IE Study is massive. Each type of biological measure (e.g., EEG, SC) often includes hundreds of separate variables. The social interview material includes hundreds of separate items. In order to avoid misleading ourselves with spurious findings we decided to review the literature with an eye toward generation of a limited number of specific hypothesis in each area. In this section we will provide a background; in later sections we will review the specific literature relating to these measures and formulate specific hypotheses.

Autonomic Nervous System (ANS)

The psychopath and serious criminal have been described by Hare (1978a) and Cleckley (1976) as being the most aggressive, dangerous, and recidivistic clients of a prison.

Most clinicians will agree; descriptions of the chronic criminal run as follows: callous, feels no guilt, lacks emotion. The ANS mediates physiological activity related to emotions. The discipline of psychophysiology is most concerned with studying peripheral signs of ANS activity such as skin conductance, heart rate and blood pressure. The most commonly studied peripheral indicant is skin conductance both in the area of crime and in the general scientific study of the ANS. We have recently reviewed the literature on SC in antisocial individuals (Mednick, Pollock, Volavka, & Gabrielli, 1982). It would be inappropriate to repeat this lengthy review here. Suffice to say that in more than 25 studies examining differences between antisocial individuals (psychopaths, criminals, delinquents) and controls the antisocial individuals evidence a consistent pattern of sluggish ANS behavior.

Electroencephalography

In general criminals (typically studied in prisons) evidence dramatically elevated rates of abnormalities in clinically evaluated EEG records. Almost all of this research which has found abnormal EEGs, has been completed with violent criminals. The advantage of the current study is the fact that the EEGs were taken during childhood before the subjects were involved in illegal violent acts or other law infringing behavior.

Two studies in the literature are prospective. One, conducted in the IE sample, noted that among delinquents slowing of the EEG was specifically related to later thievery (Mednick, Volavka, Gabrielli, & Itil, 1981). In an independent replication study Peterson, Matousek, Volavka, Mednick and Pollock (1982) found that slowing of the EEG in childhood was also related to thievery in a large sample of Swedish men.

Alcohol-related offenses comprise an important category of transgressive behavior. In our earlier work we have noted that children at risk for alcoholism tend to evidence high levels of fast EEG activity in the resting state (Gabrielli & Mednick, 1980). In our data analyses we must separate alcohol-related offenders from thievery offenders.

Neuropsychological Evidence

Neuropsychological test results allow inferences relevant to localization and lateralization of brain dysfunction. Spellacy (1977, 1978) assessed neuropsychological functioning in violent and nonviolent juvenile and adult males. Performance by violent patients was poorer on approximately two-thirds of 31 test variables. Berman (1978) reports impairments of verbal, perceptual, and nonverbal functioning indicative of neuropsychological deficiency among violent males.

Lateralized deficits. Studies in the difference of functioning of the left and right brain hemispheres have provoked efforts to identify a lateralized focus for brain dysfunction especially in violent individuals. Flor-Henry (1979) proposes a theory relating psychopathology to lateral dysfunction. According to Flor-Henry, psychopaths suffer from irregularities of the dominant hemisphere (left, in most right-handed individuals). Yeudall and Flor-Henry (1975) studied neuropsychological profiles of 25 aggressive psychopaths. Of the 25, 15 exhibited impairments and the majority of these suggest deficits localized in the dominant frontal temporal region.

The neuropsychological evidence suggests the hypothesis that violent individuals predominantly suffer impairment of frontal and temporal brain regions. Dysfunction in these brain regions (especially in the frontal lobes) is associated with impaired self control and inability to comprehend the consequences of one's own actions (Pincus & Tucker, 1978). These characteristics are compatible with our expectations regarding violent individuals.

Perinatal factors in violence. Damage to the brain has been suggested as a possible factor in the etiology of violence. In view of the fact that aggressive behavior is a consistent pattern for many boys from early childhood, we might entertain the possibility that the brain damage occurs early in life. Perinatal difficulties could be an important source of such damage.

Excluding instances of extreme levels of anoxia or mechanical damage to the brain, infants show good recovery from delivery complications, not so for serious pregnancy disorders. Signs of pregnancy difficulties, however, are more difficult to record than signs of delivery

complications. Teratogenic factors during embryonic development are frequently indexed at birth and later by small easily, observable aberrancies in the development of the infant's external physical characteristics. These aberrancies involve visible growth anomalies of the arms, hands, toes and hair which can be counted. Research has noted a significant positive relationship between such minor physical anomalies and later attention disorders, impulsivity and aggressiveness in boys. In fact, the newborn count of anomalies explains almost half the variance in hyperactivity at age three (Waldrop, Bell, McLaughlin & Halverson, 1978). Since children with these anomalies are judged to be as attractive as those without anomalies, the disturbed behavior is not likely to be due to peer mistreatment (Bell and Waldrop, 1982). It is reasonable to assume that the teratogenic agents which caused the visible physical anomalies during fetal development, also produced covert anomalies in the central nervous system. Thus a count of such physical anomalies may be seen as an index of CNS damage to the fetus during the pregnancy.

Intelligence

There is a consistent literature indicating that the offender, especially the recidivist, tends to be of lower intelligence than the non offender. One explanation of this finding suggests that lower level intelligence (especially verbal intelligence) of the future criminal produces frustration in school. This frustration in interactions with an important socializing agent may lead to the youth to seek after alternate forms of reinforcement. A more detailed review will be presented below.

Skin Conductance

The literature review suggests that the antisocial individual evidences relatively diminished responsiveness and slow recovery of skin conductance. Diminished responsiveness is especially evidenced in orienting stimulus conditions (mild stimulation). The recovery differences are noted in response to loud, surprising or stressful stimuli which elicit ANS defensive reactions.

The stimulus series utilized in this study consisted of both orienting trials and trials with loud noises. In terms of the Venables interpretation we hypothesize that the recidivists will evidence reduced orienting skin conductance

amplitude and a reduced number of orienting responses as well as slow skin conductance latency and recovery in response to the loud noise stimulus.

Results

On the whole, the results conform to the hypotheses. Those who will some years later be arrested, tend (at age 12) to evidence lower amplitude of response, fewer responses, longer latency and slower recovery. As hypothesized by Venables, the degree of responsiveness differences are significantly more marked for the OR trials and the latency-recovery differences are significantly more marked for the UCS-noise trials.

In agreement with a considerable literature, level of ANS responsiveness and latency and recovery observed in 12-year old boys taps some characteristic which is related to the likelihood those boys will be registered for recidivistic criminal behavior nine years hence. Examination of plots of ANS factors against number of registrations for criminal acts are consistent with the hypothesis that high levels of ANS responsiveness and fast ANS latency and recovery are protective factors against recidivistic criminal involvement.

Thievery, violence, uncontrolled behavior. The pattern reported for number of offenses is almost completely reflected in analyses of number of thievery offenses. Neither violent nor uncontrolled behavior offenses relate to skin conductance response patterns.

Central Nervous System Activity

Electroencephalogram (EEG) recordings from the scalp reflect central nervous system activity. Such recordings have been used to investigate criminal populations since the early 1940s (Hill & Sargant, 1943; Silverman, 1944; Hill & Pass, 1952). Most of these studies indicate that criminals' EEGs are more frequently classified as abnormal than those of non-criminal subjects. Slowing of the EEG frequency was a principal finding in these studies. The slowing is usually observed as increased activity in the slow alpha range (8-10 Hz).

One hypothesis which could explain the observed relationship between alpha slowing and criminality is that a

relatively slow frequency EEG pattern reflects a developmental lag. Slower EEG frequencies tend to predominate in childhood. As individuals mature, their average EEG frequency increases (Lindsley, 1939; Matousek & Petersen, 1973; John et al. 1980). Predominantly slower activity observed in criminals could therefore be reflective of immaturity of brain development of criminals.

Another related hypothesis is that criminals have lower arousal. Slow EEG activity is known to increase with relaxation and drowsiness and decrease in states of tension (Kooi, Tucher, & Marshall, 1978). If criminals show less arousal (as autonomic nervous system studies suggest), the observed EEGs may reflect this pattern (Mednick & Volavka, 1980).

Alcoholics have been observed to show EEG differences from non-alcoholics. Their EEGs tend to contain excessive fast EEG activity and deficient alpha. (Davis et al. 1941; Little & McAvoy, 1952; Funkhouser et al. 1953; Naitoh, 1973; Jones & Holmes, 1976.) This pattern is generally consistent with increased cortical arousal. It has been demonstrated in children at high risk for alcoholism (Gabrielli & Mednick, 1982). On this basis, we could expect individuals who commit crimes which are primarily related to alcohol (e.g., drunk driving) not to be characterized by slow alpha activity. The individual who tends to commit alcohol-related crimes should, exhibit relatively faster frequency EEG activity (beta; 13-25 Hz).

These considerations lead us to hypothesize that thieves will tend to exhibit a predominance of slow alpha activity while those exhibiting uncontrolled behavior offenses will evidence increased faster (beta) activity.

Results

Mean differences. We examined relative percents of slow alpha (8-10 Hz), beta I (18-26 Hz), and beta II (26-40 Hz) activity. We compared non-offenders, one-time offenders and recidivists for total number of offenses, theft, uncontrolled behavior, and violence. The average relative slow alpha is greater for the recidivistic thieves, but not so for the violent offenders or for uncontrolled behavior offenders. Patterns observed for overall means were also observed for specific EEG derivations

Thieves. The results for our young adult property offenders are consistent with our earlier findings (Mednick et al, 1981) in which we examined the relation of EEG slow alpha to delinquent thievery in our subjects. The results have also been replicated by a prospective study conducted on Swedish thieves (Petersen et al, 1982).

In view of the fact that there are many thieves we separated out a group of nine who were chronic offenders (five or more theft offenses). We expected that these chronic thieves would be most highly differentiated by relative slow alpha activity. Taking the groups of thieves as a scale, regression results support the hypothesis that the progression is significant. When tested as children (age 12) the later chronic offenders evidenced markedly more slow alpha activity than controls.

Uncontrolled behavior offenders. It is important to note that the uncontrolled behavior category (in our sample) heavily involves alcohol-related crime (e.g. drunkeness, loitering, drunken driving, irresponsible driving). The crimes in this category were primarily committed while individuals were under the influence of alcohol. In agreement with our hypothesis, at 12 years of age, those who later were involved in recidivist uncontrolled behavior offenses evidenced faster EEG activity.

Comment

We have observed a pattern of slower EEG activity (more slow alpha) in thieves and a pattern of fast activity in uncontrolled behavior offenses which heavily involve alcohol-related offenses. Both results are consistent with the hypothesis that criminal behavior is associated with level of cortical arousal, less arousal in the thieves and high arousal in the uncontrolled behavior offenders. Of course, the EEG was taken at age 12 under sober conditions. Most of the uncontrolled behavior offenses were committed after alcohol ingestion. Alcohol results in a marked increase in EEG slow alpha power and a general reduction in fast frequency activity. It is possible that the thieves and the uncontrolled behavior offenders both were being influenced by high levels of slow alpha at the time of their offenses.

It is perhaps of interest to speculate regarding the origins of those slow and fast EEG patterns. Both types of

patterns are known to be heritable (Vogel, 1958, 1970; Young et al. 1972; Propping, 1977, 1980). These patterns can also be produced by brain trauma.

Neurological Functioning

In this section we will consider two potentially criminogenic factors relating to brain functioning: cerebral dominance and minor physical anomalies (MPA). In line with control theory models, it is our general hypothesis that antisocial behavior is an intrinsic characteristic of man; to become truly civilized the child must learn to inhibit antisocial behavior. There are many sources of inhibition, both social-familial and individual-biological. Most (if not all) of these sources of control require an adequately functioning central nervous system (CNS). When CNS functioning is less than adequate, control of impulses may suffer. Some of these poorly controlled impulses may lead to illegal acts, especially violent offenses.

Laterality

We have published a study earlier which remarked on the increased likelihood of delinquent activity from members of the IE sample who were left side (right hemisphere) dominant (Gabrielli & Mednick, 1980). Of the left handers (as determined by the 12-year old intensive assessment) 64.7% were later arrested (by age 18); only 29.5% of the right handed individuals were arrested. Almost all of these offenses were property crimes. These results are consistent with previous findings (Fitzhugh, 1973; Andrew, 1978; Krynicki; 1978).

These facts lead us to hypothesize that signs of deviation from left hemisphere dominance will be related to increased probability of criminal behavior especially violent behavior.

Minor Physical Anomalies (MPA)

It is difficult to find adequate indices of pregnancy disturbance. If such disturbances are serious enough, however, they can produce anomalies in the developing fetus (Waldrop, Bell, McLaughlin & Halverson, 1978). This opens the possibility of indexing the effects of disorders in embryonic development by noting and counting the resultant visible minor physical anomalies (MPAs). Rapoport, Quinn

and Lamprecht (1974) and Waldrop and Halvorsen (1971) have noted that MPAs are strongly associated with disorders of pregnancy (e.g., rubella during pregnancy or bleeding during the first trimester).

The measurement of MPAs is reliable; high stability has been demonstrated from the newborn period up to seven years of age (Waldrop, Bell, McLaughlin & Halverson, 1978). There is some evidence that MPAs measured in the newborn period predict to later hyperactivity. "Boys with high newborn anomaly scores were almost <u>always</u> seen as hyperactive at age 3" (Bell & Waldrop 1982, page 212). Hyperactivity in boys is highly related to later serious delinquency (Satterfield, in press). In the Bell and Waldrop paper MPAs are found to be related to poor attention span, and impulsivity-aggressiveness.

These considerations suggest that some teratogenic factors which affect the developing physical characteristics of the fetus also damage unspecified CNS structures or processes that are related to the inhibition of aggression, activity level and attentional processes. We hypothesize that subjects in the IE sample who have MPAs will have suffered CNS damage which will reduce their ability to inhibit impulses (including antisocial impulses). In terms of criminal behavior this increased level of impulsiveness should be seen later chiefly as an increase in number of violent offenses.

<u>Results</u>

<u>Laterality</u>. Our results with adult crime are quite similar to those we observed with delinquency with this sample. A significant proportion of the offenders are left-handed and left footed. The pattern is true for thieves (handedness: chi square(1) = 9.40, $p < .005$; footedness: chi square(1) = 6.41, $p < .05$) as well as for violent offenders (handedness: chi square(1) = 7.51; $p < .01$; footedness: chi square(1) = 10.34, $p < .001$). Of left handers, 35% were arrested for some violent crime while 10% of the right handed individuals were arrested for a violent crime. The pattern is virtually the same for footedness (36% and 7%, respectively).

<u>MPAs</u>. MPAs are significantly increased only for violent offenders.

Summary

We have examined two factors relating to neurological functioning. Left side lateral preference (right hemisphere dominance) relates to both thievery and violent offending and not to uncontrolled behavior. Left hemisphere dominance has been associated with more planful, rational, less impulsive behavior. It is reasonable to expect that violent offenders might evidence deficits in these left brain characteristics.

The greater number of MPAs in violent individuals suggests that they suffered some teratogenic influence during fetal development. The relationship of MPAs to certain behavioral problems has indicated the likelihood that CNS damage to the fetus must have been suffered simultaneously. We have interpreted this damage as serving to reduce the ability of the individual to inhibit antisocial acts.

Intellectual Performance

A number of studies have reported that delinquents, and adult criminals tend to have lower than average IQ scores (Caplan, 1965; Prentice & Lelly, 1963; Thomas & Thomas, 1928; Tuchin, 1939; Woodward, 1955; Hirschi & Hindelang, 1977). Low intelligence has also been found to be predictive of criminality in prospective, longitudinal cohort studies (Moffitt et al. 1981; McGarvey et al. 1981; Van Dusen & Mednick, 1983). The difference in intelligence appears primarily on verbal and not performance tests.

In the present investigation, we attempt to determine how IQ measures obtained at age 12 discriminate the offender groups. From our own and others work we hypothesize that verbal ability will be poorer in the criminal, especially the recidivist.

In 1972, when the subjects were intensively assessed, they were administered five subtests of a Danish translation of the Wechsler Intelligence Scale for Children (WISC): Vocabulary, Similarities, Block Design, Object Assembly, and Mazes.

Results

For each type of crime measure, non-offenders score consistently higher than offenders. Significant differences

appear for Verbal IQ and verbal subtests for overall crime and for thievery. Duncan multirange tests indicate that the recividists are significantly lower in verbal ability than the other two groups of offenders. Recidivists in each type of crime evidenced significantly inferior verbal IQ in contrasts with the non-offenders.

Comment

This finding is in keeping with a fairly consistent literature. Why is verbal ability so poor in offenders especially recidivists? Camp (1977) has noted that young (6-8 years of age) aggressive boys exhibit poor verbal ability. She finds that they fail to use mediating verbal signals to control their behavior. Camp suggests that verbal tools are critical for the cognitive control of behavior. She in part ascribes aggressive behavior to "a high threshold for activating self regulating verbalizations." (p 152) If a boy is deficient in verbal skills and vocabulary this could very well prove to have the same consequences for self regulation as the functional deficit implied by the "high threshold". We could therefore suggest that the poor verbal ability of the criminals (especially recidivists) may serve to weaken the capacity of these individuals to use linguistic control systems to inhibit their antisocial behavior.

Familial Factors

The family study has presented a detailed analysis of the family-related variables which predict to criminal behavior in the male offspring. These include paternal recidivism, family instability, SES and maternal crime. The purpose of this section of the report is to determine to what degree these findings are mirrored in the data of the IE study. Both samples were drawn from the same birth cohort which implies a similarity of age and political and social period of development. In addition the methods used to define and score family factors are almost identical for the two samples.

In view of the disturbed nature and smaller size of the IE sample we will not follow all of the detailed analysis plan of the Family Study. We will restrict ourselves to a comparison of corresponding discriminant analyses in the two samples examining familial factors predicting to thievery,

uncontrolled behavior, violence, and total number of offenses.

Thievery

The family variables of the IE sample were entered as independent variables into a discriminant analysis to predict number of thievery offenses (0, 1, or 2+). Mother's age at the birth of the child (mother's age) and family stability are significant predictors with a Wilks Lambda of .79. The two significant variables discriminate the non-offenders from the other two groups. This analysis has features which both distinguish it from the Family Study thievery analysis and which are similar. One of the most consistent and most powerful predictors in the Family Study is father's recidivism. This is in accordance with previous research by others and our own studies (Kirkegard-Sorensen & Mednick 1977; Mednick, Gabrielli & Hutchings, in press). In each analysis in the IE study the father's recidivism variable only approaches significance.

This difference in results was anticipated. The IE sample was selected to be at high risk for criminal behavior. In many cases in which the father is not registered as an offender the mother is severely schizophrenic or is suffering from character disorder, both at levels which required hospitalization. Some fathers who are not recidivists have psychiatric hospital diagnoses of "psychopath". Such diagnosed psychopaths are usually severely alcoholic and have extremely weak attachments to society. It is clear that our "controls" for recidivistic fathers are often at least as deviant as our index group. For this reason we anticipated that the variable father's recidivism would have weak to moderate effects.

We indicated already that mother's age and family instability are significant predictors of amount of thievery. Father's recidivism is the next most important predictor but it does not reach statistical significance. This is doubtless due to the already mentioned difficulties in the non-recidivistic groups of parents. In the control group (non-deviant parents), however, father's recidivism was a significant predictor of thievery in the children.

Mother's age entered on the first step of the discriminant analysis. The younger the mother at the birth of her son the greater the likelihood that son would be

arrested as a thief. In the IE sample, mother's age ranges from 14-46 years. The younger mothers tend to be unmarried, of low SES and eventually have larger families. The pattern of family factors apparently contributing to a predisposition to thievery offenses in the IE sample includes family instability and young, unmarried mothers. The latter variable implies low SES and the large family size. These findings agree quite well with the comparable Family Study analysis.

Uncontrolled Behavior

An analogous discriminant analysis was completed predicting to uncontrolled behavior offenses. The results were quite similar to the thievery analysis. Mother's age entered at the first step with number of constellations as the next step (not quite significant). In the comparable Family Study analysis SES and number of constellations were the two significant predictors. In view of the relationship between mother's age and SES the two analyses are comparable. In fact in the Family Study analysis of uncontrolled behavior which is restricted to intact families, mother's age appears as a significant predictor, further indicating the agreement between the results of these two independent analyses.

Violent Offenses

A similar discriminant analysis was completed for violent offenders. Number of constellations entered at the first step followed by SES (not significant).

Summary

It is clear that family instability is a critical variable associated with all of these three forms of criminal behavior (thievery, controlled behavior and violence). The family variables do not present differential patterns of factors predicting to the different types of crimes. Family instability seems to provide a general predisposition to criminal behavior.

III. Biosocial Interaction

In this section we will examine how family factors combine with biological and psychological factors in relating to criminal behavior. The analyses of the Family

Study and the family factors of the IE sample revealed that the variable Family Stability summarized very well the family influences on criminal behavior. Consequently we decided to see how Family Stability combined with the biological measures in influencing future criminal behavior. The variables chosen for this analysis therefore, include Family Stability (up to age 11 years) in combination with ANS factors (latency, recovery and number of OR), CNS factors (relative amounts of alpha and beta activity), verbal intelligence, and neurological factors (MPAs and laterality).

Skin conductance. The subjects with greater family instability and slower ANS latency tend significantly to commit more criminal acts. There is no statistical interaction; the independent variables have an additive effect. The highest proportion of subjects arrested is attained by the subgroup with both slow ANS latency and unstable family conditions. Somewhat the same pattern is seen for family stability and number of OR responses. The same additive relationship seen for latency is seen for half recovery time.

EEG. The most interesting finding with the EEG relates to uncontrolled behavior offenses. There is no significant statistical interaction. The role of family stability and fast brain activity in uncontrolled behavior offenses is additive. The greatest proportion of uncontrolled behavior offenders is reached by the group with relatively large amounts of fast beta activity who are raised in unstable families. The EEG did not relate to violence.

Neurological factors. While laterality is not related to thievery or uncontrolled behavior in those raised in stable families, in the context of an unstable family background, right brain dominance is associated with increased thievery and uncontrolled behavior. Interestingly enough, the other neurological factor, MPAs, evidences the same type of interactive relationship with family stability. Those reared in a stable family do not evidence increased levels of arrests if they have a large number of MPAs; those reared in unstable families have a relatively large number of arrests if they have a large number of MPAs. What is of special interest is the fact that MPAs interact with family stability in predicting violence. Almost 70% of those with unstable families and a relatively large number of MPAs are arrested for at least one violent offense.

Comment on an Application of These Results

First we should note that the psycho-biological and family factors relate additively and independently to expressions of criminal behavior. That is, they are not explaining the same variance. This fact has some implications for application of these findings. Society's most severe crime problems are tied to the highly active behavior of recidivists and chronic offenders. If such individuals could be identified early in their delinquent careers, effective preventive intervention might be developed which could treat these youths (e.g., by enabling them to control their criminogenic tendencies) or they might be counseled and trained for careers which could make productive use of their distinctive characteristics. But the first step in applying this model of preventive intervention is early identification of the future recidivist. Combinations of social-familial factors have been successful by themselves in explaining up to 27% of the variance in criminal behavior (Robins, 1966). We have predicted earlier that the addition of biological and psychological variables and biosocial interactions to the assessment procedures would improve prediction. A major goal of this project has been empirically to assess this hypothesis. It is clear from our results that predictions of recidivism can be improved by <u>combining</u> biological and sociofamilial measures. There are a number of implications of an applied nature to this improvement of prediction.

For example, we might profitably commence studies with large numbers of first time offenders, assessing them with a wide variety of measures including some variables from the IE assessment. We would then wait until some evidence recidivism and determine which combination of assessment measures distinguish the future recidivist and chronic offender. By application of modern techniques for assessment construction and some iterations there is reason to believe that we might, relatively quickly, produce a practicable, reliable, valid, brief assessment battery which would identifiy our target population at the time of their first encounter with the criminal justice system.

The reliable early identification of the recidivist would make possible targetted intervention studies with a limited number of selected subjects and specific, measurable goals. Hypotheses for intervention techniques could be drawn

from current criminological theory and from consideration of the critical anamnestic, biological, psychological and socio-familial variables which distinguish the recidivist.

Neurological Factors

Statistical interactions between the family variable and biological factors were significant for the neurological factors, laterality, and MPAs. This interactive effect of family stability and biological factors is reminiscent of the early study by Drillien (1964). She found that premature infants tended to perform poorly in school. Further study revealed that this infirmity of the prematurely born did not predispose to school failure in cases in which the premature infant was raised in a stable family. In unstable families, premature infants suffered in intellectual ability and performance. In other words, in the Drillien study rearing factors made up for perinatal insult.

A number of similar interactive results have been reported for other perinatal-family factors (Mednick, Mura, Schulsinger & Mednick, 1971; Sameroff, 1975). We have already indicated that number of MPAs may be in part viewed as an index of disturbances during pregnancy. In this sense, the observed interaction with family factors may be seen as consonant with the literature.

FAMILY ENVIRONMENT CORRELATES OF YOUNG ADULT CRIME

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Table of Contents

Part I: Family Environment Correlates of Young Adult Crime

PREFACE

The general purpose of the Longitudinal study of Social and Biological Factors in Crime is to examine the registered criminal behavior in a subsample of a Danish birth cohort of an average age of 21 years. The total study focuses on two sets of predictors of crime: (1) familial and social factors; and (2) individual characteristics, specifically ANS responsivity and EEG readings. The predictive contribution of each set of variables is determined separately as well as additively and in interaction with the other set.

Subjects

The subjects for this inquiry constitute a subsample of a Danish birth cohort. In 1959, a prospective longitudinal study was initiated in Copenhagen; 9125 consecutive hospital deliveries were included. As part of this study, the subjects were examined pre- and perinatally and the total group was again seen by the original investigators at age one year. The one year examination constitutes the last examination of the total cohort. Since then however, a series of follow-up studies has been carried out on different subsamples of the cohort. Two such subsamples, followed up at 11-13 and 18-20 years respectively, form the subject groups, for the present set of studies.

Intensive Assessment Study

At 11-13 years of age, 263 children underwent an intensive assessment including computer-scored EEG and ANS examinations, cognitive and intellectual assessment, personality testing, a detailed 1 1/2 hour neurological examination, and a psychological interview. Of the total 263 subjects, 144 had parents who were deviant or psychopathic, and 121 had normal parents. All parents took part in a lengthy home interview relating to the familial and social conditions of the home, parental attitudes and characteristics, and life history data of the subject. In addition, the social worker who conducted the interviews evaluated aspects of the home environment and the personal characteristics of the mother according to a predetermined set of criteria.

This follow-up study was supported by a grant from the Center for Studies of Crime and Delinquency, NIMH (S. Mednick, Principal Investigator).

Family Study

When the cohort reached age 18-20 years, another subsample consisting of a 10 percent random sample of the total cohort was included in a follow-up study (N=857). The purpose of this study was to investigate the long term consequences for the child of a set of family structure variables and of selected descriptors of maternal characteristics. The follow-up procedures involved an intensive mother interview conducted in the home. The

interview dealt with family stability and compatibility, characteristics of members of the household, social factors influencing the family, maternal education and attitudes, etc. The social workers who conducted the interviews completed a set of ratings similar to those described under the Intensive Assessment Study.

The follow-up procedures of the Family Study also involved accessing information from the National Population Register concerning the moves the family had made, the sex and birthdates of siblings, and parental marital history. Data on parental criminal behavior was obtained from the Danish National Police Register. The data collection and data organization procedures of this study are described further below. This follow-up study was supported by the National Institute of Child Health and Development, NIH (Birgitte Mednick and Robert Baker, principal investigators).

General Objectives of the Inquiry

In January 1981, the cohort ranged from 20-22 years of age. At that time, information was collected on the registered criminality of the subjects in both the Intensive Assessment and the Family Study samples.

In the aggregate, this set of studies analyzes the relationships between and among different categories of information previously collected on these two samples and the current 1981 criminality data. The analyses reported were carried out in four successive parts.

The aim of the Part I analyses was the identification of antecedent social and familial variables which predict to later criminal behavior. These analyses included the 825 subjects previously studied in the Family Study, and constitute the basis for the present report.

Part II analyses were attempts to replicate the findings from Part I, using the Intensive Assessment samples as far as the existing overlap between the datasets on the two samples would permit (S. Mednick and W. Gabrielli, investigators).

Part III involved analyses of the relationships between the individual characteristics (e.g. ANS, EEG) and the dependent measures of antisocial and criminal behavior using the Intensive Assessment Sample (similar data is not available on the Family Study sample) (S. Mednick and W. Gabrielli, investigators).

Part IV involved analyses of the interactions between the social/familial and biological variables in explaining the etiology of criminal behavior, again using the Intensive Assessment sample (all principal investigators).

PART I: FAMILY ENVIRONMENT CORRELATES OF YOUNG ADULT CRIME

A. DESCRIPTION OF SAMPLE AND VARIABLES

Sample

The total subject group of the Danish Perinatal Study from which the 857 Family Study subjects were drawn represents a slightly lower mean SES when compared to a representative Danish sample. In addition, the incidences of out-of-wedlock births to teenage mothers are significantly higher in this sample. The reasons for this are: 1. The University Hospital of Copenhagen (Rigshospitalet) is located in the center of the city and draws a sizeable proportion of its patients from the poorer inner city neighborhoods. 2. At the time of the original data collection for the Danish Perinatal Project the admission policies of Rigshospitalet were such that unmarried pregnant women from the whole Copenhagen area were referred to that hospital for delivery. The characteristics of subjects of the Danish Perinatal Project have been described in detail by Mednick et al (1983). The selection of the 857 subjects to be followed up in the Family Study involved the following steps: 1149 cases were randomly selected and contacted. A refusal rate of approximately 20 percent of those contacted was expected on the basis of previous follow-up studies with the same population.

3. 232 subjects did not want to take part in the Family Study and, in addition, 60 subjects were disqualified for such reasons as maternal death, emigration, etc.

The demographic characteristics of the Family Study sample were similar to those of the total Danish Perinatal Sample, i.e., an elevated incidence of teenage and out-of-wedlock births, and lower average SES than found in representative Danish samples. However, the whole range of the SES distribution is represented in the sample. The criminality data used in the analyses of the present study was collected in 1981. At this time an additional 27 subjects were lost to the Family Study sample due to death, emigration, etc., thus leaving 325 subjects who constitute the subject pool for this study.

Description of the Family Environment

On the basis of the literature on social and familial predictors of criminal behavior, the following set of variables was selected from the data files of the Family Study for use as predictors of criminal behavior in the present set of studies.

Socio Economic Status

The SES measure used in the study was calculated on the basis of a scale developed specifically for use with Danish populations (Svalastoga, 1959). The scale scores are based on the occupational status of the head of the household. The score range is from 0 (unskilled worker) to 6 (person

with higher academic education and occupying a leadership position.)

Number of Family Constellations

The problems with using the dichotomous variable intact versus non-intact family are described in the literature review below. The number of constellations is a measure of overall stability of the family and appears to be a more reliable predictor of criminal behavior. A change in constellation is coded whenever a change occurs in the adults living in the home; e.g., a father figure moving in or out, a relative moving in or out, etc. If the child lived away from the home for a period of time, e.g., in a children's home or a boarding school, this also was coded as a constellation change. The information used in the development of this variable was derived from the Social Worker interviews, during which the mothers were asked to describe each consecutive constellation in which the children had lived from birth to follow-up.

Family Stability

This measure is also based on the constellation information. The childhood period was divided into 3 age levels: 0-4; 5-11; and 12 and above. The stability of the home during each of these time periods was evaluated for each subject according to a prespecified set of criteria. A full description of these would be too lengthy. Suffice to say that an age period was coded as stable if no change or

one minor change had taken place (e.g. grandmother moving in); all other changes during the period were coded as an unstable influence factor. Thus each subject was assigned a score indicating the degree of stability characterizing the home environment during each of the three age periods:

Years With Father

As another indication of the stability, the years which the biological father spent in the home were calculated.

Family Dissension

The variable family dissension is a scale score based on eight interview items dealing with areas of marital discord (alpha = .78) Scores on family dissension are available only for subjects whose mothers lived in a marital situation within the five year period preceding the Family Study follow-up.

Family Size, Birth Order, and Spacing of Children in the Family

The measure family size was based on total number of live children born to the subjects' mother. Paternal half-sibs were only counted if living in the household. Several analyses were done comparing different groups of subjects defined in terms of birth order and spacing. The descriptors of these comparison groups are self explanatory.

Parental Criminality

Information pertaining to parental criminality was

obtained from the National Danish Police Register files. All police contacts and court decisions in Denmark are recorded in this file. The Register is described in more detail in a later section of this report dealing with the dependent variable. The specific nature of parental crimes was not taken into account in this study. Differentiation was made, however, between parents who were charged with only one crime and to recidivistic parents. Thus, two dichotomous variables were developed for both biological parents of each subject: one indicating one-time offense and one for recidivism.

Maternal Characteristics

On the basis of the literature, four of the maternal descriptors used in the Family Study were judged to be of possible value in predicting criminal behavior in offspring: maternal age, which was directly coded, and three scale scores derived from the mother interview items and from the social worker's ratings of the mother. One of the scales, "Mother's Orderliness," is an indicator of the overall degree of orderliness and neatness that characterized the mother's personal appearance and the home (r alpha = .80) "Mother's Contentment" provides a measure of the mother's degree of adaptiveness to and contentment with her situation, as well as ability to function in it (alpha r = .77). "Mother's Health" is a scale score indicating the general status of the mother's health history (alpha r = .58).

Definition of Criminal Activity

As mentioned in the previous section, the data used for generating the dependent variable in this study was obtained from the Danish National Police Register files. All police contacts and court decisions are recorded in this file. Danish police practice is applied with a relatively even hand. "Police officers are legally required to report cases, if they have a suspect they are not permitted to make judgements in such matters---. The social status of a Danish police officer is comparatively high; they are regarded as being incorruptible" (Christiansen 1977). Wolfgang (1977) describes the National Police Register thusly: "The reliability and validity of the Danish record keeping system are almost beyond criticism. The criminal registry office in Denmark is probably the most thorough, comprehensive and accurate in the Western world."

For the purposes of this study an individual was defined as criminal if he was registered in this Police Register. Information about "hidden criminality" was not available; however, we were encouraged to work with this official definition of criminality in view of the excellence of the Register and the relatively strong evidence that the hidden criminal is the less serious, less recidivistic criminal (Christie, Andenaes & Skerbaek 1965; West & Farrington 1973; Hindelang, Hirschi & Weis 1979). The criminality data are both analyzed in terms of classical

police categories and in terms of degree of recidivism.

Typology of Criminal Profiles

For the initial analyses, it was decided to examine the association between environmental factors and different classes of criminal offenses grouped according to classical police categories: (1) violent crimes, (2) uncontrolled behavior not involving attacks on persons, and (3) thievery and property offenses. Table 1 presents a list of the offenses included in each category. This approach assumes a certain amount of specialization in the criminal behavior of offenders as opposed to the development of a more general criminal lifestyle. The empirical evidence relevant to this assumption is unfortunately not very clear.

In a recent paper, Klein (1983) reviewed the findings of 33 studies examining the extent to which the offenses of juvenile delinquents tend to show specialization rather than what the author calls a "cafeteria-style approach" to crime. Klein concluded that in view of the fact that only four studies support the specialization or patterning view of delinquency, and the rest either unequivocally support the notion of no specialization (21 studies) or yield ambiguous findings (8 studies), it would seem more prudent to reject the specialization hypothesis. It should be emphasized that factors such as nature of data (self report versus record data) and statistical procedures employed were ruled out as possible mediators of the findings. Klein's conclusion was corroborated in a study by Collins and Cliff (1982). In the

Collins and Cliff Study, however, the lack of specialization or patterning was shown to characterize adult criminality as well as juvenile delinquency. The data, subjected to factor- and cluster analyses by Collins and Cliff (1982), consisted of the complete police records of the criminal behavior committed by 28,879 Danish men from age 15 to age at follow-up (between 27 and 31 years). The results did not support the criminal typologies suggested in the literature (Gibbons, 1965, 1975; Roebuck, 1965, Blumberg, 1981). Rather, the data showed one general criminality factor and one 'minor traffic offense' factor. In addition, it was found that many offenses did not belong with either of the factors.

In contrast to the above, a series of studies concerned with the etiology of criminal behavior have shown differences in the configurations of environmental variables related to different types of crime, such as aggression, property offenses, incorrigibility, etc. (Norland, et al., 1979; Johnstone, 1978). The results from this area of research do not present a coherent picture at all, but are characterized by apparent contradictory findings. The reconcilability is made difficult because of data source differences (e.g. self report versus record data, and differences in procedures used in scoring subtypes of criminal behavior). As an example, Wadsworth (1979), using official records, found property offenses to be related to family factors, as do Norland, et al. (1979)

Table 1

Criminal Offenses By Category and Severity[1]

Violence

robbery*
armed robbery*
domestic fight
public fights
threats
violence*
keeping other person prisoner*
attempted murder*
murder*
cruelty to animals
rape*
illegal removal of child

Uncontrolled behavior: Vandalism

drunkenness, loitering
warning from police
irresponsible behavior
destruction of property
arson*
drunken driving*
irresponsible driving, speeding
violations against specific conditions

Thievery and Property Offenses

joy riding
minor thievery
buying and selling of stolen goods
thievery
breaking and entering*
larseny
fraud forgery*
crimes in public office*
blackmail
counterfeit money

License Violations

driving without a license
violation of specific laws
gambling
weight class violations
false identity perjury
false accusation
weapon laws

Minor Traffic, etc.

traffic 1
traffic 2
minor violations against military law

Treason

Narcotic Law

Major Traffic

manslaughter
involuntary causing harm to others

Sex Crimes

[1] offenses marked by an asterisk (*) indicate those judged to be "severe" (see Note 1).

using self report data. Johnstone (1978), on the other hand, analyzed self report data and found different types of property offenses not significantly related to family factors. In general, Wadsworth's (1979) analyses do support the notion that criminality may not be a "homogeneous phenomenon." That is, while similar environmental agents may contribute to most criminal activity, they may possess differential discriminant ability across criminality types. Similarly, Empey and Lubeck (1971) suggested a more-or-less common set of environmental elements or agents. However, using path analytic techniques to test competing causal models involving the elements, they noted variations in the effectiveness of the models across delinquency types and geographical settings.

Clearly, further clarification of the differential etiological importance of the antecedents identified depends on more valid operational specifications of criminality types -- as well as a better understanding of how the variables interact within different general environmental contexts. A general problem in reviewing studies in this area is that it is nearly impossible to determine the extent of overlap between the different types of criminal behavior defined. For example, a person scoring high on a factor or measure indicating aggressive or violent behavior may very well also score high on a property offense measure, or an incorrigibility measure. On the basis of the negative findings from the research attempting to identify patterns

in criminal behavior, it seems quite likely that the overlap between categories will vary greatly and unsystematically from sample to sample and frequently be quite sizeable, thus rendering prediction of specific types of crime a rather unproductive activity. In view of these findings, it appears that reduction of the dependent variable to a simple indicator of amount of criminal behavior manifested may be warranted, rather than attempting a more qualitative analysis of specified criminal activity. In spite of such justification we elected to establish a prediction framework that would remain somewhat sensitive to specific types of crime. In so doing we partially avoided the premature and possibly unjustified elimination of potentially useful data detail. Also, dismissing as artifacts the findings of those studies that did yield differential predictions for different criminal types did not seem prudent.

Juvenile vs. Adult Criminality

Like the British study of a 21 year old birth cohort (Wadsworth, 1979), the initial analyses presented here derived their outcome measures from the total criminal career of the subjects, from age 15 (the cut-off point for registration in the Danish National Criminality Register) to the time of follow-up, when the subjects had reached a mean age of 21. No status offenses were included in the criminality data. Thus, we need not have to be concerned that inclusion of the juvenile charges with the data on adult crime might distort the etiological picture obtained

due to the presence of definitional criminality in the former category. The hypothesis that status offenses have a different etiology than other offenses has been repeatedly proposed (Johnstone, 1978; Wilkinson, 1981).

Klein (1982) counters with the notion that elimination of status offenses from the juvenile data does not adequately compensate for or negate the differences between juvenile and adult offenses. Thus, according to Klein, combining the two when generating outcome variables in criminological research is not recommended. Klein describes several issues pertinent to the differentiation between the crimes of the two age groups: the expressiveness of juvenile crime versus the instrumentality of adult crime, the differences in malleability of the behavior of the two groups, the differences in reactions to the crimes on the part of authorities, the differences in instigation to commit crime, and the differences in recording of juvenile crimes.

Although Klein's warnings in general appear valid, there seems to be some indication in the literature that meaningful answers may be obtained to certain types of research questions even though crimes committed before and after 18 are combined to form the dependent variable. We are referring to research with specific focus on the predictors of the occurrence of criminal behavior as opposed to research focusing on the nature of criminal careers and the factors which may have influenced their course. As

noted earlier, the longitudinal research reported by Wadsworth (1979) shows that the predictors of crime committed up to age 21 are similar to those for juvenile delinquency. Similarly, West & Farrington (1977) clearly showed that the predictors of criminal behavior starting in the juvenile period and continuing into adulthood presented a high degree of similarity with those for juvenile delinquency in general. The longitudinal studies by McCord & McCord (1959) and Glueck & Glueck (1968) also corroborated the hypothesis of similarity of predictors of juvenile and adult crime. In large part, the reason for this relates to the fact that a great proportion of juvenile delinquents continue to commit crimes after the juvenile period (although the motives for the crimes, the reaction of the environment, etc. may change along the lines sketched out by Klein) and also that the incidence of adult crime is greater in persons with multiple juvenile offenses (West & Farrington, 1977; Robins, 1966). In view of these findings, and to maintain a reasonable sample size, the total criminal careers of the subjects were used in our initial analyses. Additonal analyses will be presented in which the predictors of early onset of criminal behavior (i.e., during the juvenile period) are compared with the predictors of later onset of criminality.

Sex Differences in Criminal Behavior

Of the 419 females included in the Family Study sample, only 32 were registered as having been charged with a crime.

This much lower incidence rate of law breaking behavior among females is in agreement with the literature (Gibbons, 1970; Wilkinson, 1980). However, this small number of female offenders makes data analyses is clearly limited. Because we will not focus on female offenders, the literature on female delinquency will not be reviewed. A summary of the most frequently reported findings will suffice. Although some testimony exists to the contrary (Cowie, Cowie & Slater, 1968), the predominant finding is that family discord and disruption tend to be more strongly related to female than to male delinquency (Andrew, 1976; Wilkinson, 1980; Offord et al., 1979). The relationship between family size and delinquency, on the other hand, has been reported to be stronger in male samples (Andrew, 1976).

B. LITERATURE REVIEW

As noted in the introduction, this study examines the association of criminal behavior with two sets of antecedent variables: a) familial and social factors and b) individual characteristics, e.g., ANS responsivity and EEG. The predictive power of each set of variables is determined independently as well as additively and in interaction with the other set. This section presents a summary of the extant literature relevant to the relationships between familial and social variables and criminal behavior. For the purposes of this review no distinction is made between studies predicting to juvenile offenses (i.e. criminal offenses not status offenses) and those predicting to both juvenile and adult or only adult offenses. The reason for this is to be found in the similarity of the predictors of criminal behavior of the two age groups - discussed further below.

Family Structure

As pointed out by Rahav (1979) studies examining the relationship between birth order and criminal behavior during the first half of this century tended to find firstborns overrepresented among juvenile delinquents and criminals. Later studies, however, (Glueck & Glueck, 1950; Nye, 1958; and McCord, McCord, & Zola, 1959) found most

criminality among middleborn children and least among firstborns, with lastborns reflecting an intermediate risk. In general, the comparatively low level of delinquency and/or criminality in firstborns has been replicated consistently in recent research (Herrell, 1970; Mullin, 1973; Syrotuik, 1978; Rahav, 1979; Wadsworth, 1979).

The finding of overrepresentation of middleborns among criminals (Wadsworth 1979; West & Farrington 1973) has been the subject of some criticism on methodological grounds. Hirschi et al (1967) and West & Farrington (1973) have warned against uncritical acceptance of this finding. They maintain that this apparent relationship may be an artifact of the disproportionate number of subjects from relatively large families who were included in the delinquent or criminal samples studied. Controlling for family size, West and Farrington (1977) found no increase in criminal behavior for middleborns from sibships of 4 or below. Rahav (1979), on the other hand, using Greenwood's and Yule's procedure (1914), found a noticable overrepresentation of middleborns from 4-5 child families and even stronger from 6-7 child families among Israeli delinquents. Thus, at the present time, the issue of higher criminality in middleborns is not conclusively settled.

As referred to above, there is some research evidence from the 1950s indicating that lastborns constitute a separate subgroup of laterborns showing comparatively less criminal behavior, i.e. as compared with middleborns. The

more recent studies by Rahav (1979) and Wadsworth (1979) have replicated this finding. Wadsworth (1979) extended the analytic framework for examining the impacts of birth order on criminal behavior to include information on number of older and younger sibs as well as on spacing to closest younger and older sibs. In his British sample of males, oldest and middleborn males showed an increase in criminality as a function of higher number of younger sibs; similarly, middleborns and lastborns showed higher incidence as the number of older sibs increased. Wadsworth (1979) also reported that spacing to the immediately younger sib showed a significant relationship with crime: the longer a subject spent as an only or the youngest child of a family, the less likely he would be to exhibit criminal behavior later. Wadsworth's overall interpretation of these findings centers on the lack of maternal attention as a mediator. The firstborns' advantage have is attributed to the initial time spent as the only object of parental attention. The finding that longer sib spacing increases a firstborn's immunity to later delinquency supports this interpretation. The disadvantage of middleborns also seems explainable in these terms, i.e., a middleborn has no time during which he is the only recipient of parental attention, and the arrival of a younger child will invariably lessen the share of parental attention he received while the youngest child in the family. The finding that the longer middleborns are the youngest in the family the greater their immunity against

later engagement in criminal behavior obviously lends further support to the credibility of this interpretation.

Family Size

As noted in the previous section, there is some support for the notion that the observed relationships between birth order and criminal behavior may be more parsimoniously explained in terms of variations in family size. A general tendency for delinquents and criminals to come from relatively large families has been unequivocally established (Nye, 1958; Robins, 1966; Griffith & Rundle 1976; West & Farrington, 1973; Wadsworth, 1979). Other correlates of family size have been suggested as active agents in these relationships; e.g., overcrowding (Ferguson, 1952; West & Farrington, 1973); lack of internal and indirect control (Nye, 1958); low family income, social deprivation and poverty (West & Farrington 1973); and poor parental supervision, and physical neglect (West & Farrington 1973; Wadsworth, 1979).

A few attempts have been made to estimate family size effects with some of these correlates held constant or statistically controlled. West and Farrington (1973) found no relationship between family size and delinquency in the least overcrowded homes. However, in their analyses of the total sample, controlling for overcrowding, family income, parental supervision and physical neglect, there was a reduction of the strength of the relationship between family

size and delinquency, but not a complete elimination of it. Wadsworth (1979) found family size related to delinquency only in the manual skills social group. Thus there seems to be some indication that the relationship between family size and criminal behavior is in part mediated through potentially negative environmental characteristics which tend to be correlated with larger family size (e.g., poverty, overcrowding, lack of parental supervision and neglect). It also seems warranted, however, to conclude that in the aggregate such environmental characteristics do not "explain" variance contributed by size. That is, family size seems to be a structural variable that contributes more than the sum of the correlated elements identified. For example, the amount and content of parental attention made available seems a probable additional etiological agent that is influenced by family size. Stated in another way, the arguments presented supporting parental attention as a mediator of birth order differences in criminal behavior may be extended to explain the family size findings, i.e., more children equals less available attention per child. Recent research on the only child yields additional support for this explanatory position.

The relative crime risk of the only child seems to have changed over time. Earlier work by Burt (1925) and Parsley (1933) found onlies to be more crime-prone than other birth positions. Robins (1966) found an elevated risk of criminal activity for onlies compared with children from two and

three child families. Recent studies, however, have not replicated that tendency (Wadsworth, 1979). Rather the research has shown a low relative risk for onlies similar to that reported for firstborns.

Parental Attention in Existing Theory

The inferred etiological importance assigned to parental attention in the development of criminal behavior fits well within the framework of major psychological and sociological theories. Developmental psychologists have long emphasized the overriding importance of amount and quality of parent child (or parent substitute-child) interaction in cognitive development as well as emotional functioning of children. Through adequate quantity and quality of parental attention and interaction the earliest attachments are formed. These attachments in turn become major determinants of child functioning as well as of the quality of parent-child and child-peer interactions later in childhood (Ainsworth & Bell, 1974; Bronfenbrenner, 1979; Sroufe, 1979).

The importance of attachment and bonding to parental figures has also been emphasized by sociologists. Control theory (Hirschi, 1969) proposes that criminal behavior occurs when the bond between the individual and society is broken. The bond to society involves four elements: attachment to others (parents, peers), commitment to conventional acts, involvement in conventional activities

and a belief in a set of moral values shared by conventional society. Clearly, the attachment to parents temporarily precedes attachment to peers as well as the other three elements of the bond as defined by the theory. Thus, proponents of control theory concur with developmental psychologists in assigning a very central role to the ongoing development of interaction styles. Attachment to parents and identification with their values influence the degree to which alternative peer group values are accepted. A major weakness of control theory is also related to this point. The theory in its original form assumes bonds to conventional adults and peers but does not discuss the impact of non-conventional attachment figures. Hindelang (1973) pointed out the importance of differentiating between bonds to conventional and delinquent peers. Others (Linden and Hackler, 1973; Lyerly and Skipper, 1981) have emphasized the importance to the theory of taking into account the quality and characteristics of parents or other adults to whom attachments are formed. In response to this criticism, the character of the attachment figures as well as the nature and strength of the attachment itself have been incorporated among the predictors of criminal behavior proposed by the theory. The theoretical orientation characterizing psychological research on attachment, as well as Control Theory, appears relevant to understanding the relationship between criminal behavior and the familial variables reviewed below, such as broken homes, parental

criminality and personality characteristics.

Broken Homes

Wilkenson (1974) pointed out that the degree to which broken homes have been identified as a cause of delinquency has varied considerably over time. During the early part of this century and before, heavy emphasis was put on the broken home as an etiological factor in crime. Then, in 1932, Shaw and McKay reported a study in which no difference in frequency of broken homes was found in the backgrounds of delinquents and controls respectively. Wilkinson points out that for some years following the publication of this study the literature reflected a decreased interest in nonintactness of the family as a predictor of crime. During the early fifties a new wave of studies relevant to this issue began to appear. This literature presented considerable disagreement concerning the etiological importance of the broken home. Some studies attributed great importance to this variable (Gluck & Gluck, 1959; West & Farrington, 1973, Griffith & Rundle, 1976). Other studies, particularly ones where the dependent variable was based on self-report rather than on public records of criminality, tended to show only a very weak impact of nonintactness (Nye, 1958; Dentler & Monroe, 1961; Hirschi, 1969). Johnstone (1981), reacting to the inconclusiveness of these results, said that the practical importance of the reported findings can not be evaluated on the basis of the

overall weak statistical relationships generally reported. He suggested a need for changes in the conceptualizations underlying the research methodological accomodations. Should such a change occur, a more adequate picture might be obtained of the real influence of family systems on the development of criminal behavior. Johnstone concurs with Wilkinson (1974) in assigning high priority to this effort, partcularly in view of the increasing number of children growing up under conditions other than the traditional nuclear family. Specifically, Johnstone described the major problem with the literature in the area as the failure of investigators to acknowledge the great heterogeniety which can be observed within groups of nonintact as well as intact families. The likelihood is that within both groups the whole range of functioning adequacy will be represented (Nye, 1958). Similarity of family structure does not ipso facto imply similarity in family functioning or family atmosphere, although, according to Johnstone (1981), such similarity seems to have been a tacit assumption underlying research in this area. Johnstone's recommendation that researchers begin looking at the qualitative aspects of homes within these two major groups seems prudent. Continuing to focus exclusively on intact-non-intact comparisons will mask the effects of qualitative variables that are likely the etiological agents of importance. The result will be continued findings of small statistical differences with very little, if any, practical

significance.

Clearly, the rationale for dividing the groups of intact and nonintact families into more homogenous subgroups must have its basis in a theoretical framework with some empirical support. The extant literature does provide a few useful leads. Several researchers in the area have speculated on the mechanisms mediating the differences between children from intact and nonintact families and have attempted empirical tests of their hypotheses. Family conflict has been identified as a likely mediator of the relationship (McCord et al, 1959; West & Farrington, 1973; Norland et al, 1979; Rutter & Madge, 1976). Part of the evidence for this has been the finding that families that are nonintact due to death do not seem to produce criminality (West & Farrington, 1973, Douglas et al, 1968; Wadsworth, 1979). Other evidence is based on the observation that conflict-ridden intact homes produce a rate of criminal behavior among the offspring comparable to non-intact homes (McCord et al., 1959; West & Farrington, 1973; Rutter, 1978). Thus, when nonintactness is not accompanied by parental conflict, as in the case of death, no negative consequences are observed. Conversely, even in intact families, parental conflict alone is capable of producing in the offspring deviance that is usually associated with nonintactness. It should be emphasized that nonintact families possess heterogeneity with respect to parental conflict just as do intact families. That is, in some cases

a family break-up may take place without the children experiencing prolonged parental conflict, either pre- or post-divorce. Similarly, some unmarried mothers may live quite harmoniously with their children born outside of a marriage. As implied above, if the structural characteristic intactness is not systematically related to critical qualitative chartacteristics, its importance as a "marker" variable is diminished. Johnstone (1981) stated, "family structure does not imply function."

The notion of parental conflict as an active agent in the development of criminal behavior fits well into the overall explanatory notion discussed above. Quality of bonds or attachment to parents is the overall determinant of child behavior, according to this position; thus every type of family condition or event which could be seen as weakening this bond may be interpreted as a possible indirect cause of criminal behavior. Parental conflict may have this effect through several sets of dynamics; e.g., lack of parental expression of love and attention, experience of being torn between parents, interference with identification processes, inconsistency in child rearing, etc.

Lack of family stability seems another probable mediator of the negative impact of nonintactness. By definition, intact families are more stable than nonintact. Within the latter group, however, there is a wide variation in the stability of the post-divorce home. The importance

of controlling for post-divorce stability when examining effects of divorce has been pointed out by Shinn (1978) and Hetherington et al (1979). Interestingly, it seems probable that decreased permanence of adult figures in the home (e.g., periods with mother alone interspersed by periods with successive stepfathers or extended family situations) would tend to diminish the child's opportunity for developing and maintaining permanent and strong bonds and attachments to parental figures. For example, existing bonds may be broken and new ones not developed due to insufficient exposure to possible attachment figures, or to interfering negative emotions of one sort or another. In addition to decreasing the opportunities for formation of bonds, instability of adults in the home is likely to entail other consequences of relevance to the formation of social norms, such as discontinuity in the development of moral values promoted by the home as well as discontinuity in the zeal with which these values are advocated and enforced. A single mother may not be able, due to lack of economic, physical or emotional resources, to do an adequate job of reinforcing conventional values. Or, a reconstituted family that includes a stepfather may neglect this task due to another set of dynamics (Kellam et al, 1977). Thus, unstable family environments may act to inhibit the internalization of conventional social norms in children.

Wadsworth (1979) examined the relationship between timing of initial family breakup and later criminal behavior

and found that divorces taking place within the first five years of the child's life were more predictive of later crime. Offord et al (1978), on the other hand, found that the timing of guardian changes had no influence. Another question not conclusively answered relates to whether family factors such as nonintactness are related to any specific type or severity of crime. Johnstone (1978) found family factors to predict to less serious crimes. Wadsworth (1979), and Chilton & Markle (1972), on the other hand, found the relationships to be with more serious anti-person offenses. Wilkinson (1980) quoted a series of studies, all finding broken homes less related to thefts than to more "ungovernable" types of crimes. However, a confounding influence in the research reported is the fact that several of the studies used self-reports of crime rather than official record information (Hirschi, 1969; Nye, 1958; Dentler & Monroe, 1961). As mentioned above, the latter type of data has been shown to yield weaker overall relationships between nonintactness and criminal behavior.

Parental Crime

There is extensive evidence that parental crime is associated with crime in children (West & Farrington, 1973; 1977; Farrington, Gundry & West, 1975; Robins, West & Herjani, 1975; Rutter, 1978; Wilson, 1975). In contrast to family nonintactness, parental crime appears to have not only a statistically significant impact, but a very

practical one as well. For example Farrington et al (1975) reported that nearly half the boys of criminal fathers had criminal records, as compared with only one-fifth of those with noncriminal fathers. Similarly, Robins et al (1975) reported that parental crime accounted for 50 per cent of the explained variance of child crime in their sample. There are three possible explanations for the relationship between parental and child crime. The tendency to engage in criminal behavior may be transmitted genetically, environmentally; or through an interaction of the two sets of factors. S. Mednick and Volavka (in press) have presented evidence suggesting a genetic contribution to the relationship. Most suggestive is the finding that adopted sons of criminal fathers show higher prevalence of criminality than do either adopted sons of noncriminal fathers or sons raised by criminal adoptive fathers. The genetic influence seems particularly suggestive in recidivistic sons. The systematic differentiation between a genetic and an environmental influence through an adoption design is rare in this field. In the vast majority of studies examining the transmission of criminal behavior across generations, the relative contribution of genes versus environment can not be determined since these studies examine offspring who have lived with their criminal fathers or mothers for some period of time. The parental influence therefore may be both genetic and environmental. Little precise knowledge exists about the ways in which parental

criminality exerts its environmental influence on children. For example, a rather central issue of the importance of length of exposure time to the criminal parent has not received systematic research attention. Thus, it is not known whether there is a critical duration of exposure or a critical child age at which this exposure must take place in order for the child to adopt the criminal behaviors. The length of time the criminal parent lived in the home has generally not been taken into account, although some studies have established a certain minimum number of years of exposure as a criterion for including subjects. For example, Farrington et al. (1975) included only fathers who had lived with their children for the first three years. However, they did not further attempt to estimate the impact of the amount or timing of exposure. In other studies (Robins, 1966; Robins et al., 1975), free variation of this variable was allowed, i.e., fathers who had never lived in the home were included as well as fathers who had lived there during the subjects' whole childhood. Clearly, this variable has to be systematically analyzed in order for the nature and magnitude of the environmental influence to be adequately assessed. The nature of the environmental influence of parental crime may be direct (a direct influence of the parent on the child), indirect (the parent influencing the environment which influences the child, e.g., via low SES, low stability, etc.), or both. The direct influence may result from the criminal parents'

poorer ability for developing and nurturing attachment, and the detrimental effects that this has on the child's psychological development. However, closeness to parents may also actually be detrimental if it results in the inculcation of unconventional values and attitudes. The nature of the indirect effect may be conceptualized in the following way. Criminality in parents is correlated with a series of environmental conditions which are known to be associated with criminal behavior in offspring: low SES status, larger family size, family instability, poor supervision, and mental illness are among the conditions most frequently cited (West & Farrington, 1973). They also found that parental criminality remained a significant predictor even when controlling for the above noted environmental variables; thus suggesting a more direct effect of parental crime. There is also a suggestion in the literature that the indirect effect in some instances is the stronger of the two. Robins et al., (1975) found that children who lived with their criminal father less than two years showed higher levels of sociopathy than children who lived with him for a longer period. The interpretation given was that whatever stability is gained by having a father around -- even a criminal one -- yields more protection against criminal behavior in offspring than the probably less stable psychological and economic situation of the home without the criminal father.

So far, the term parental criminality has been used

without specific reference to possibility of differential effects as a function of the sex of the criminal parent. Most of the data that exists is concerned with the impact of fathers crime, since criminal behavior is far more prevalent in males. Further, as pointed out by Farrington et al. (1975), and Robins et al. (1975), it is hard to evaluate the effects of maternal crime in the relatively few cases which have been studied due to a tendency among criminal women to marry criminal men. Robins et al. (1975) reported maternal crime to be related to crime in males. There was also a tendency in this sample for maternal crime to be more strongly related to criminality in sons than was paternal crime. In the all-male sample reported by Farrington et al. (1975), maternal crime was found to have an impact independently of paternal crime. Both studies reported the highest incidence of crime in offspring where both parents had committed criminal acts. Farrington et al. reported the incidence in such families to be as high as 63 percent.

Socio Economic Status

Historically low SES has been accepted as a predictor of delinquency and criminality (Wadsworth 1979; Johnstone, 1978). The importance of this relationship has been seriously challenged by researchers working with self report data on criminality as opposed to official police records or arrest data (Nye, Short and Olsen, 1962; Dentler and Monroe, 1961; Hirschi, 1969). These researchers, and others working

with similar data, report only a very trivial impact of SES and hypothesize that the larger impact found in analyses of official record data is due to low SES persons being more likely to be picked up by the police and prosecuted. However, the findings of Johnstone (1978) seem to reinstitute low SES status of the home as a definite predictor of delinquency and crime even when self report data constitute the dependent variable. As mentioned, the literature using official record data concur in an effect of low SES on prevalence of crime (Douglas, 1968; Wadsworth, 1979). The research on SES influence show some disagreement concerning the most adequate definition of the variable. West and Farrington (1973) identified a series of SES correlates known to be related to criminal behavior: large family size and poor parental behavior and supervision. They found that after controls for these variables were imposed, a reduced but still a significant impact of low family income remained, indicating some impact of poor economic conditions over and above the impact of these more qualitative measures of the homes. An economic index of SES was also found to influence criminality in offspring independent of poor housing and crowding in the home. Younger maternal age, which is highly correlated with low SES, has also been found to be related to criminality in offspring (Wadsworth, 1979). Again, the extent to which this relationship is mediated by poorer economic conditions, lower educational level, or the higher incidence of marital

breakup and instability characterizing families who started childbearing very early (Baldwin, 1978) has not been established.

Quality of Parent-Child Interaction

The importance of the quality of parent-child interaction has been touched upon repeatedly throughout this review. Attachment or bonds to parents who represent conventional moral values has been promoted as a major protection against the development of criminal behavior in offspring. The other side of this argument implies that parents who possess characteristics which make the formation of bonds more difficult and/or do not consistently reinforce such values will have a detrimental effect on their children's adaptation to the norms of society. The earlier studies (McCord et al, 1959; Glueck & Glueck, 1959) identified lax or erratic and overstrict discipline, as well as poor parental supervision, as leading to criminal activities in offspring. Later studies have corroborated this finding and have suggested additional parental descriptors such as coldness, rejection and harshness (Farrington, 1978; Wilson, 1975 1980; Norland et al, 1979; West & Farrington, 1973; Rutter, 1978). Clearly the impact of these parental variables is not independent of other variables such as parental criminality and mental illness (Offord et al, 1978). West & Farrington (1973) demonstrated the close interrelationship among these variables. However,

In one regression analysis reported by these authors, the variable contributing the most unique variance to criminal behavior was called poor parental behavior. The authors described this variable as a global indication of poor parental attitudes and disciplinary techniques, taking into account both the emotional quality and the techniques of child rearing.

It is important again to emphasize the interdependency between and among the qualitative descriptors of parental figures and the other environmental variables discussed above (e.g., SES, family size, and family stability). It seems clear that all of the latter are related to criminal behavior in children, (West and Farrington, 1973), partly via their positive correlation with less than optimal parental behavior and attitudes which ultimately affect the interaction patterns in the home.

C. PROCEDURES AND RESULTS

General Pattern of Inquiry

The central purpose of the inquiry in Part I of this study was to tease out the independent, additively and interactive contributions of a selected set of familial and social factors to the prediction of criminal behavior. While specification of the familial and social variables was a reasonably straightforward task, definition of what constituted criminal behavior was not. As noted in the review of literature, there are problems associated with defining criminal patterns or specializations that generally hold up across studies and contexts. Thus in developing an inquiry strategy that would be both sensitive and responsive to the issues involved, the criminal outcome measure was defined in several ways as the inquiry progressed.

1. In the first set of analyses the outcome variable was defined in such a way that the predictor variables were given an opportunity to discriminate between those who had no criminal record at all and those who had recorded one or more offenses, with each crime type analyzed separately; i.e., thievery, violence, and uncontrolled behavior. Thus, inclusion in an analysis as a recidivistic thief did not in this set of analyses preclude being included in another analysis as a one-time or two-plus violent offender. In other words, there was an overlap of crime descriptors for those who participated in a variety of criminal activity.

Clearly, if the kind or amount of overlap or confoundment was essentially the same for all of the crime types being analyzed, the patterns of predictors across the crime type analyses would likely be quite similar. Thus, the two major products of these analyses should be:

a) identification of patterns of antecedent variables that predict criminal behavior in general(i.e., separate criminal offenders from non-offenders); and

b) clarification of the differential patterns of predictors (if any) across the crime type categories as initially defined.

The discriminant function analysis was the principal statistical technique used in the first set of analyses.

2. In the second set of analyses the outcome definitions remained the same. On the basis of the results of the discriminant analyses described above, the sample was divided into subgroups homogenized on the basis of specified variable-related characteristics and the criminal outcome variables were analyzed as they covaried with the possession or non-possession of the set of predictor characteristics. Log-linear modeling in three-factor contingency tables permitted a more microscopic view of the specific aspects of a characteristic associated with criminal behavior. This analytic approach also accommodated categorical variables not amenable to regression techniques (e.g., an amalgam of birth order and family size).

3. The third inquiry considered two other outcome variable definitions: a) collapsing crime types in favor of using a measure of crime severity; and b) collapsing both type and severity into a single measure of the total number of arrest dates. Ultimately, a step-wise regression analysis, including a simultaneous solution, was completed defining the outcome variable as the number of recorded dates of criminal activity and ignoring specified crime types.

4. The inquiry described in 2 above divided the sample into subgroups possessing homogenous predictor characteristics, but stayed with the overlapping criminal typology. In inquiry set 4 we restructured the sample into subgroups possessing more homogenous outcome characteristics. Purifying the crime categories, of course, led to a much reduced N, thus restricting our analyses somewhat. However, at the last stage of Part I of the study we hoped to distinguish between violence and thievery with as little contamination as possible from other crime categories.

Criminal Specialization vs the "Cafeteria"

As emphasized in the review of past studies, prediction of specific types of criminal activity has been most difficult due to the overlap between categories and the

variability of the overlap across studies. However, there is support for the notion that criminality may not be a "homogeneous" phenomenon (Wadsworth, 1979) and that while the antecedents may be the same, there are variations in the patterns across criminal "types" and geographical settings (Empey & Lubeck, 1971).

The Danish sample reflects the overlap noted in other studies, and suggests that defining criminal "types" or patterns may be difficult using multivariate procedures of analysis. The general description of our sample of males is shown below:

Criminal Status	Number	Percent
a. non-offenders	213	53
b. one-time offenders	70	17
c. Recidivists	123	30
Total	406	100

Table 2 shows the extent of criminal activity overlap. Row I, one offense, is the only row whose cells are mutually exclusive. Obviously, then, the cells in Rows II through V do not sum to the Ns shown above. The intent of this data array is simply to illustrate at the outset the fact that recidivism in this sample reflects an overlapping and complex pattern of offenses. For example, it is impossible to define a recidivistic "thief" without acknowledging the fact that the offender probably has also participated in other types of criminal activity as well.

Table 2

Cell N's for Each Pattern of Criminality Recorded

Number of Offenses		1. Thievery	2. Uncontrolled Behavior	3. Violence	4. Traffic	5. Other
I. One only		14	19	5	30	12
Recidivists						
II. Thievery	a. one	--	20	8	15	6
	b. two +	(7)	41	27	26	23
III. Uncontrolled Behavior	a. one	21	--	7	18	16
	b. two +	40	(7)	32	33	29
IV. Violence	a. one	13	15	--	12	8
	b. two +	22	23	(2)	16	14
V. Traffic	a. one	25	29	13	--	17
	b. two +	16	22	15	(13)	13

Using thievery as the illustration, Row II describes the offense complexity of the recidivists in the sample. Cells IIb, 1 through 5 show the number of recidivists who recorded two or more thievery offenses and who also participated in other types of criminal activity. Only seven (Cell IIb1) restricted their activity to thievery; simliarly, all of the other cells with circled numbers indicate specialization in the referenced crime type. The dash recorded in cell IIa,1 simply points to the fact that if only one thievery offense has been recorded the recidivism is reflected in one or more of the other types of crime. Cell IIa, 3 has eight people who committed one thievery offense and at least one violent offense. The remainder of the table may be interpreted simliarly. What is striking about the data display is that only 29 of the 123 recidivists (23 percent) restricted their criminal activity to one crime type, and 13 of the 29 were traffic offenders.

Table 2 supports Klein's (1982) position that there is no crime specialization. The findings also seem consistent with the factor analytic work of Collins and Cliff (1982) in which two criminal factors were empirically supported: general crime and minor traffic offenders. To more directly confirm this with our present sample two analyses were completed clustering criminal males and selected crime and family variables. These analyses include:

1. criminal males who were in "stable" or intact families

during the period age 12 to 18; and

2. criminal males who recorded family "instability" during the period.

Splitting the sample permitted us to include the measure "family dissension" in the intact group. While this was of secondary interest, comparing the two analyses could provide some clarification of how important instability without divorce within an intact family might be.

Four crime variables were included. The scores for each crime category were coded as the actual number of changes recorded: thievery; violence; uncontrolled behavior; and traffic offenses. The following family variables were included:

1. Father recidivism - yes or no
2. Family size - 1, 2, or 3-plus children
3. SES at time of follow-up - 0 to 7
4. Mother's age at index birth - actual age
5. Mother's education level - actual years of schooling
6. Mother's orderliness - actual scale score
7. Family dissension - actual scale score (included for intact analysis only)

Results of the two analyses were essentially the same. In both cases the Collins and Cliff (1982) findings were corroborated. The analysis of the intact group that included the family dissension score will be presented here. The analysis clustered the variables by the average distance

method (BMDP1M, revised April 1982). Table 3 shows the correlation matrix for the variables included. Table 4 shows the clusters of variables in the order they were included. Included also are the scaled correlations and the distance or similarity when each cluster was formed. Cluster I is clearly a representation of what Collins and Cliff (1982) called a general crime factor: thievery, violence, and uncontrolled behavior. Note that none of the family variables are included in the cluster. Cluster III is a weak cluster that includes traffic along with family dissension and mothers' age. The zero-order correlations indicate a very low but positive relationship among the three variables. Suffice at this point to note again the consistency of these findings with Klein (1982) and Collins and Cliff (1982). This is not to say, however, that the social and family variables do not relate in some systematic ways to specified patterns of criminal activity; but only that they constitute separable dimensions.

Predicting Specific Categories of Crime

Initially two series of discriminant function analyses were carried out predicting to thievery and uncontrolled behavior. Due to the small number of subjects charged with violent crimes, this type of multivariate analysis was not feasible for that outcome. The analyses completed were designed to discriminate between three groups of subjects within each criminal pattern. 1. subjects with one offense

Table 3

Correlations for Variables in Cluster Analysis

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Thievery	--										
2. Violence	54	--									
3. Uncontrolled Behavior	63	70	--								
4. Family Size	24	32	19	--							
5. Father Recidivism	11	14	09	27	--						
6. Traffic	00	08	06	17	11	--					
7. Family Dissension	02	15	09	20	-11	14	--				
8. Mother's Age at Index Birth	13	27	11	-06	02	09	11	--			
9. Mother's Education Level	-19	-23	-27	-05	-13	-05	-11	07	--		
10. SES at Time of Follow-up	-09	-14	-16	-01	-01	01	06	00	45	--	
11. Mother's Orderliness	-13	-11	-03	-12	00	11	-10	-05	29	37	--

Table 4

Cluster of Variables for Criminal Males and Scaled Correlations

Cluster & Distance When Formed		Variables	Scaled Correlations*	
			Variable	
			2	3
I	1	Thievery	76	81
(79.24)	2	Violence	--	84
	3	Uncontrolled Behavior		--
			5	
II	4	Family Size	63	
(63.63)	5	Father Recidivism	--	
			7	8
III	6	Traffic	56	54
(54.89)	7	Family Dissension	--	55
	8	Mother's Age At Index Birth		--
			10	11
IV	9	Mother's Educational Level	72	64
(66.62)	10	SES At Time of Follow-up	--	68
	11	Mother's Orderliness		--

*e.g.,; r = -1.00 scaled as 0, r = .00 scaled as 50, and r = .70 scaled as 85.

of a given type; 2. subjects with two or more offenses in that category; and 3. subjects with no criminality recorded. The latter group is the same in all of the reported analyses. By keeping the zero crime group free of criminal charges, some of the available subjects are lost. For example, in analyses predicting to thievery, cases with no thievery but with charges in some other category were excluded.

Thievery

The first four discriminant analyses to be presented include the same set of predictor variables. The analyses differ in that the order of entry of the predictors into the equation varies. The predictor variables used in these analyses appear in the left column of Table 7. The following variables were included:

- Number of constellations after the child's fourth year. (In preliminary analyses it was discovered that this predictor had a stronger association with criminal behavior than did the total number of constellations, i.e., including changes during the first four years.)
- Mother one time offender
- Mother recidivist
- Father one time offender
- Father recidivist
- Number of years spent with biological father
- Mother's age

of a given type; 2. subjects with two or more offenses in that category; and 3. subjects with no criminality recorded. The latter group is the same in all of the reported analyses. By keeping the zero crime group free of criminal charges, some of the available subjects are lost. For example, in analyses predicting to thievery, cases with no thievery but with charges in some other category were excluded.

Thievery

The first four discriminant analyses to be presented include the same set of predictor variables. The analyses differ in that the order of entry of the predictors into the equation varies. The predictor variables used in these analyses appear in the left column of Table 7. The following variables were included:

- Number of constellations after the child's fourth year. (In preliminary analyses it was discovered that this predictor had a stronger association with criminal behavior than did the total number of constellations, i.e., including changes during the first four years.)
- Mother one time offender
- Mother recidivist
- Father one time offender
- Father recidivist
- Number of years spent with biological father
- Mother's age

- Family size
- Mother's contentment
- Mother's orderliness
- Mother's health
- SES

The rationale for including these variables in the analyses is based on the findings cited in the literature review section above. Table 5 presents the means and standard deviations of these variables for the males in the sample. Table 6 presents the intercorrelations among them. The purpose of the first analysis (Table 7) was to determine the amount of variance accounted for by the predictors with the influence of SES controlled. Thus, SES was forced to enter the equation at the first step. The analyses showed that number of family constellations contributed the most to the equation, followed by maternal recidivism, paternal recidivism and family size (in descending order of importance). Wilk's Lambda for the five significant predicters was .73. Examination of the F matrix included in Table 7 shows that all five significant variables are most effective in differentiating between the no thievery group and the recidivists. In the second analysis, SES was kept out of the equation until the last step in order to determine the relative predictive power of the other predictors without controlling for SES. Table 8 shows the results. Omitting the control for SES does not change the relative order of importance of the other predictors, but

Table 5

Means and Standard Deviations
for Predictor Variables

Variable	Number	Mean	Standard Deviation
SES	365	2.79	2.04
No. Fam. Const.	406	1.97	1.48
Mo. Cr. Recid.	400	.04	.20
Fa. Cr. Recid.	388	.35	.48
Fam. Size	406	2.60	1.18
Mo. Cr. Once	400	.07	.26
Mo. Content	406	12.44	2.47
Mo. Health	406	18.78	2.06
Yrs. W/ Fa.	406	11.39	6.87
Mo. Age	405	25.57	6.48
Fa. Cr. Once	388	.08	.26
Mo. Order	406	12.27	1.57

Table 6

Correlation Matrix for Predictor Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. SES	--	-15	-13	-23	-10	-09	23	-09	20	23	12	33
2. No. Fam. Const.		--	13	15	01	08	-26	27	-45	-21	-07	-24
3. Mo. Cr. Recid.			--	19	10	-06	-11	14	-13	-03	-05	-11
4. Fa. Cr. Recid.				--	0	07	-13	11	-31	-12	-21	-21
5. Fam. Size					--	07	01	04	11	04	01	-17
6. Mo. Cr. Once						--	-08	07	-09	01	-08	-10
7. Mo. Content							--	-32	18	-01	01	31
8. Mo. Health								--	-13	03	-04	-14
9. Yrs. W/ Fa.									--	22	06	17
10. Mo. Age										--	-01	04
11. Fa. Cr. Once											--	09
12. Mo. Order												--

Table 7

STEPWISE DISCRIMINANT ANALYSIS: THIEVERY, SES forced in first
DEGREES OF FREEDOM FIRST STEP: 2,249

STEP	PREDICTOR VARIABLE	F-RATIO TO ENTER	DF	WILK'S LAMBDA	F-MATRIX			DF
					NONE ONCE	NONE RECID	ONCE RECID	
1	SES	12.90	2,249	0.906	12.6	16.3	0.05	1,249
2	No. Fam. Const	9.57	2,248	0.833	8.12	19.5	1.94	2,248
3	Mo. Cr. Recid	8.22	2,247	0.781	5.56	18.4	5.46	3,247
4	Fa. Cr. Recid	4.51	2,246	0.753	5.64	15.3	4.08	4,246
5	Fam. Size	3.99*	2,245	0.729	4.65	13.71	4.73	5,245
6	Mo. Cr. Once	2.53	2,244					
7	Mo. Content	2.13	2,243					
8	Mo. Health	1.52	2,242					
9	Yrs. W/ Fa.	0.28	2,241					
10	Mo. Age	0.34	2,240					
11	Fa. Cr. Once	0.28	2,239					
12	Mo. Order.	0.05	2,238					
13								
14								

* - last entry significant at the $p < .05$ level

does allow one additional variable, mother's contentment, to reach statistical significance. Again, the stability ofthe family, followed by parental crime and family size, showed the strongest predictive power. Wilk's Lambda for these variables was .74. SES reached significance at the .05 level when it entered the equation at the last step. Clearly the impact of SES was dramatically reduced when the variance shared by this variable with the previously entered predictors was removed. These findings confirm the results from other record studies by showing an association between low SES and criminal activity (Douglas 1968, Wadsworth 1979). If no control for the correlated variables is imposed, SES accounts for 10 percent of the variance. In view of the strict nature of the Danish judicial record keeping system described above, and of the magnitude of the observed SES influence, it is not likely that the latter can be explained away as simply an artifact of biased record keeping. Rather the findings support Johnstone's (1978) conclusion that low SES is a significant predictor of crime. The data contradict those of West & Farrington (1973). The latter authors found that low family income, but not the more general measure, parental occupation status, was significantly associated with criminality in boys. The findings support the hypothesis that the global SES impact on the development of criminal behavior is mediated in part by family instability, large family size, parental crime and maternal contentment. The suggestion made in the literature

Table 8

STEPWISE DISCRIMINANT ANALYSIS: THIEVERY, SES entered last
DEGREES OF FREEDOM FIRST STEP: 2,249

STEP	PREDICTOR VARIABLE	F-RATIO TO ENTER	DF	WILK'S LAMBDA	F-MATRIX			DF
					NONE ONCE	NONE RECID	ONCE RECID	
1	No. Fam. Const.	14.30*	2,249	0.897	5.18	26.2	3.89	1,249
2	Mo. Cr. Recid.	9.04*	2,248	0.836	2.70	22.2	8.21	2,248
3	Fa. Cr. Recid.	7.36*	2,247	0.789	4.84	17.9	5.45	3,247
4	Fam. Size	4.37*	2,246	0.762	3.70	15.7	5.88	4,246
5	Mo. Content	3.11*	2,245	0.743	3.31	13.9	4.83	5,245
6	Mo. Cr. Once	2.54	2,244					
7	Mo. Health	1.53	2,243					
8	Mo. Age	0.68	2,242					
9	Yrs. W/ Fa.	0.22	2,241					
10	Fa. Cr. Once	0.13	2,240					
11	Mo. Order.	0.12	2,239					
12	SES	4.16*	2,238					
13								
14								

* - entry significant at the $p < .05$ level

review that overall stability of the family would be a strong predictor of criminal behavior is strongly supported by these analyses. Family instability appears to have a level of predictive power similar to that of SES; i.e. when the variables were entered at the first step of the discriminant analysis, they both accounted for approximately 10 percent of the variance. Entering SES before number of constellations reduced the F ratio of the latter from 14.30 to 9.57. In the analyses where SES was kept out until the last step the F to enter for SES was 12.90 before the first step and 9.57 after the entry of number of constellations (the latter figure is not included in the table). Thus although the variables are modestly correlated with each other (r=-.15) they clearly make independent contributions to the discriminant functions.

Similar to the findings of Farrington et al, (1975), paternal and maternal crime presented independent predictive power in relation to child crime. The results of the analysis tend to support those of Robins et al, (1975) in showing maternal crime to be the stronger predictor. Although control for SES reduced the predictive power of parental crime, these variables remained significant predictors, as in West & Farrington's study (1973). The finding that family size remained significant with control for SES also corresponds to the findings of West & Farrington (1973). The association between family size and crime seem stronger in these two studies than in the study

by Wadsworth (1979), who reported a relationship only in the manual class.

Comparison of the results from the two analyses seems to indicate that maternal discontentment is among the mediators of the association between low SES and the development of criminal behavior. This finding corroborates that of Rutter (1978) who found maternal neurotic depression to be a mediator of the relationship between low SES and behavior disorders. Although other studies have not defined maternal characteristics along the exact same dimension, the finding that lower maternal adaptation and contentment is related to criminality in male offspring intuitively fits the overall results from previous research on mother characteristics (e.g. findings of associations between maternal lax or erratic discipline, poor supervision, coldness, etc.). It seems quite plausible that a mother who has poorly adapted to her situation and is generally discontent will be less likely to be warm, nurturing and consistent in her dealings with her child.

Two additional analyses were performed with different orders of entry of the independent variables. One analysis forced father's criminality in at the first step and mother's criminality at the last. The order of entry was then reversed in a subsequent analysis. The results of these analyses did not add any new information to that resulting from the analyses discussed above. Thus, they will not be presented here with elaborated data displays.

The interpretation of the findings described above suggested significant independent contributions of the two parental crime variables. The tendency for maternal criminality to have a stronger association with thievery was supported by these analyses.

Offord et al. (1978) have described different patterns of the predictors of criminal behavior for intact and non-intact families. Thus, the male subjects were divided into two groups, one for males who had lived with their biological parents all their lives (intact families) and one who had experienced divorce in their home. The analyses of the intact group included the same set of variables as those used in the previously reported analyses with two exceptions. 1) The number of constellation variables, obviously meaningless in this connection, was deleted; and 2) a variable indicating family dissension was added. As mentioned in the literature review, some evidence exists that family dissension or discord may be associated with the development of criminal behavior. This association has been suggested as one of the mediators of the relationship between broken homes and criminality. In this analysis, family dissension is defined by a scale score developed from seven individual mother interview items indicating dissension in different areas, e.g., child rearing, sexual interactions, economics, etc. The analyses of the non-intact families included three variables not included in previously reported analyses. The three variables indicated

whether a stepfather entered the family: 1) before the child was four years of age, 2) between five and eleven years of age, or 3) at a later age.

The analyses of intact families (Table 9) showed mother's recidivism, family size, and family dissension to be significant predictors (Wilk's lambda = .68). Within the non-intact families (Table 10), mother's recidivism, stability of the family (i.e., number of constellation changes), father's recidivism, stepfather entering between ages 5 and 11, and maternal nonrecidivistic crime were predictors (Wilks' lambda = .70). These findings support the notion that family discord is a possible criminogenic agent. If the family discord variable has this influence in an intact home, its' possible contribution to the association between divorce and criminal behavior seems supported as well. The analyses also support the hypothesis presented in the literature review that stability of the post-divorce family is related to the development of crime in children. The finding that family size is a predictor in intact families but not in non-intact families corresponds to the findings of Offord et al. (1978). However, the findings that both paternal and maternal crime predict in non-intact families is contrary to the results of these authors who found that parental characteristics (i.e., criminality and mental illness) were only predictive in intact families (See Table 10). The importance of a stepfather entering the family between the child ages five

Table 9

STEPWISE DISCRIMINANT ANALYSIS: THIEVERY: Intact Families
DEGREES OF FREEDOM FIRST STEP: 2,95

STEP	PREDICTOR VARIABLE	F-RATIO TO ENTER	DF	WILK'S LAMBDA	F-MATRIX			DF
					NONE ONCE	NONE RECID	ONCE RECID	
1	Mo. Cr. Recid.	8.92	2,95	0.842	0.00	17.8	8.64	1,95
2	Fam. Size	5.75	2,94	0.750	0.21	15.2	8.75	2,94
3	Fam. Dissen.	5.15*	2,93	0.675	1.11	13.4	6.06	3,93
4	SES	2.15	2,92	0.645	1.20	11.1	4.57	4,92
5	Fa. Cr. Once	1.22	2,91					
6	Mo. Age	0.98	2,90					
7	Mo. Health	0.75	2,89					
8	Mo. Content	0.41	2,88					
9	Fa. Cr. Recid.	0.36	2,87					
10	Mo. Cr. Once	0.43	2,86					
11	Mo. Order	0.21	2,85					
12	Mo. Educ.	0.10	2,84					
13								
14								

* - last entry significant at the $p < .01$ or $p < .05$ level

Table 10

STEPWISE DISCRIMINANT ANALYSIS: THIEVERY: Non-Intact Families
DEGREES OF FREEDOM FIRST STEP: 2,119

STEP	PREDICTOR VARIABLE	F-RATIO TO ENTER	DF	WILK'S LAMBDA	F-MATRIX			DF
					NONE ONCE	NONE RECID	ONCE RECID	
1	Mo. Cr. Recid.	5.76	2,119	0.912	0.07	10.6	6.85	1,119
2	No. Fam. Const.	3.18	2,118	0.865	0.74	8.41	3.76	2,118
3	Fa. Cr. Recid.	3.31	2,117	0.819	1.56	7.40	2.50	3,117
4	Step Fa. 5-11	3.21	2,116	0.776	1.33	7.41	2.31	4,116
5	Mo. Cr. Once	3.89*	2,115	0.727	1.05	7.68	2.86	5,115
6	SES	1.802	2,114	0.704	1.32	6.76	2.37	6,114
7	Mo. Content	0.90	2,113					
8	Mo. Age	0.60	2,112					
9	Fam. Size	0.44	2,111					
10	Step Fa. > 12	0.30	2,110					
11	Mo. Educ.	0.30	2,109					
12	Mo. Health	0.22	2,108					
13	Mo. Order	0.20	2,107					
14	Step Fa. < 4	0.17	2,106					

* - last entry significant at the $p < .01$ level

and eleven also seems contrary to the study of Offord et al. (1978), who found that timing of guardian changes was nonpredictive of child crime.

Uncontrolled Behavior

A similar set of analyses was carried out predicting to uncontrolled behavior (i.e., acts showing aggression not directed toward persons). In the analysis in which SES entered at the first step, only one additional variable, number of constellations, reached significance (Wilk's lambda = .91). The amount of variance accounted for by SES was 5 percent, and the number of constellations variable accounted for 4 percent. In the analysis in which SES was held out of the equation until the last step, number of constellations entered first as expected. The variable accounted for 5 percent of the variance in this analysis. No other variable with the exception of SES reached significance. The very weak contribution of paternal recidivism to uncontrolled behavior is in contrast with its strong predictive power in connection with thievery.

The analyses predicting toward uncontrolled behavior in non-intact families showed none of the predictors to be significant. However, the analyses of intact families yielded a very substantial function (Lambda =.71). As noted in Table 11, family dissension turned out to be the strongest predictor, accounting for 13 percent of the variance. Mother's recidivism accounted for 12 percent, and mother's age for 4 percent. The younger the mother, the

Table 11

STEPWISE DISCRIMINANT ANALYSIS: UNCONTROLLED BEHAVIOR: Intact Families
DEGREES OF FREEDOM FIRST STEP: 2,107

STEP	PREDICTOR VARIABLE	F-RATIO TO ENTER	DF	WILK'S LAMBDA	F-MATRIX			DF
					NONE ONCE	NONE RECID	ONCE RECID	
1	Fam. Dissen.	7.73	2,107	0.874	1.29	14.97	5.79	1,107
2	Mo. Cr. Recid.	8.47	2,106	0.753	0.67	17.00	8.72	2,106
3	Mo. Age	3.12*	2,105	0.711	0.75	13.81	6.65	3,105
4	Fa. Cr. Once	2.22	2,104	0.682	1.68	10.26	5.38	4,104
5	SES	1.93	2,103					
6	Mo. Content	1.90	2,102					
7	Mo. Educ.	1.21	2,101					
8	Mo. Cr. Once	0.838	2,100					
9	Mo. Health	0.445	2,99					
10	Fam. Size	0.441	2,98					
11	Mo. Order	0.358	2,97					
12	Fa. Cr. Recid.	0.334	2,96					
13								
14								

* - last entry significant at the $p < .05$ level

more child uncontrolled behavior. These results lend further support to the notion that family discord is of central importance in the association between broken homes and criminality (i.e., in a non-broken home, this factor alone accounts for 13 percent of the variance) Unlike the results of the analyses predicting to thievery, the results of the analyses of uncontrolled behavior are consistent with Offord et al (1978), in 1) demonstrating a generally lower predictability of crime in nonintact families; and 2) indicating that parental crime is predictive only of criminal behavior in males from intact families.

Nonintactness Due to Death vs Divorce

As mentioned in the literature review, some evidence exists that nonintactness of the family is not associated with increased criminality in the offspring if the family breakup was caused by death as opposed to divorce. Thirteen of the males analyzed in this study had experienced the death of their father. Of these, five (33 percent) had criminal records. Thus, the Danish sample does not support the suggestion that nonintactness caused by death is less conducive to development of criminal behavior than is nonintactness caused by other factors. However, the small sample size makes a definitive statement unjustified.

Juvenile vs Adult Onset of Criminality

As mentioned in the literature review, research comparing juvenile delinquents with older criminals shows that similar life-history factors seem to characterize both groups. As pointed out by West & Farrington (1977) and Robins (1966), among others, this is due in large part to the fact that the majority of adult offenders also have records of juvenile offenses. However, West & Farrington (1977) identified a special subgroup of adult offenders characterized by the onset of criminal behavior after age 18. This group possessed a significantly lower average SES than nonoffenders. In this respect the adult onset criminals were different from the juvenile onset cases studied by West & Farrington, where low SES did not discriminate between juvenile offenders and their non-criminal peers.

Two discriminant function analyses were completed using the same predictors as those employed in the above analyses; 1) a comparison of juvenile onset cases with non-criminals; and 2) a comparison of late-onset cases with non-criminals. A total of 109 cases began their criminal career before 18 years of age. Three variables discriminated between these subjects and non-criminal cases: SES; father's recidivism; and number of constellations (Wilk's lambda=.90).

In the analysis comparing late-onset cases (N=48) with non-criminal subjects, the number of constellations and young maternal age variables showed significant predictive

power (Wilk's lambda = .94). Finally an analysis was performed comparing early onset with late onset cases. Only one predictor reached significance; the subjects who began their criminal behavior later had more orderly mothers than the juvenile onset criminals (Wilk's lambda = .96). Since neither analyses demonstrated sufficient power (lambdas of .90 and .94 respectively), no data displays are presented.

These findings do not corroborate those of West and Farrington with regard to low SES being exclusively associated with later onset of criminality. On the contrary, SES differentiated significantly between early onset subjects and non-criminals, but not between late onset and crime-free subjects. In view of the rather weak prediction observed in these analyses, and the limited number of subjects included, further interpretation of the differences in prediction of juvenile versus adult onset of criminal behavior seems unwarranted.

Log-Linear Analyses

Introduction

The discriminant analyses reported in the previous section identified a set of variables that reliably contributed to the distinction between no offenses and recidivism in the index child. Distinctions between one offense and recidivism were much less robust across types of crimes on the bases of variables selected. While the same

predictor variables appeared to make a contribution to the "explanation" of the general types of offenses, their specific pattern and strength varied across types of adolescent crime. Two aspects of the previous analyses pointed to the desirability of applying other inquiry techniques. First, there was an indication that some of the variables used in the discriminant analyses possess categorical rather than interval scale characteristics. Second, other characteristics of interest, not amenable to regression techniques, needed to be analyzed in combination with the variables which showed significant prediction. Thus, on the basis of the results of the discriminant analyses, an attempt was made to divide the sample into subgroups homogenized on the basis of specified variable-related characteristics. The advantage of this procedure was that it permitted us to analyze the dependent variable (in this case, young adult criminal activity) as it was associated with subgroups that have been identified as possessing or not possessing a specified set of predictor characteristics.

A log-linear analytic approach was used. We restricted the analyses to three-factor contingencies. Although it would have been desirable to include additional factors, doing so would increase manifold the number of cells in the tables, and with the sample size there would be too many zero frequency cells. While we lose the ability to directly test interactions, log-linear modeling of three factor

contingency tables does provide several advantages over two-factor analyses. First, it provides a systematic approach to explaining observed frequencies in multidimensional tables; and secondly, it estimates the relative magnitude of each of the effects of interest. Another advantage, similar to that of regression and ANOVA, is that the additive effects of the variable of interest may be judged by allowing a linear modeling of expected cell frequencies (Everitt, 1977; Bishop, Fienberg & Holland, 1975; Goodman, 1972).

It will be of some help in understanding the tables and graphs to be presented if a general interpretation procedure were outlined. The major objective of the analyses is to identify the most parsimonious model fitting the data. This is accomplished in two steps:

1) the model's measure of goodness of fit (G-squared residual in the tables) is obtained (an ANOVA-like residual measure)

2) a component's contribution to the model is measured by comparing it with another model that contains all of the components excepting the one of interest. The difference in the goodness-of fit residual for the model (G-squared component) constitutes the improvement ascribed to the additional component. In all cases, the "baseline model" is used as the comparison base for determining the statistical significance of a component's contribution.

Graphical representations of the variable associations

are presented for most of the analyses. Through such representations it is hoped that not only will the additive effects that were directly tested be illustrated, but that interactions not testable might be graphically suggested. It will be noted in some of the graphs that certain categories have been collapsed or omitted. The specific rationale for such treatment will be provided in the text of the interpretation. But, generally, this action was warranted on the bases of both the analysis itself and/or the cumulative suggestion of all preceding analyses. Collapsing table categories is permitted according to Bishop, Fienberg, & Holland (1975:39-41) provided that the variable is independent of at least one of the remaining pair of variables. The reduced table for graphic representation may be examined without danger of misleading conclusions; this is a situation akin to the partial correlation concept found in regression.

Factors and Variable Analyzed

As indicated, analyses reported in the previous section identified a set of variables that consistently contributed to the distinction between index children with no criminal offenses and those with one offense, and two or more. They were:

1. Father criminality
2. Number of family constellations after age four
3. Family size

4. Mother criminality

5. Socio-economic status (SES)

The above variables and the literature formed the basis for defining the factors to be used in the log-linear analyses. The following variables were used in various three-factor combinations with the three criminal types:

1) Family Stability. As initially defined, this variable consisted of three scores for each subject: one stability score for the period between birth and age four; one for the period between ages 5 and 11; and one for ages 12 and beyond. If during the period there were a change in the adult configuration of the family constellation, the subject would be recorded as having experienced instability during that period. Changes such as a grandparent moving in with the biological mother and father would not be considered an indication of instability. However, a stepfather moving in with the mother or the biological father moving out would constitute instability.

In the preliminary regression analyses it became clear that instability during the period 0-4 years was not associated with later child criminality. Thus, the variable for the discriminant analyses was coded as the number of constellations after age four. In the log-linear analyses we attempted to increase the sensitivity of the variable by including a separate score for each of the later periods--ages 5-11, and 12 on.

2) Family Structure. This variable is essentially a birth order measure. The categories we used in these analyses locate the index child as 1) an only child; 2) the first of two; 3) the last of two; 4) the first of three or more; 5) the last of three or more; and 6) the middle of three or more. Based on the literature, the specifications of these categories showed the best promise of reflecting any association that birth order might have with the outcome variables.

3) Presence of Father. This variable categorized the index child's relationship with the biological father as it was reflected in the number of years the biological father lived at home subsequent to the birth of the index child. The categories were defined as follows: 1) father never present; 2) father lived at home for some time between birth and age nine; and 3) father present in the family for nine or more years. Initial attempts to make further refinements in the categories did not yield sufficient improvement in sensitivity to warrant their use. Thus, the first nine years were collapsed into one category.

4) Family Size. Initial log-linear analyses indicated that differentiating the larger family size categories did not contribute to the model. This, coupled with the fact that the additional cells reduced the power substantially, led to defining the family size variable as having three categories; 1) one child; 1) two children; and 3) three or more children.

5) Socio-economic Status. As previously described, the basis for this variable is the Svalastoga (1959) seven-point occupational scale. On the basis of initial analyses, the scale was collapsed into three categories: 1) Low SES, 0 and 1; 2) Middle SES, 2, 3, and 4; and 3) High SES, 5 and 6.

6) Father Crime. Initially, this variable included three categories: 1) no crime; 2) one offense; and 3) two or more offenses. The preliminary analyses indicated that there was little advantage in retaining the one-time father offenders. Thus, for the log-linear analyses the index children with one-time father offenders were dropped from further analysis (as contrasted with collapsing categories and retaining cases.)

7) Mother Crime. Since there were only 26 mothers who had recorded offenses, this variable was divided into only two categories: 1) no mother crime; and 2) some mother crime.

Table 12 shows the specific log-linear analyses completed. Each criminal type--thievery, violence, and uncontrolled behavior--was included as the dependent variable in three-factor contingency analyses defined by the cells indicated with an asterisk (*). For example, cells 1 and 2 indicate that father crime and mother crime were combined with each of the three criminal types. Thus, a total of 36 log-linear analyses were completed and reported. The cells marked with a check (√) were completed, but not reported due to lack of contribution and significance.

Table 12

Three-Factor Log Linear Analyses Completed[1]

Variables	1 (FaCr)	2 (MoCr)	3 (FamStr)	4 (FamSta)	5 (FaPr)	6 (Famsz)	7 (SES)
1. Father Crime		*	*	*	*	*	*
2. Mother Crime			✓	*	✓	*	*
3. Family Structure				✓	✓	✓	✓
4. Family Stability					✓	✓	*
5. Father Presence						✓	✓
6. Family Size							✓
7. SES							

* analyses completed and reported
✓ analyses completed, but not reported in detail

[1] The third factor in each analysis was either child thievery, violence, or uncontrolled behavior; a total of 63 analyses were completed with 30 reported in some detail.

Combinations of Family Factors with Father Criminality

With young adult (or often called child) criminality as the dependent variable factor, the father criminality factor was included in a series of three-factor log-linear analyses in an attempt to tease out the conditions under which the apparent robustness of father's criminality might be mutable. As shown in Table 12, the child crime and father crime factors were successively analyzed with the following third factors:

- Family structure
- Family stability
- Father presence
- Family size
- Socio-economic status
- Mother crime

Interpretations of and inferences drawn from the findings will be witheld until all six sets of log-linear analyses have been reported.

Family Structure and Young Adult Thievery

Table 13 shows the results of the log-linear analysis. The baseline model (G^2= 58.23) is statistically significant beyond the .01 level, thus indicating that further component analyses are warranted. The father crime component is highly significant, but the family structure component did not reach statistical significance. The combined component (G^2 =38.6) is significant, on the strength of the father

crime component, and possibly an additive contribution of family structure. Since the family structure component did not reach significance, testing models with controls is unnecessary. In spite of the fact that the the family structure component did not reach statistical significance, there was still a suggestion that it might possess an additive contribution to the model. Thus, Figure 1 includes a graphic display of all categories of the three factors. The top portion of the figure shows the percentage of children with one or more recorded thievery offenses in each father crime category for each birth position. For example, 33 percent of the only children with no father crime had one or more recorded thievery offenses. Thirty-five percent of the only children with recidivistic fathers had one or more recorded thievery offenses. The bottom portion of Figure 1 graphs the incidence of child crime by birth position. The dotted line is the percentage of one-time child offenses in each position; the solid line is the percentage of two-plus child offenses. The following points summarize the findings:

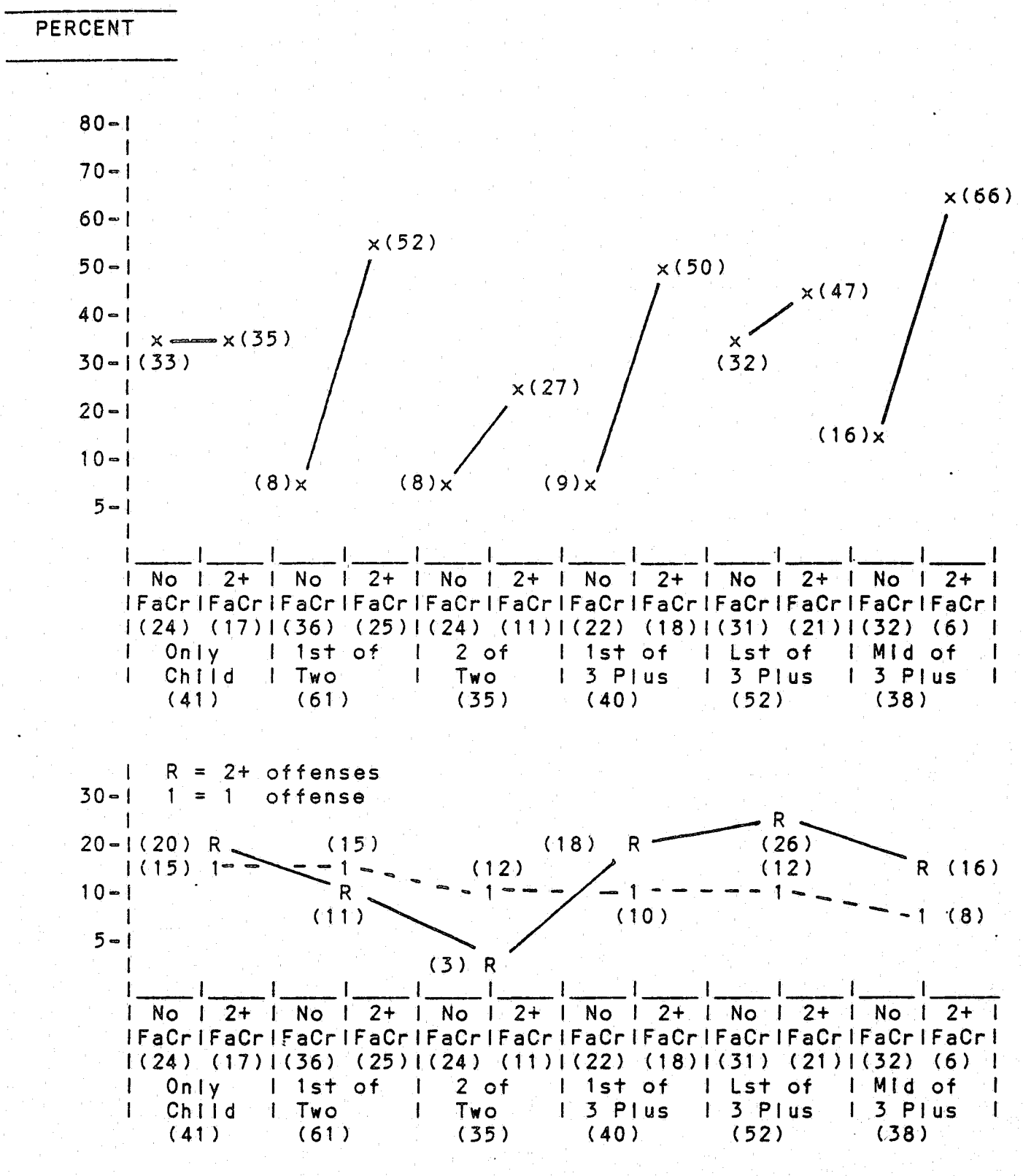
1. Father recidivism is indeed associated with child criminality. The differences in incidence of child criminality between no father crime and father recidivism across birth positions is remarkable. However, it is noteworthy that there is variability in the slopes of the lines, as well as in the absolute magnitude of child crime across the birth positions.

TABLE 13

LOG-LINEAR ANALYSIS: THIEVERY(N) x FAMILY STRUCTURE(S) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NS,NF,SF	19.62	20	.48	38.61	14	<.01
FAMILY STRUCTURE	NS,SF	43.43	24	.01	14.80	10	NS
FATHER CRIME	NF,SF	33.01	30	.32	25.22	4	<.01
BASELINE	N,SF	58.23	34	.01			

Figure 1



Variables: Father Crime, Family Structure, Child Thievery

The first of two, first of three-plus, and middle of three-plus birth positions reflect similar patterns: relatively low child crime in the no father crime cells and a high incidence in the father recidivism cells. However, such is not the case in the other three birth positions. The only child and last of three-plus cells show moderately high incidence of child crime irrespective of father crime, while the second of two position reflects a lower incidence of child crime in the father recidivism cell than would be expected.

2. When the father crime cells are collapsed and the incidence of child crime is graphed across birth positions, several comments seem warranted:

a) The second of two-child family cell reflects a remarkably low incidence of child thievery recidivism (3 percent), even with 31 (N=11) percent of the fathers showing recidivism.

b) The only child and last of three-plus cells registered the highest percentage of child recidivism (20 and 26 percent respectively). However, the last of three-plus proportion did not statistically differ from either the only child or first of three-plus cells.

c) The proportions of one-time child thievery across cells were quite similar, ranging from 8 to 15 percent.

d) The distribution of father recidivism across birth position cells was somewhat uneven. Four of the six cells reflected between 40 and 45 percent father

recidivism; exceptions were the only child cell (31 percent) and the middle of three-plus (16 percent). The aggregated proportion of father recidivists represented in this analysis was 37 percent.

Family Structure and Young Adult Violence

Table 14 shows the results of the log-linear analysis of father crime, family structure and child violence. Again, the baseline model (G^2 =66.69) indicates that further component analyses are warranted. As in the previous analysis (child thievery), the family structure component was not a statistically significant contributor to the model, but, the number of degrees of freedom (12) resulting from the six-position elaboration of structure may have been a factor. Obviously, the father crime component is the most robust. From Figure 2 it is clear that in general the patterns are the same as those noted in the young adult thievery analysis. However, there is one notable exception. As in the thievery analysis, the only child, second of two, and last of three-plus positions do not reflect the same relationship with father crime as the other three birth positions. However, in the young adult violence analysis a disordinal interaction is suggested. That is, father recidivism is associated with a lower incidence of child violence than no father crime in those birth positions. In all other respects the two analyses yielded quite similar results.

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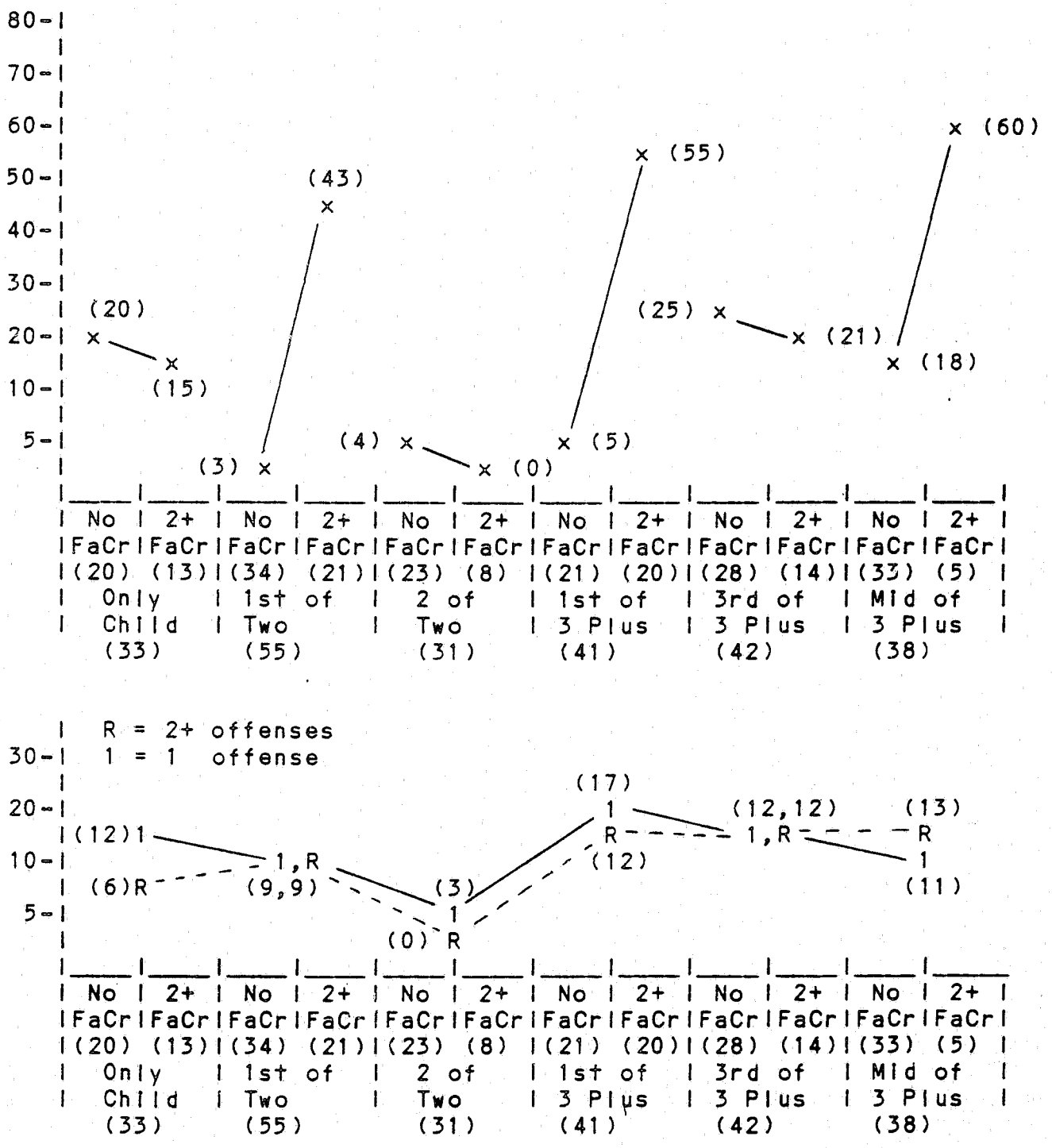
TABLE 14

LOG-LINEAR ANALYSIS: VIOLENCE(N) x FATHER CRIME(F) x FAMILY STRUCTURE(S)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NF,NS,SF	35.06	18	.01	31.63	16	<.01
FAMILY STRUCTURE	NS,SF	50.93	22	.01	15.76	12	NS
FATHER CRIME	NF,SF	51.09	30	.01	15.60	4	<.01
BASELINE	N,SF	66.69	34	.01			

Figure 2


PERCENT
80
70
60
50
40
30
20
10
5
(20)
(15)
(43)
(3)
(4)
(0)
(55)
(5)
(25)
(21)
(60)
(18)
No FaCr (20)
2+ FaCr (13)
Only Child (33)
No FaCr (34)
2+ FaCr (21)
1st of Two (55)
No FaCr (23)
2+ FaCr (8)
2 of Two (31)
No FaCr (21)
2+ FaCr (20)
1st of 3 Plus (41)
No FaCr (28)
2+ FaCr (14)
3rd of 3 Plus (42)
No FaCr (33)
2+ FaCr (5)
Mid of 3 Plus (38)
R = 2+ offenses
1 = 1 offense
30
20
10
5
(12)1
(6)R
1,R
(9,9)
(3)
1
(0) R
(17)
1
R
(12)
(12,12)
1,R
(13)
R
1
(11)
Variables: Father Crime, Family Structure, Child Violence

Family Structure and Young Adult Uncontrolled Behavior

Table 15 shows the results of the log-linear analyses of father crime, family structure, and child uncontrolled behavior. The baseline residual (G^2 =44.76) and subsequent component analyses indicate that only father criminality relates to the incidence of child uncontrolled behavior; family structure does not make a statistically significant independent or additive contribution to the model. Although it was not warranted on statistical grounds, the results were graphed to determine if patterns similar to the other offense types were observable. Figure 3 graphs the proportion of one or more young adult uncontrolled offenses by father crime within each birth position. Note that while the differences are not statistically significant, the only child, second of two, and last of three-plus positions are not consistent with the other three. In general, the pattern is the same, although there are suggestions that the father crime influence differs by type of child crime, at least in the only child, second of two, and last of three-plus positions.

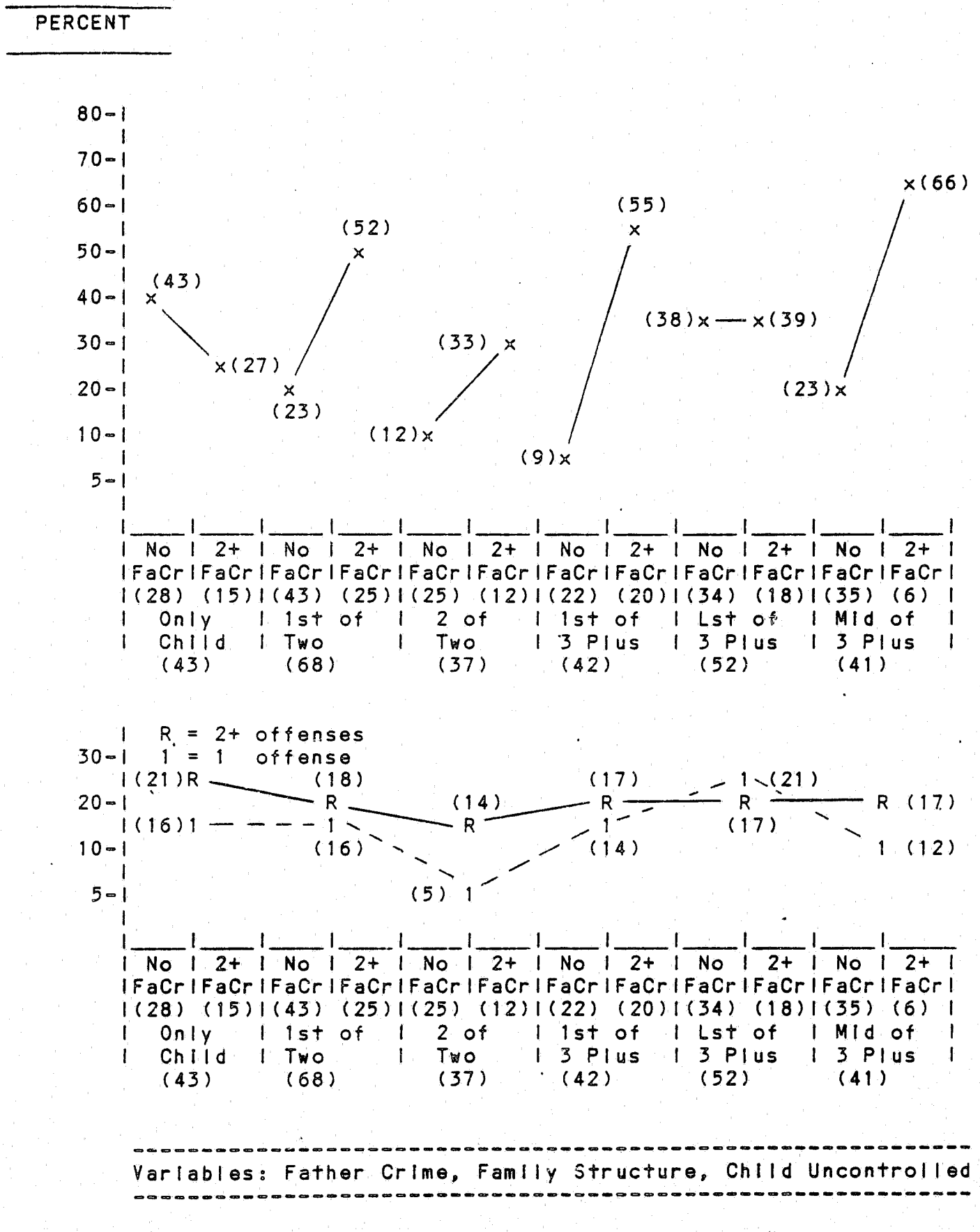
In view of the lack of statistical significance presented by the variable family structure in the three reported analyses, it was decided not to include this variable in further analyses. However, as mentioned in the literature review, shorter spacing to next younger sibling, has been found to be related to increased incidence of

Table 15

LOG-LINEAR ANALYSIS: No. of Uncontrolled Behaviours (N) X
Family Structure (S) X
Father's Criminality (F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
Combined	NS, NF, SF	24.77	20	.21	19.99	14	n.s
Family Structure	NS, SF	37.53	24	.04	7.23	10	n.s
Father's Criminality	NF, SF	32.51	30	.34	12.25	4	<.01
Baseline	N, SF	44.76	34	.10			

Figure 3



Variables: Father Crime, Family Structure, Child Uncontrolled

criminal behavior (Wadsworth 1979). Before family structure as a predictor of criminal behavior was dismissed completely in these data, a set of analyses was performed which focused particularly on short spacing as a possible predictor of crime. The influence of spacing was analyzed by dividing the birth position groups used in the above three analyses (with the obvious exception of onlies and lastborns) into cases with less than 2 years to next youngest sib and more than 2 years to next sibling. Four one-way ANOVAs were performed using spacing within each of the four birth position groups as independent variables and number of arrest dates as the dependent variable. None of these analyses showed significance, thus indicating an apparent lack of support for the hypothesis that shorter spacing to younger sib influences the development of criminal behavior in these data.

Family Stability and Young-Adult Thievery

As noted in the definitions of the variables, each child received three stability scores; one each for the periods 0-4 years, 5-11, and 12 on. The preliminary regression analyses that entered all three as separate dummy variables indicated that the stability score for the period 0 to 4 years of age made no contribution to the explanation of child crime for any of the criminal categories. Thus, for the log-linear analyses each child was placed in a stability category made up of combinations of scores from two stability periods--age 5-11 and 12 on. Table 16 shows

the log-linear analysis. Clearly all components are significantly related to child thievery. Of even greater importance, when the models are tested, each component is significant when controlled for the other. The top part of Figure 4 graphs the proportion of one or more child thievery offenses by father crime within each stability category. As in all previous analyses, father recidivism is highly related to child thievery. Further inspection of the figure highlights several important findings:

1. Instability during adolescence (>12) is highly related to child thievery irrespective of stability during the age 5-11 period and incidence of father recidivism.
2. Father recidivism further heightens the risk of child crime during instability from age 5 on; and it is always important irrespective of stability status, as illustrated by the 40 percent child thievery in the stable ages 5-18 cell.
3. It is of considerable importance that absence of father crime appears to decrease the risk of child thievery <u>only</u> when there is stability during adolescence. This is illustrated by comparing the no father crime cells of the two stable >12 cells (19 and 10 percent respectively) with the no father crime cells of the two unstable >12 cells (47 and 42 percent respectively).

TABLE 16

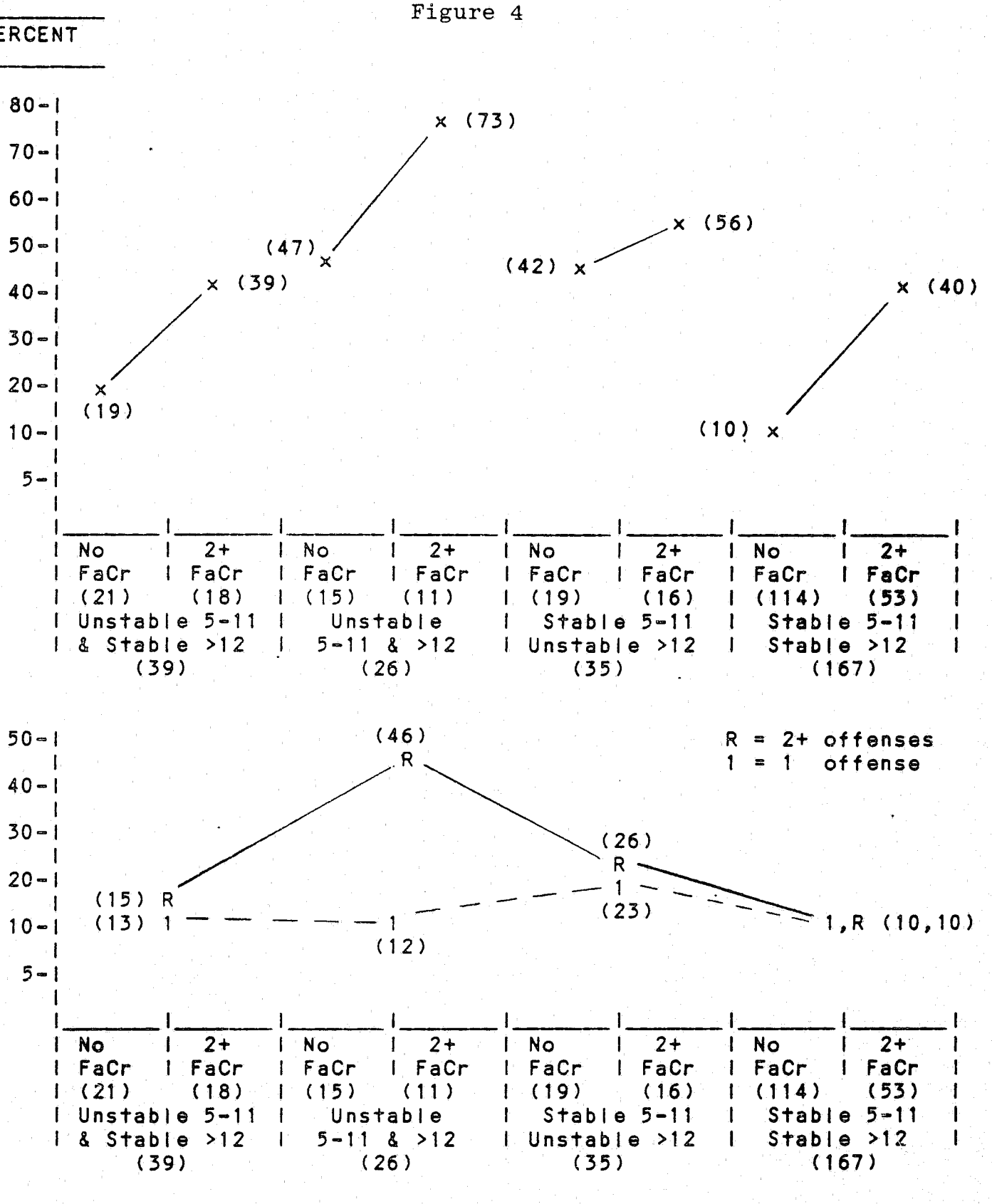
LOG-LINEAR ANALYSIS: THIEVERY(N) x FAMILY STABILITY(S) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G2 residual	D.F.	p	G2 component	D.F.	p
COMBINED	NS,NF,SF	4.14	6	.65	49.18	8	<.01
FAMILY STABILITY	NS,SF	25.41	8	.01	27.91	6	<.01
FATHER CRIME	NF,SF	29.47	12	.01	23.85	2	<.01
BASELINE	N,SF	53.32	14	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G2 component	D.F.	p
FAMILY STABILITY CONTROLLING FOR FATHER CRIME	25.33	6	<.01
FATHER CRIME CONTROLLING FOR FAMILY STABILITY	21.27	2	<.01

Figure 4



Variables: Father Crime, Family Stability, Child Thievery

4. The additive influence of father crime and family stability is further highlighted in the bottom half of Figure 4. Note particularly that 46 percent of the children in the unstable age 5 through adolescence cell committed two or more thievery offenses.

Family Stability and Young Adult Violence

Table 17 shows the log-linear analysis for father crime, family stability, and child violence. Both the father criminality and combined models are statistically significant. Although family stability did not reach significance, the G^2 of 19.57 did contribute to the combined model; thus, as with child thievery, all factors were graphed.

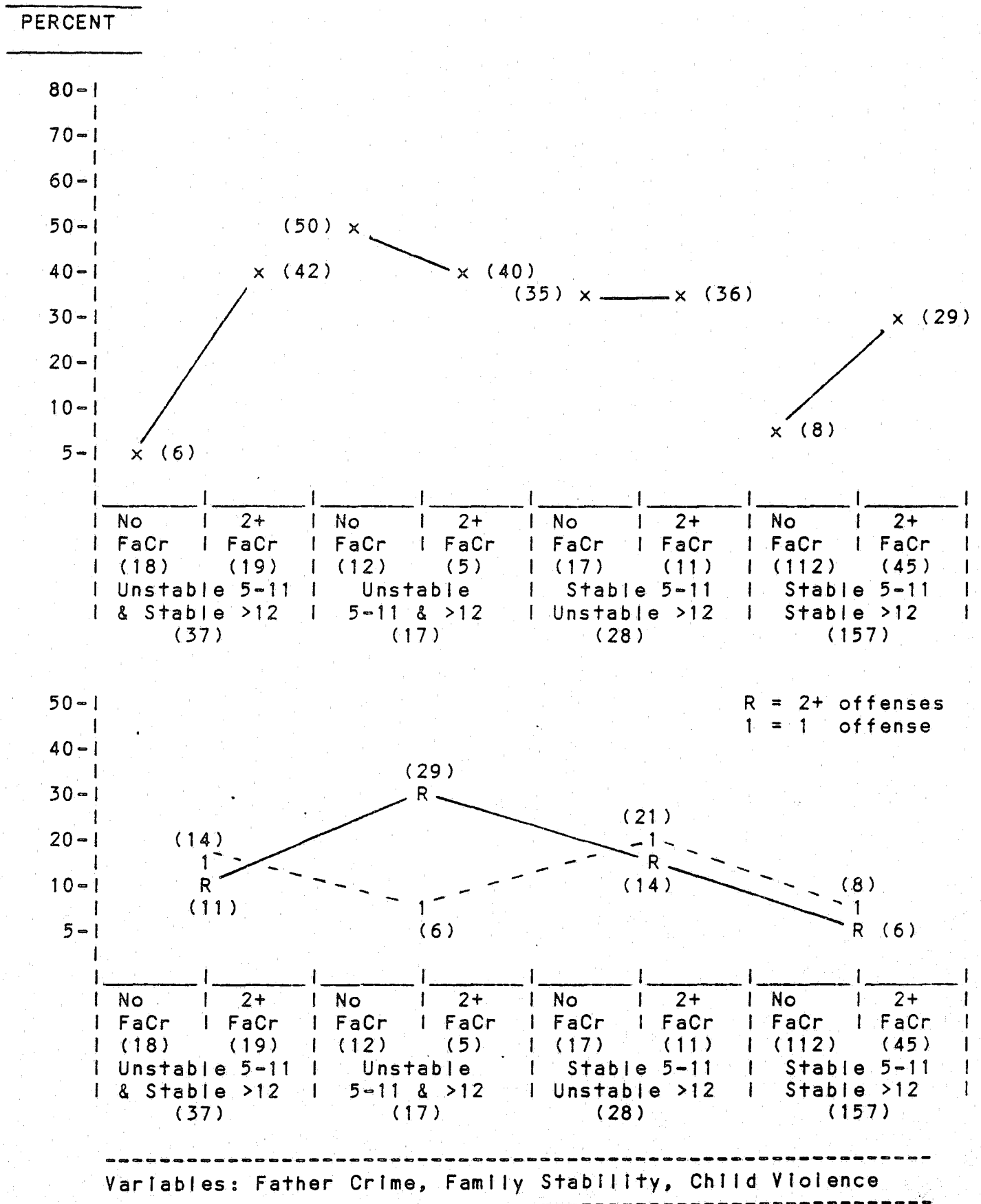
Inspection of Figure 5 suggests that there is considerable similarity with the findings of the child thievery analysis. While the proportions are slightly different, the two unstable beyond age 12 cells reflect considerable risk. Likewise, the unstable age 5 through adolescence cell reflects the highest comparative proportion of recidivistic child violence. Certainly, the similarity is sufficient to suggest that child thievery and child violence cannot be distinguished on the basis of differential patterns of family stability and father crime.

TABLE 17

LOG-LINEAR ANALYSIS: VIOLENCE(N) x FAMILY STABILITY(S) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NS,NF,SF	18.05	13	.16	34.07	21	<.05
FAMILY STABILITY	NS,SF	32.55	17	.01	19.57	17	NS
FATHER CRIME	NF,SF	37.56	30	.16	14.56	4	<.01
BASELINE	N,SF	52.12	34	.02			

Figure 5


PERCENT
80
70
60
50
40
30
20
10
5
(6)
(42)
(50)
(40)
(35)
(36)
(8)
(29)
No FaCr (18) 2+ FaCr (19) Unstable & Stable 5-11 >12 (37)
No FaCr (12) 2+ FaCr (5) Unstable 5-11 & >12 (17)
No FaCr (17) 2+ FaCr (11) Stable Unstable 5-11 >12 (28)
No FaCr (112) 2+ FaCr (45) Stable Stable 5-11 >12 (157)
R = 2+ offenses
1 = 1 offense
50
40
30
20
10
5
(14) 1
(11) R
(29) R
(6) 1
(21) 1
(14) R
(8) 1
R (6)
No FaCr (18) 2+ FaCr (19) Unstable & Stable 5-11 >12 (37)
No FaCr (12) 2+ FaCr (5) Unstable 5-11 & >12 (17)
No FaCr (17) 2+ FaCr (11) Stable Unstable 5-11 >12 (28)
No FaCr (112) 2+ FaCr (45) Stable Stable 5-11 >12 (157)
Variables: Father Crime, Family Stability, Child Violence

Family Stability and Young-Adult Uncontrolled Behavior

Table 18 shows the analysis of father crime, family stability, and uncontrolled offenses. Essentially, the outcomes are the same as those for the violence analysis. Figure 6 graphs all three factors and reflects the same pattern of findings reported for thievery and violence. While this finding might be spurious, the only slight difference in the analysis is that instability after age 12 reflected high child recidivism irrespective of the stability status from age 5-11. Clearly, the three analyses reported relating family stability and father crime to the three child crime types strongly indicate no differential relationships between the two status variables and child thievery, violence, and uncontrolled behavior.

Presence of Father and Young-Adult Thievery

As noted in the definition of the variable above, the period of the child's life between age one and nine was collapsed into a single category. Elaboration of that period did not result in additional sensitivity and reduced the power of the analysis because of the increased degrees of freedom introduced.

Table 19 shows the log-linear analysis for father crime, presence of father, and child thievery. The component analyses indicated that both father crime and presence of father had significant independent effects. However, when the models were tested with controls, presence of father did not reach statistical significance; father

TABLE 18

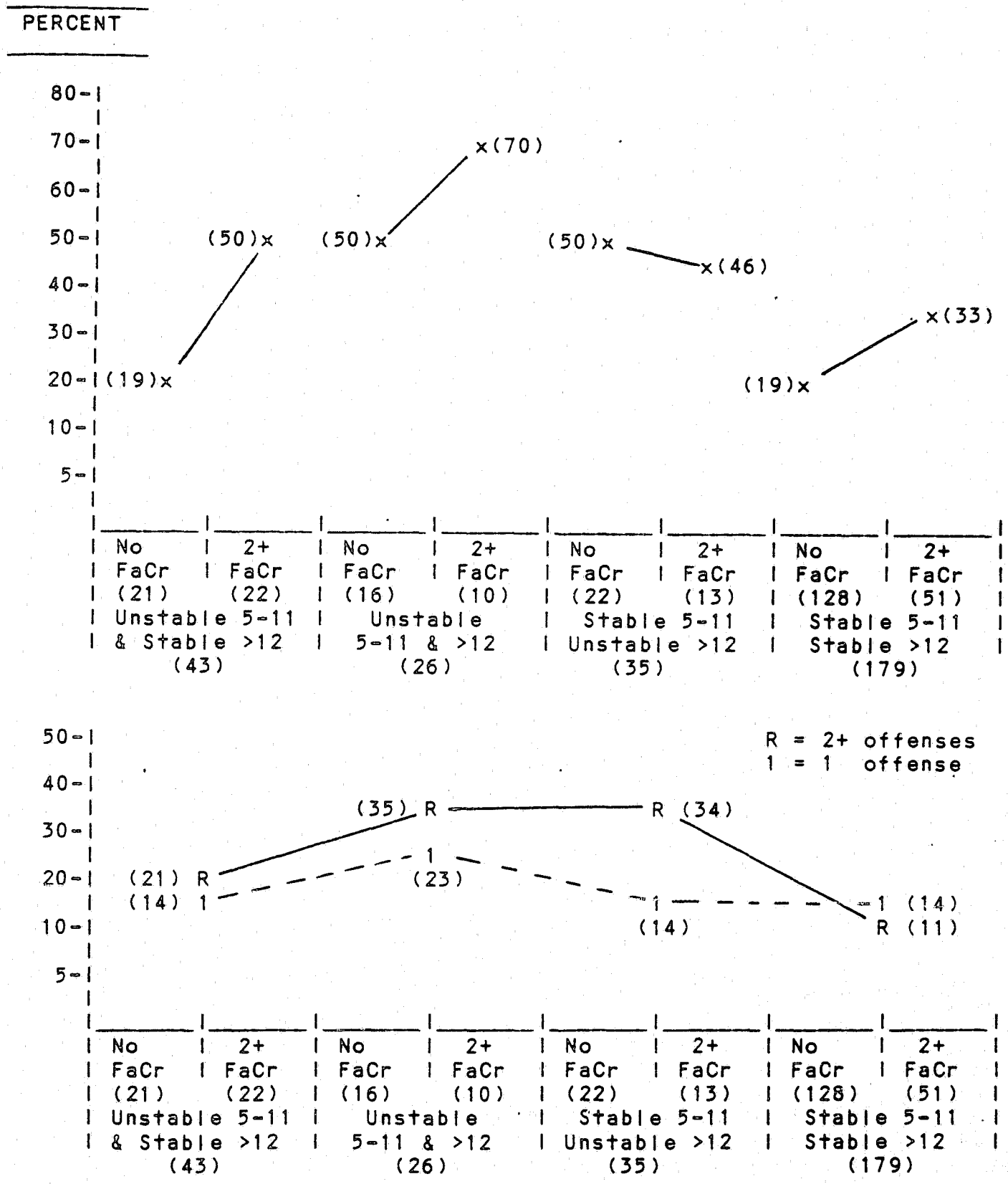
LOG-LINEAR ANALYSIS: UNCONTROLLED BEHAVIOR(N) x FAMILY STABILITY(S) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NS,NF,SF	3.97	6	.68	29.95	8	<.01
FAMILY STABILITY	NS,SF	13.18	8	.11	20.74	6	<.01
FATHER CRIME	NF,SF	22.90	12	.03	11.02	2	<.01
BASELINE	N,SF	33.92	14	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
FAMILY STABILITY CONTROLLING FOR FATHER CRIME	18.93	6	<.01
FATHER CRIME CONTROLLING FOR FAMILY STABILITY	9.21	2	<.01

Figure 6



Variables: Father Crime, Family Stability, Child Uncontrolled

crime was the only model that was significant. However, as with the previous analyses, all three factors were graphed.

Figure 7 graphs the proportions of one or more child thievery offenses by father crime within each father present cell. It also superimposes the proportion of recidivist and one-time offenders within each father present cell. The findings can be summarized as follows:

1. Father recidivism seems to be associated with child thievery in the predicted way with respect to the father present 1-9 years and over 9 years cells that is, comparatively low when there is no father crime and much higher when the father is a recidivist.
2. When the father was never present, father crime has no differential impact on child thievery (35 percent and 33 percent incidence for no father crime and father recidivism respectively).
3. Increased presence of a no-crime father is associated with a decreasing child crime rate; the converse is also true.
4. Interestingly, when the father is never present his recidivism is associated with comparatively lower child thievery than father recidivism in the other categories. By the same token, a no-crime and never-present father is associated with comparatively higher child crime.

TABLE 19

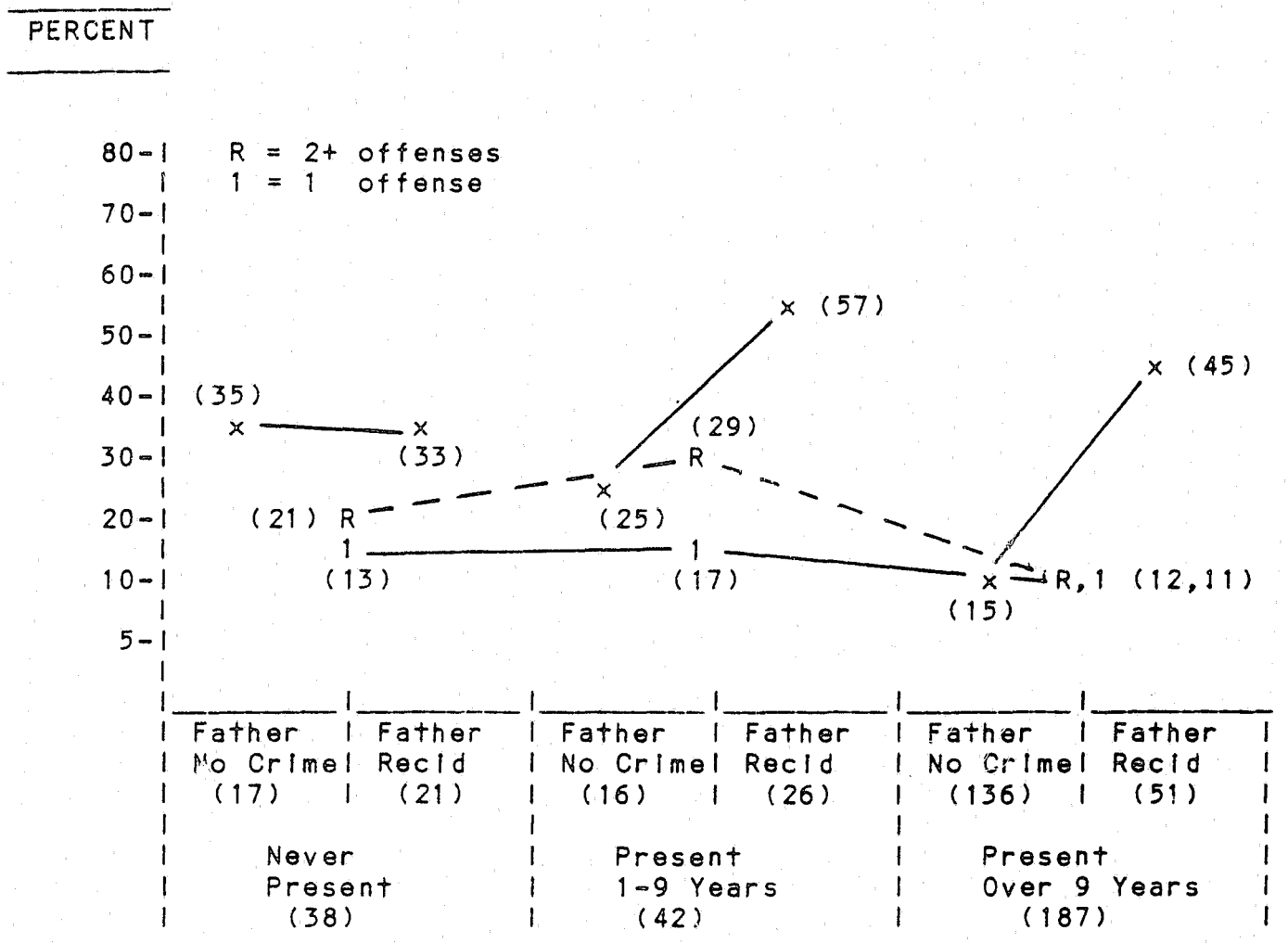
LOG-LINEAR ANALYSIS: THIEVERY(N) x FATHER PRESENT(P) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G2 residual	D.F.	p	G2 component	D.F.	p
COMBINED	NF,NP,FP	4.93	4	.29	27.29	6	<.01
FATHER PRESENT	NP,FP	22.84	6	.01	9.38	4	<.05
FATHER CRIME	NF,FP	8.37	8	.40	23.85	2	<.01
BASELINE	N,FP	32.22	10	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G2 component	D.F.	p
FATHER PRESENT CONTROLLING FOR FATHER CRIME	3.44	4	NS
FATHER CRIME CONTROLLING FOR FATHER PRESENT	17.91	2	<.01

Figure 7


PERCENT
R = 2+ offenses
1 = 1 offense
80-
70-
60-
50-
40-
30-
20-
10-
5-
(35)
(33)
(21) R
1
(13)
(25)
(29)
R
1
(17)
(57)
(45)
(15)
R,1 (12,11)
Father No Crime (17)
Father Recid (21)
Father No Crime (16)
Father Recid (26)
Father No Crime (136)
Father Recid (51)
Never Present (38)
Present 1-9 Years (42)
Present Over 9 Years (187)
Variables: Father Crime, Father Presence, Child Thievery

Presence of Father and Young-Adult Violence

Table 20 shows the log-linear analysis for father crime, presence of father, and child violence. Statistically, only the father crime component is significant (G^2 df_4 =14.56); however, for comparisons with other patterns all three factors graphed. Figure 8 reflects a pattern almost identical to the child thievery analysis. The only difference is that in general there are lower proportions of violent offenses. It is clear that child thievery and violence cannot be differentiated on the basis of the father crime and presence of father factors.

Presence of Father and Young-Adult Uncontrolled Behavior

Table 21 shows the log-linear analysis for this combination. The father's criminality component is statistically significant, but presence of father is not. However, the combined component suggests an additive contribution. Figure 9 graphs all three factors. Again, the patterns reflected are almost identical to those in the child thievery and violence analyses.

Family Size and Young-Adult Thievery

As noted in the definition of variables, there was no advantage realized by differentiating families of three or more children. Thus, the categories used were: one child, two children, and three-plus children. Table 22 shows the log-linear analysis of father crime, family size, and child thievery. The father crime and combined components are

TABLE 20

LOG-LINEAR ANALYSIS: VIOLENCE(N) x FATHER PRESENT(P) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NP,NF,PF	8.05	8	.43	20.54	14	NS
FATHER PRESENT	NP,PF	19.91	12	.07	8.68	10	NS
FATHER CRIME	NF,PF	14.03	18	.73	14.56	4	<.01
BASELINE	N,PF	28.59	22	.16			

Figure 8

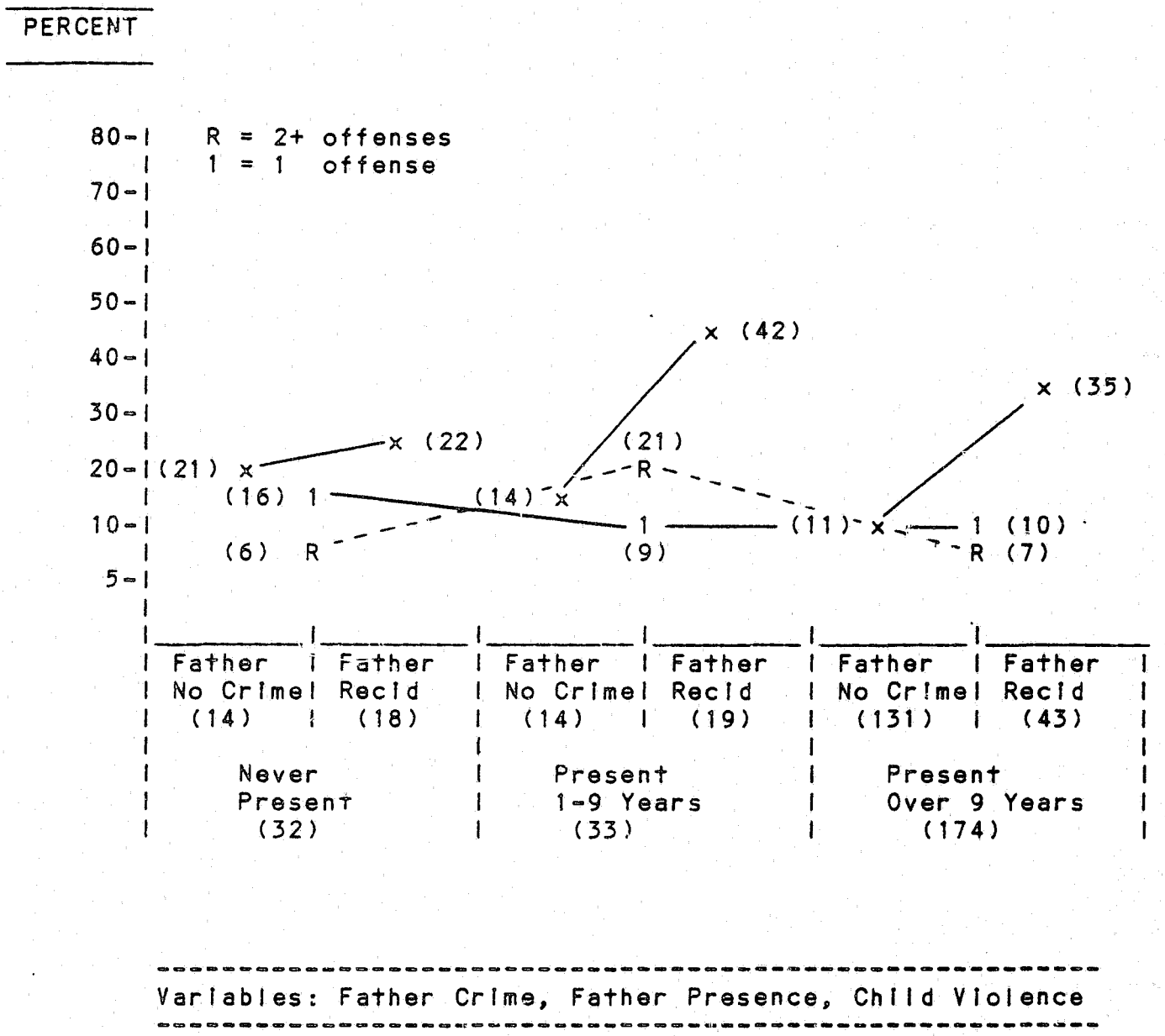

PERCENT
R = 2+ offenses
1 = 1 offense
80
70
60
50
40
30
20
10
5
(21)
(16)
(6)
(22)
(14)
(9)
(42)
(21)
(11)
(35)
(10)
(7)
Father No Crime (14)
Father Recid (18)
Father No Crime (14)
Father Recid (19)
Father No Crime (131)
Father Recid (43)
Never Present (32)
Present 1-9 Years (33)
Present Over 9 Years (174)
Variables: Father Crime, Father Presence, Child Violence

TABLE 21

LOG-LINEAR ANALYSIS: UNCONTROLLED BEHAVIOR(N) x FATHER PRESENT(P) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NP,NF,FP	2.03	4	.73	16.00	6	<.02
FATHER PRESENT	NP,FP	9.79	6	.14	8.24	4	NS
FATHER CRIME	NF,FP	7.01	8	.53	11.02	2	<.01
BASELINE	N,FP	18.03	10	.05			

Figure 9

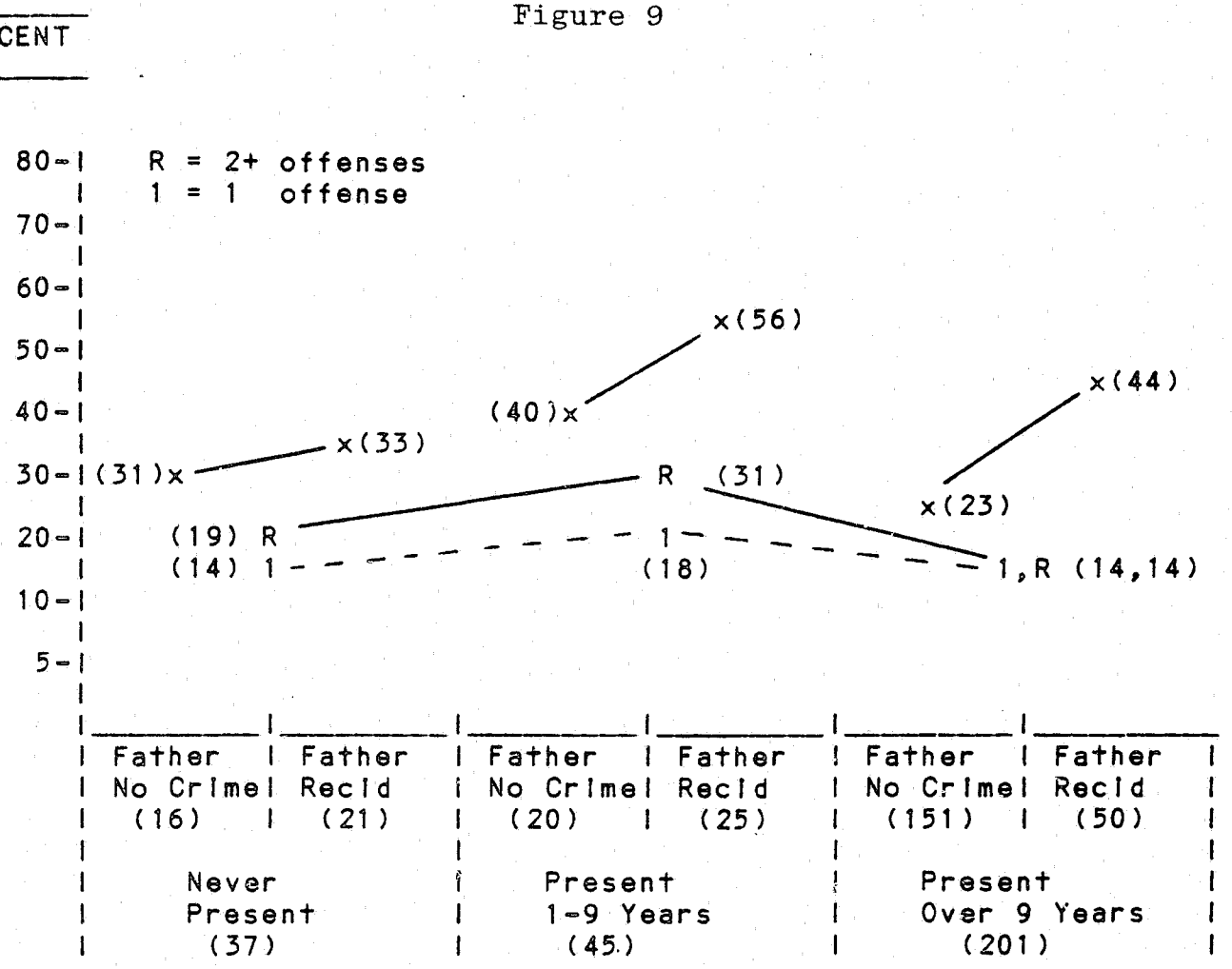
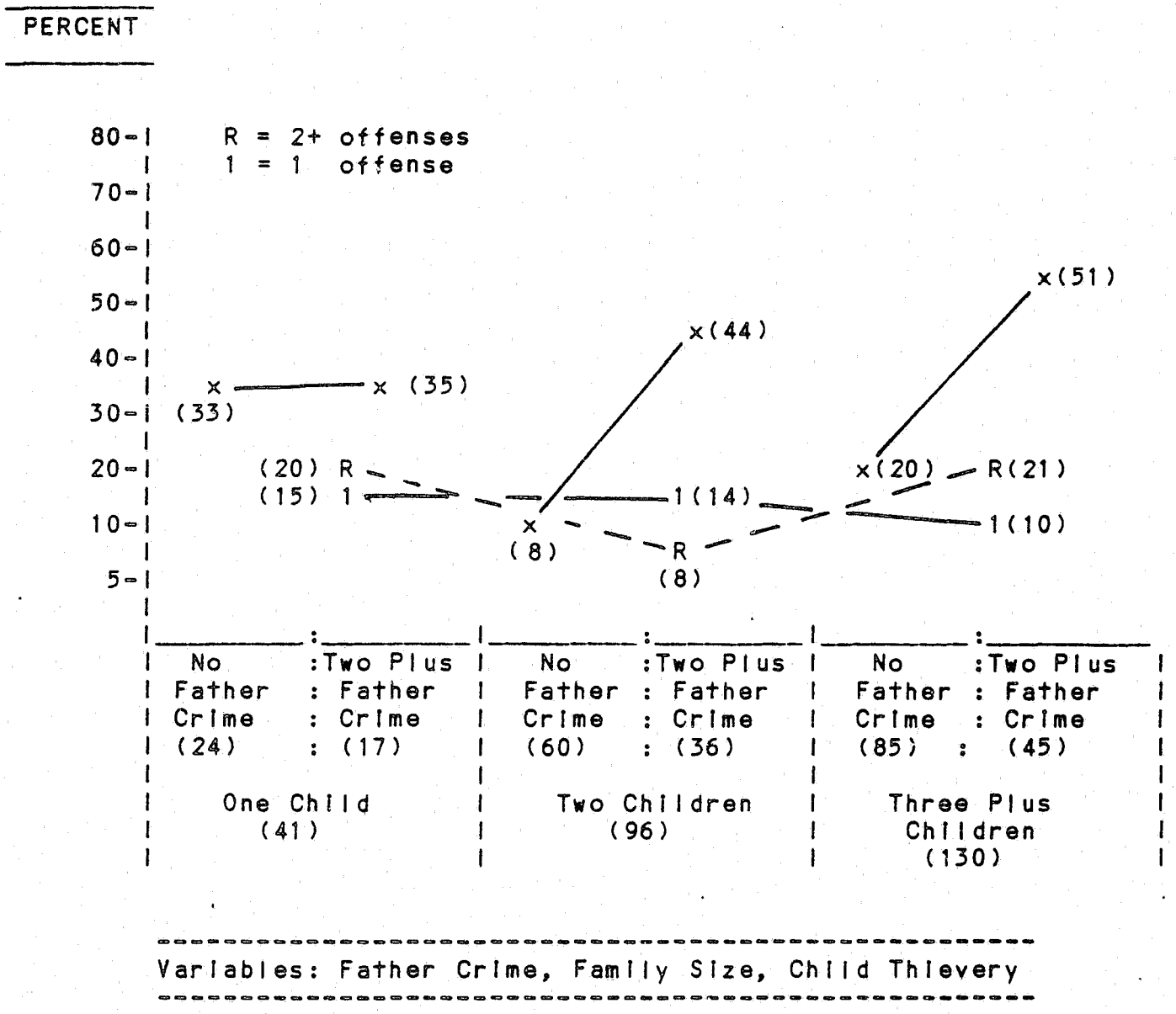

PERCENT
R = 2+ offenses
1 = 1 offense
80
70
60
50
40
30
20
10
5
(31)
x(33)
(19) R
(14) 1
(40)
x(56)
R (31)
1 (18)
x(23)
x(44)
1,R (14,14)
Father No Crime (16)
Father Recid (21)
Never Present (37)
Father No Crime (20)
Father Recid (25)
Present 1-9 Years (45)
Father No Crime (151)
Father Recid (50)
Present Over 9 Years (201)
Variables: Father Crime, Father Presence, Child Uncontrolled

TABLE 22

LOG-LINEAR ANALYSIS: THIEVERY(N) x FAMILY SIZE(S) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NS,NF,SF	7.27	4	.12	32.25	6	<.01
FAMILY SIZE	NS,SF	31.55	6	.01	7.97	4	NS
FATHER CRIME	NF,SF	15.68	8	.05	23.84	2	<.01
BASELINE	N,SF	39.52	10	.01			

Figure 10


PERCENT
R = 2+ offenses
1 = 1 offense
80
70
60
50
40
30
20
10
5
x (33)
x (35)
(20) R
(15) 1
x (8)
x (44)
R (8)
1 (14)
x (20)
x (51)
R (21)
1 (10)
No Father Crime (24)
Two Plus Father Crime (17)
One Child (41)
No Father Crime (60)
Two Plus Father Crime (36)
Two Children (96)
No Father Crime (85)
Two Plus Father Crime (45)
Three Plus Children (130)
Variables: Father Crime, Family Size, Child Thievery

statistically significant, but family size as an independent effect is not. Figure 10 graphs all three factors. Actually this turns out to be a duplicate of the family structure analysis (Figure 1) with the first and second of two cells collapsed (family size=2) and all three birth positions of three-plus children collapsed (family size=3+). The findings highlight the difference between one child families and the others noted in regard to the Figure 1 findings. The results also indicate that: 1) higher numbers of children are associated generally with elevated risk of child thievery; and 2) child thievery recidivism in two-child families tends to be lower than that of one-child and three-plus children families.

Family Size and Young-Adult Violence

Table 23 shows the log-linear analysis for this set of factors. As was the case for child thievery, the father crime and combination components were significant, but the family size component was not. Figure 11 graphs all three factors. The findings mirror the child thievery analysis and actually illustrate that there is a loss of sensitivity when birth position (family structure) is ignored. That is, in Figure 2 the first of two cell presents quite a different pattern than the second of two cell. When cells are collapsed to reflect family size all that is confirmed is the effect of number of children.

TABLE 23

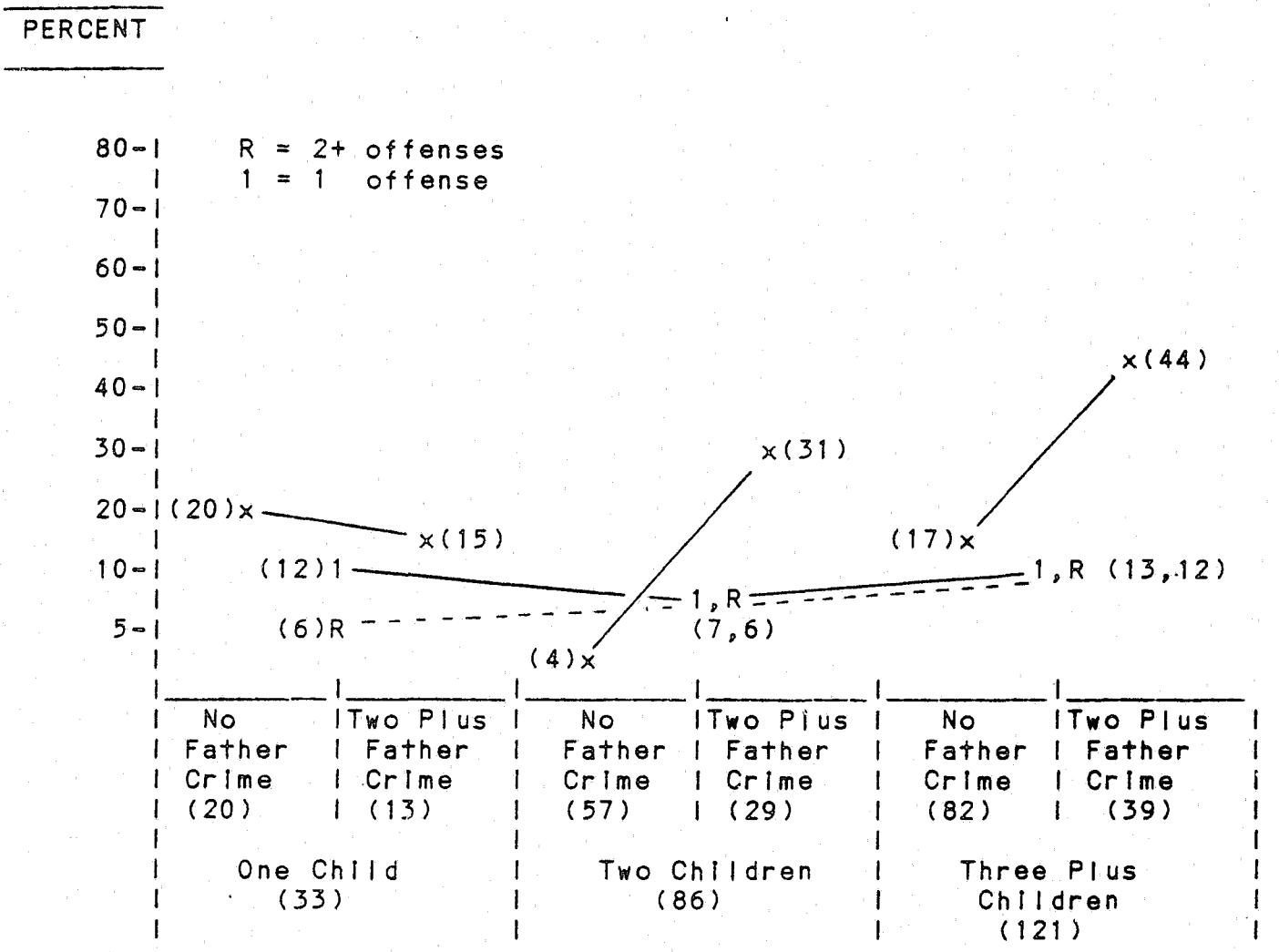
LOG-LINEAR ANALYSIS: VIOLENCE(N) x FAMILY SIZE(S) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NS,NF,SF	10.55	4	.03	22.22	6	<.01
FAMILY SIZE	NS,SF	26.88	6	.01	5.89	4	NS
FATHER CRIME	NF,SF	17.31	8	.03	15.46	2	<.01
BASELINE	N,SF	32.77	10	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
FAMILY SIZE CONTROLLING FOR FATHER CRIME	6.76	4	NS
FATHER CRIME CONTROLLING FOR FAMILY SIZE	16.33	2	<.01

Figure 11


PERCENT
R = 2+ offenses
1 = 1 offense
80
70
60
50
40
30
20
10
5
(20)x
x(15)
(12)1
(6)R
(4)x
x(31)
1,R
(7,6)
(17)x
x(44)
1,R (13,12)
No Father Crime (20)
Two Plus Father Crime (13)
No Father Crime (57)
Two Plus Father Crime (29)
No Father Crime (82)
Two Plus Father Crime (39)
One Child (33)
Two Children (86)
Three Plus Children (121)
Variables: Father Crime, Family Size, Child Violence

Family Size and Young-Adult Uncontrolled Behavior

Table 24 shows the log-linear analysis of this set of factors. Figure 12 graphs all three factors. The comments made in the two previous sections obtain here. Child thievery, violence, and uncontrolled behavior cannot be distinguished on the basis of father criminality and family size.

Socio-economic Status and Young-Adult Thievery

As noted in the definition of variables section, the seven-category Svalastoga (1959) occupational scale was collapsed into three categories: low, middle and high. Table 25 shows the log-linear analysis of this set of factors. Since all components are significant, the models were tested with controls. The test indicates that each component makes a contribution when controlled for the other component. Figure 13 graphs all three factors. The findings may be summarized as follows:

1. Father recidivism is associated with a higher incidence of child thievery within each SES category.
2. The proportion of child thievery across SES categories reflects a linear decrease of child thievery as SES status increases. This is dramatized by the fact that the no father crime cell in the low SES category shows an incidence of child thievery two percent higher than the father recidivism cell in the high SES category (35 and

TABLE 24

LOG-LINEAR ANALYSIS: UNCONTROLLED BEHAVIOR(N) x FAMILY SIZE(S) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NS,NF,SF	8.04	4	.09	12.61	6	<.05
FAMILY SIZE	NS,SF	19.18	6	.01	1.47	4	NS
FATHER CRIME	NF,SF	9.64	8	.29	11.01	2	<.01
BASELINE	N,SF	20.65	10	.02			

Figure 12 .

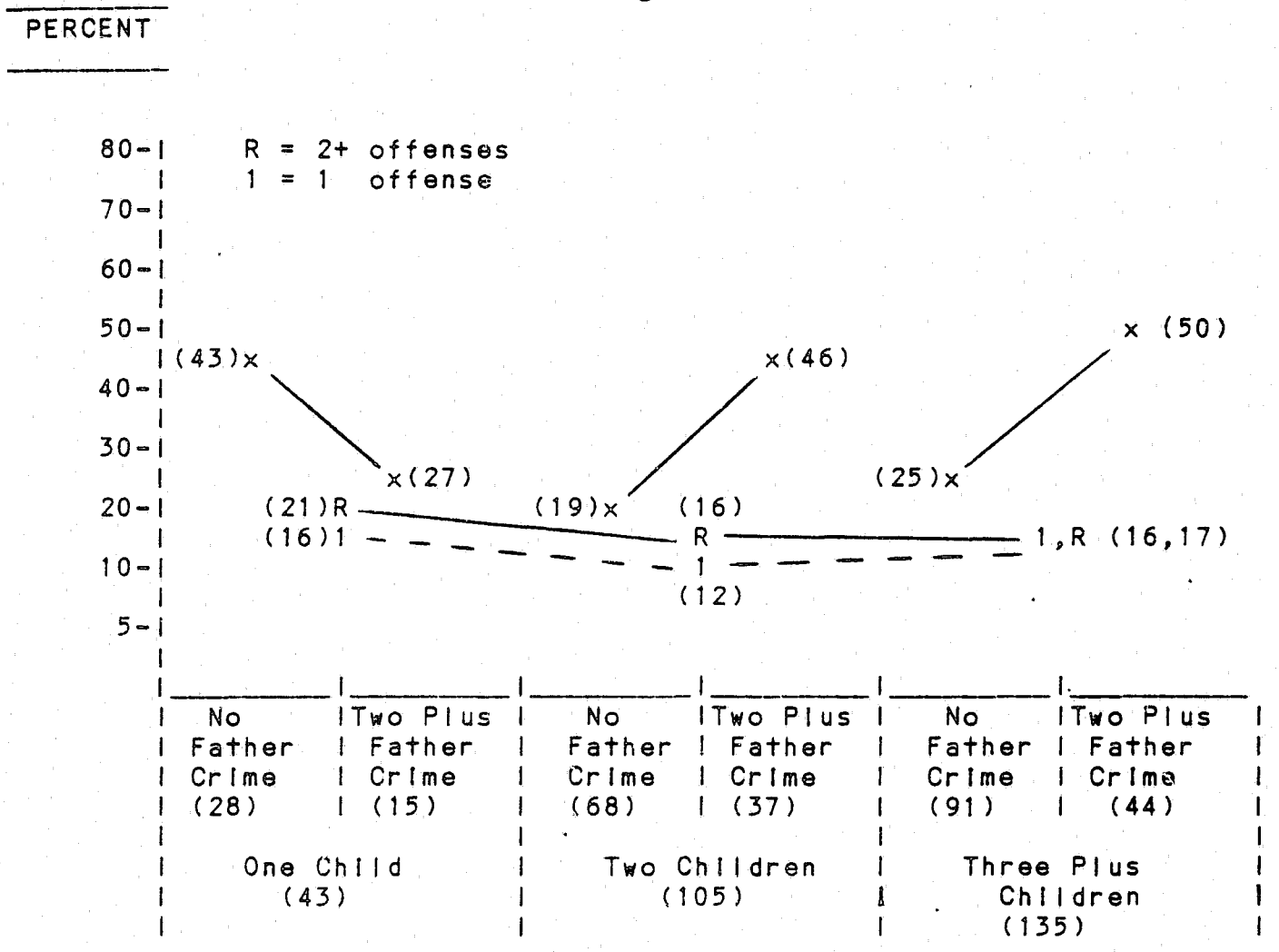

PERCENT
R = 2+ offenses
1 = 1 offense
80
70
60
50
40
30
20
10
5
(43)
(27)
(21)R
(16)1
(19)
(46)
R
1
(12)
(25)
(50)
1,R (16,17)
(16)
No Father Crime (28)
Two Plus Father Crime (15)
No Father Crime (68)
Two Plus Father Crime (37)
No Father Crime (91)
Two Plus Father Crime (44)
One Child (43)
Two Children (105)
Three Plus Children (135)
Variables: Father Crime, Family Size, Child Uncontrolled

TABLE 25

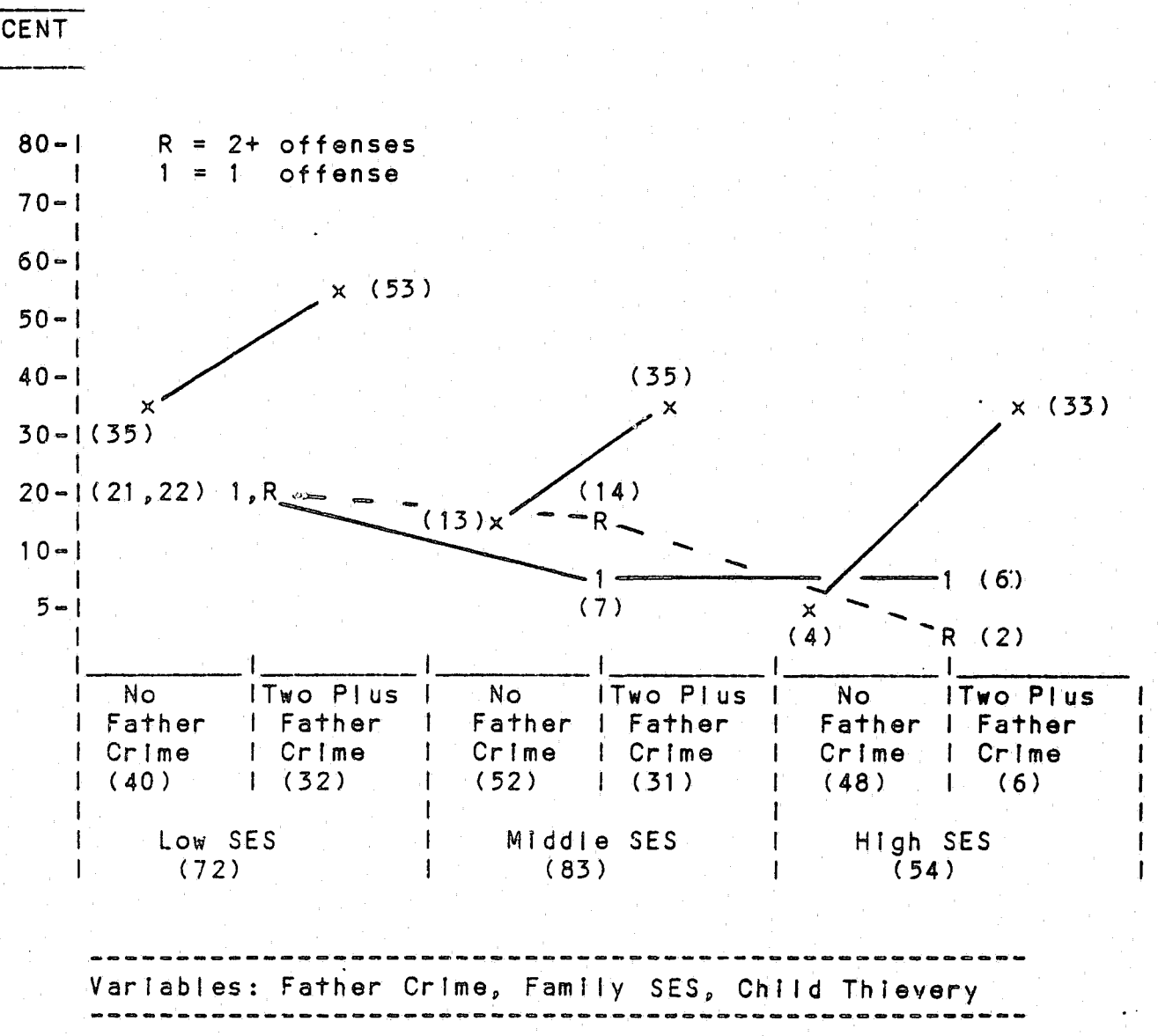
LOG-LINEAR ANALYSIS: THIEVERY(N) x SES(T) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NT,NF,TF	4.21	4	.38	35.63	6	<.01
SES	NT,TF	14.25	6	.03	25.59	4	<.01
FATHER CRIME	NF,TF	22.60	8	.01	17.24	2	<.01
BASELINE	N,TF	39.84	10	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
SES CONTROLLING FOR FATHER CRIME	18.39	4	<.01
FATHER CRIME CONTROLLING FOR SES	10.04	2	<.01

Figure 13


PERCENT
R = 2+ offenses
1 = 1 offense
80
70
60
50
40
30
20
10
5
(53)
(35)
(35)
(21,22)
1,R
(13)
(14)
R
1
(7)
1 (6)
(4)
R (2)
(33)
No Father Crime (40)
Two Plus Father Crime (32)
No Father Crime (52)
Two Plus Father Crime (31)
No Father Crime (48)
Two Plus Father Crime (6)
Low SES (72)
Middle SES (83)
High SES (54)
Variables: Father Crime, Family SES, Child Thievery

33 percent respectively). It is generally illustrated by proportions of child thievery across SES categories when the father crime factor is ignored.

Socio-economic Status and Young-Adult Violence

Table 26 shows the log-linear analysis of this set of factors. Since all components are significant, the models were tested with controls. Each model was significant beyond the .05 level. Figure 14 graphs all three factors. In general the patterns for this analysis are similar to those for the child thievery analysis. However, it appears that the significance of the SES component is a function primarily of the low incidence of violence in the high SES category, as opposed to a linear relationship with SES.

Socio-economic Status and Young-Adult Uncontrolled Behavior

Table 27 shows the log-linear analysis of this set of factors. Since all components are significant, the models were tested with controls. Interestingly, neither model is significant when controlled for the other. This indicates that, statistically at any rate, the factors father crime and SES share essentially the same "explanatory" variance as far as child uncontrolled behavior is concerned. Figure 15 graphs all three factors. Graphically, the patterns are almost identical to those of the child thievery analysis. The slightly elevated incidence of child uncontrolled behavior in two-plus father crime in the high SES category is based on a very small number (N=7); otherwise the

TABLE 26

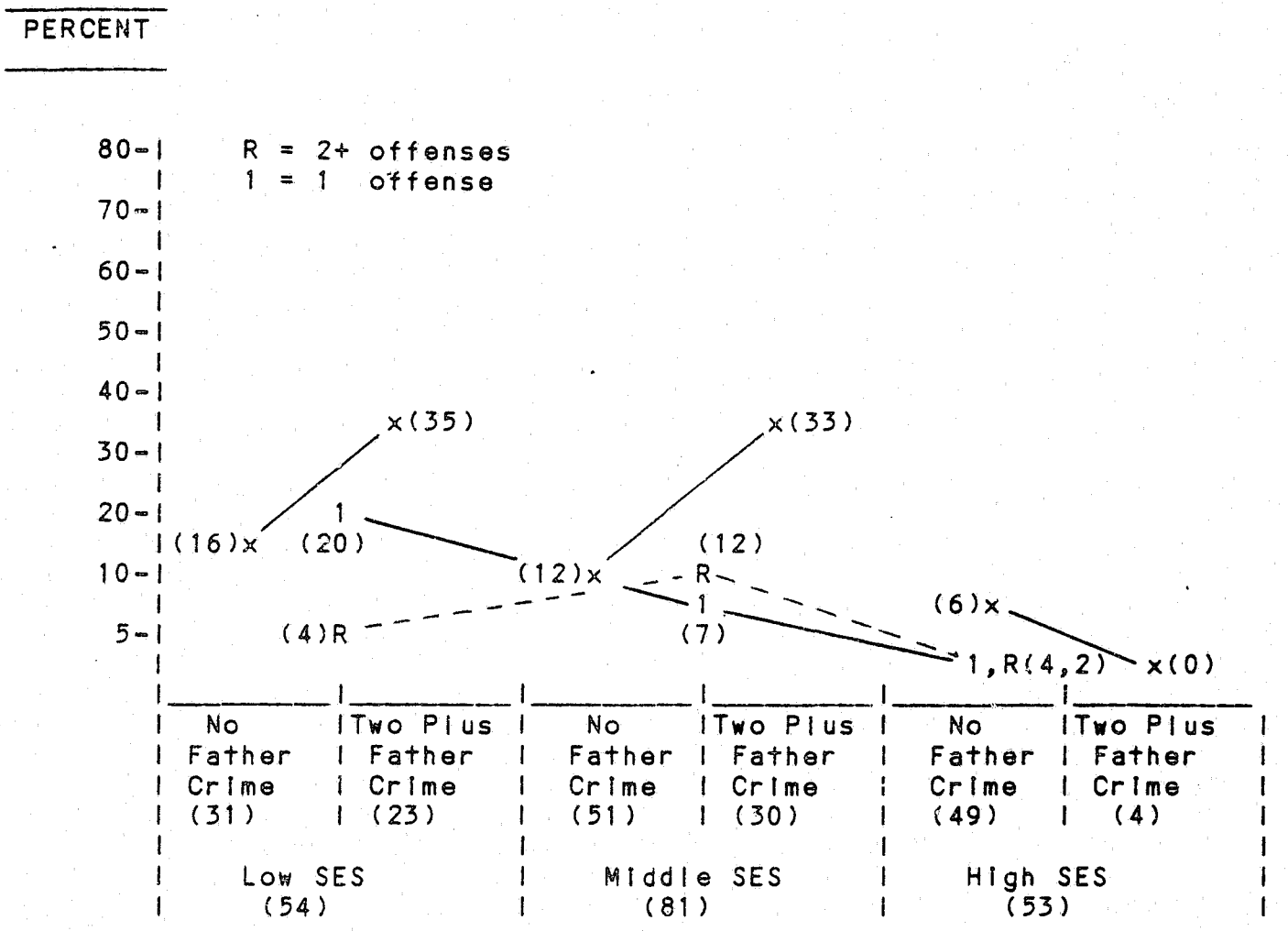
LOG-LINEAR ANALYSIS: VIOLENCE(N) x SES(T) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G2 residual	D.F.	p	G2 component	D.F.	p
COMBINED	NT,NF,TF	3.36	4	.50	22.67	6	<.01
SES	NT,TF	10.59	6	.10	15.44	4	<.01
FATHER CRIME	NF,TF	14.40	8	.07	11.63	2	<.01
BASELINE	N,TF	26.03	10	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G2 component	D.F.	p
SES CONTROLLING FOR FATHER CRIME	11.04	4	<.05
FATHER CRIME CONTROLLING FOR SES	7.23	2	<.05

Figure 14



Variables: Father Crime, Family SES, Child Violence

TABLE 27

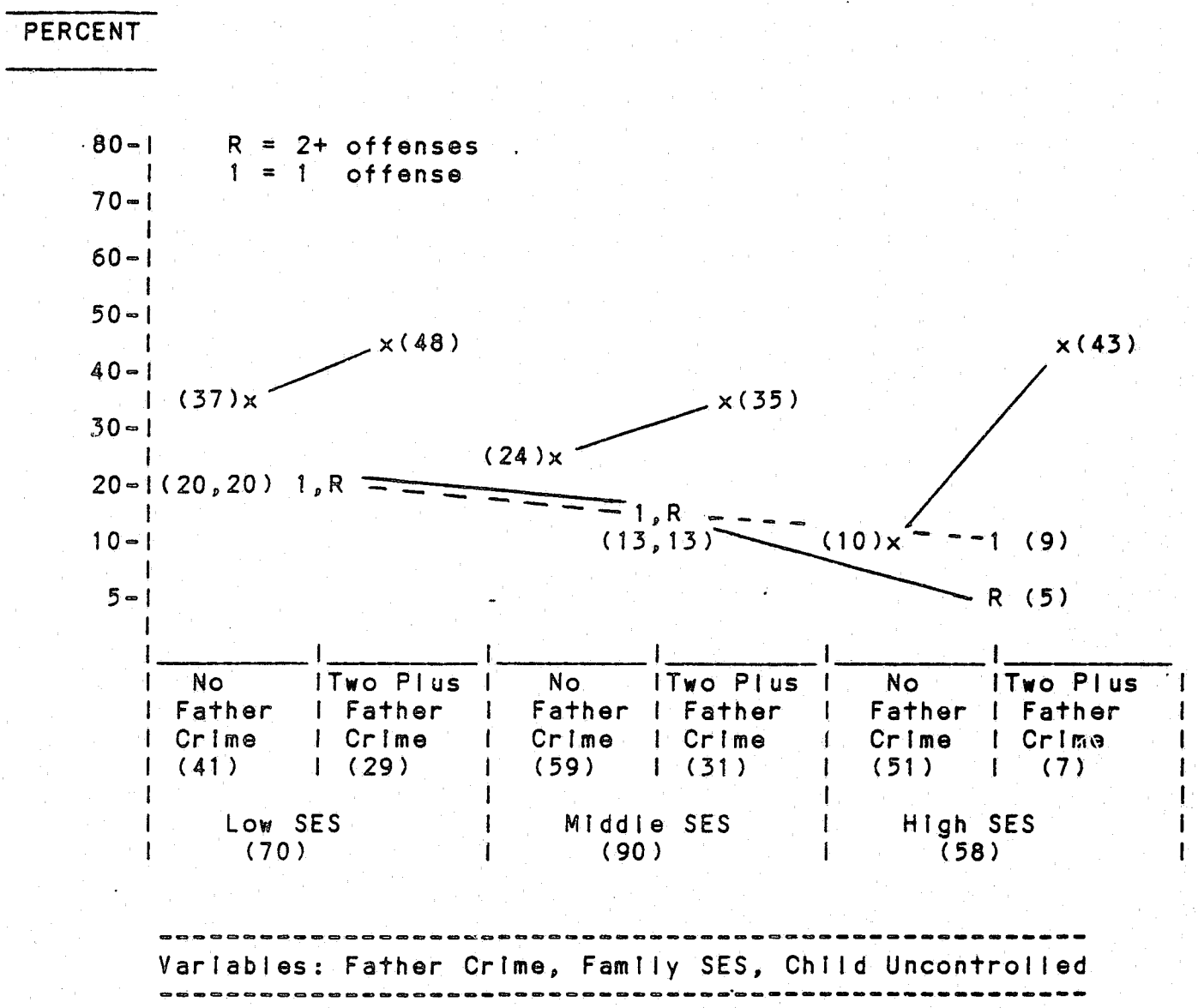
LOG-LINEAR ANALYSIS: UNCONTROLLED BEHAVIOR(N) x SES(T) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G2 residual	D.F.	p	G2 component	D.F.	p
COMBINED	NT,NF,TF	7.98	4	.09	17.56	6	<.01
SES	NT,TF	12.51	6	.05	13.03	4	<.05
FATHER CRIME	NF,TF	17.37	8	.03	8.17	2	<.05
BASELINE	N,TF	25.54	10	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G2 component	D.F.	p
SES CONTROLLING FOR FATHER CRIME	9.39	4	NS
FATHER CRIME CONTROLLING FOR SES	4.53	2	NS

Figure 15


PERCENT
R = 2+ offenses
1 = 1 offense
80
70
60
50
40
30
20
10
5
(37)x
x(48)
(24)x
x(35)
(20,20) 1,R
1,R
(13,13)
(10)x
x(43)
1 (9)
R (5)
No Father Crime (41)
Two Plus Father Crime (29)
No Father Crime (59)
Two Plus Father Crime (31)
No Father Crime (51)
Two Plus Father Crime (7)
Low SES (70)
Middle SES (90)
High SES (58)
Variables: Father Crime, Family SES, Child Uncontrolled

patterns are the same

Combinations of Family Factors With Mother Criminality

Although there were only 37 mothers who had recorded offenses, their impact on the prediction of young adult crime in the initial discriminant analyses warranted a closer look at the nature of their contribution. Thus, with child criminality as the dependent variable factor, the mother criminality factor was included in log-linear analyses with the following factors:

1. family stability
2. family size
3. socio-economic status
4. father criminality

Family Stability and Young Adult Thievery

Table 28 shows the log-linear analysis for mother crime, family stability, and child thievery. Even with only 37 recorded mother crime all components are statistically significant beyond the .01 level. When family stability and mother crime are tested controlling for each other both still make significant contributions to the model. Figure 16 graphs the three factors. The findings may be summarized as follows:

1. The shape of the child thievery curve across stability categories for both mother crime categories is almost identical: high for the unstable during both periods and lower for the stable during both periods. The major difference

TABLE 28

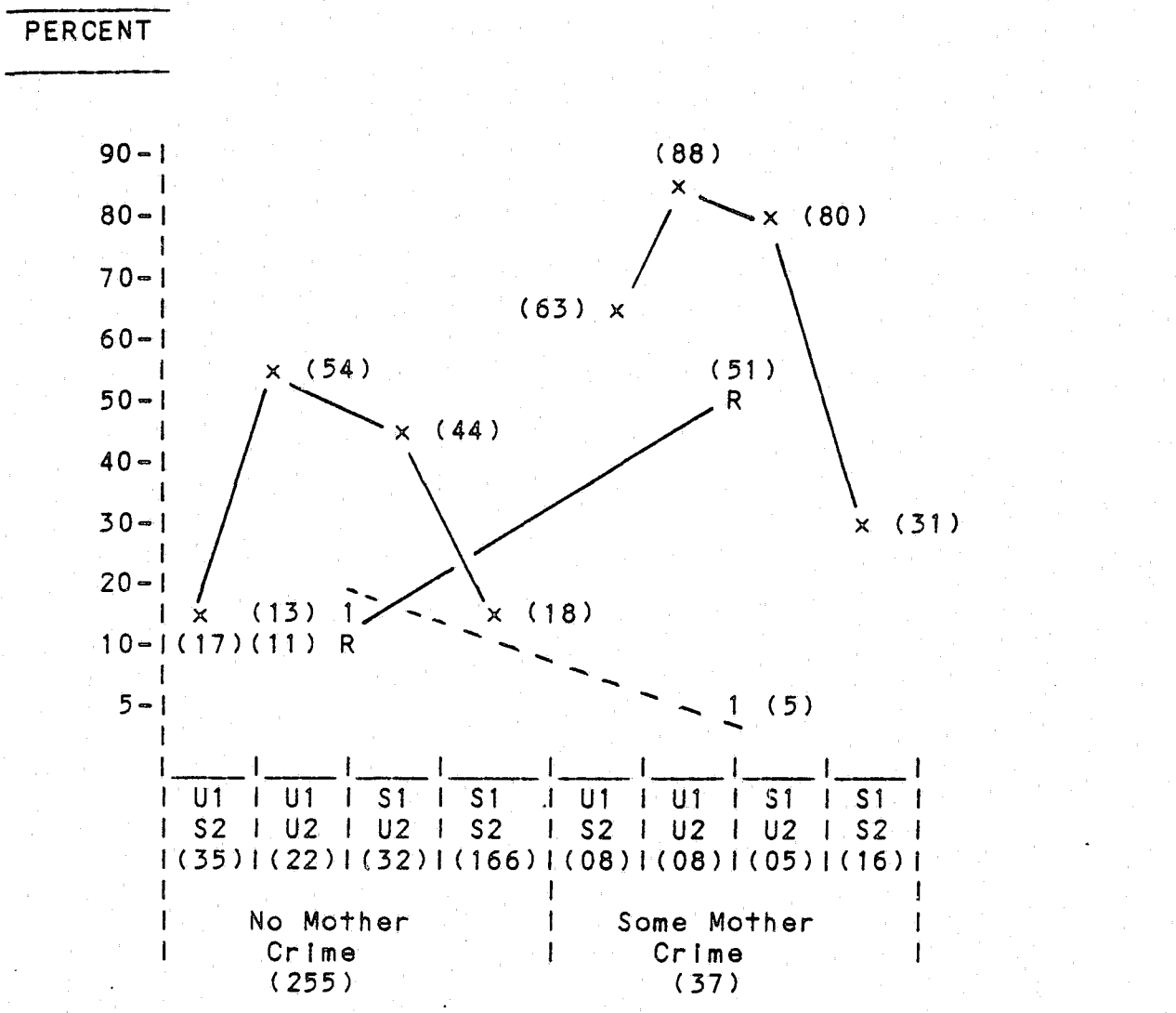
LOG-LINEAR ANALYSIS: THIEVERY(N) x MOTHER CRIME(M) x FAMILY STABILITY(S)

MODEL TESTED	MARGINALS	G2 residual	D.F.	p	G2 component	D.F.	p
COMBINED	NM,NS,SM	4.75	6	.58	60.93	8	<.01
FAMILY STABILITY	NS,SM	29.43	8	.01	36.25	6	<.01
MOTHER CRIME	NM,SM	35.55	12	.01	30.13	2	<.01
BASELINE	N,SM	65.68	14	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G2 component	D.F.	p
FAMILY STABILITY CONTROLLING FOR MOTHER CRIME	24.68	2	<.01
MOTHER CRIME CONTROLLING FOR FAMILY STABILITY	30.80	6	<.01

Figure 16



NOTE:

U1 = unstable 5-12 years
U2 = unstable 12+ years
S1 = stable 5-12 years
S2 = stable 12+ years
R = 2+ offenses
1 = 1 offense

Variables: Mother Crime, Family Stability, Child Thievery

is that the some mother crime category elevates the average magnitude of the total curve by about 25 percent. Clearly, some mother crime is correlated with child criminality, and family stability has a significant additive, but not interactive, effect.

2. The graphs accentuate the importance of stability during adolescence. It clearly is a critical correlate of child thievery.

Family Stability and Young Adult Violence

Table 29 shows the log-linear analysis for mother crime, family stability, and child violence. Figure 17 graphs all three factors. The results of the analysis are almost identical to those for child thievery.

Family Stability and Young Adult Uncontrolled Behavior

Table 30 shows the log-linear analysis for mother crime, family stability, and child uncontrolled behavior. The only difference between these results and those for child thievery and violence is that when the models are tested with controls only family stability is significant. Figure 18 graphs the three factors. The patterns are so similar to those for the child thievery and violence analysis that further comment is unnecessary. However, it is again reinforced that attempts to distinguish among criminal types on the basis of the predictor variables have not yet produced positive results.

TABLE 29

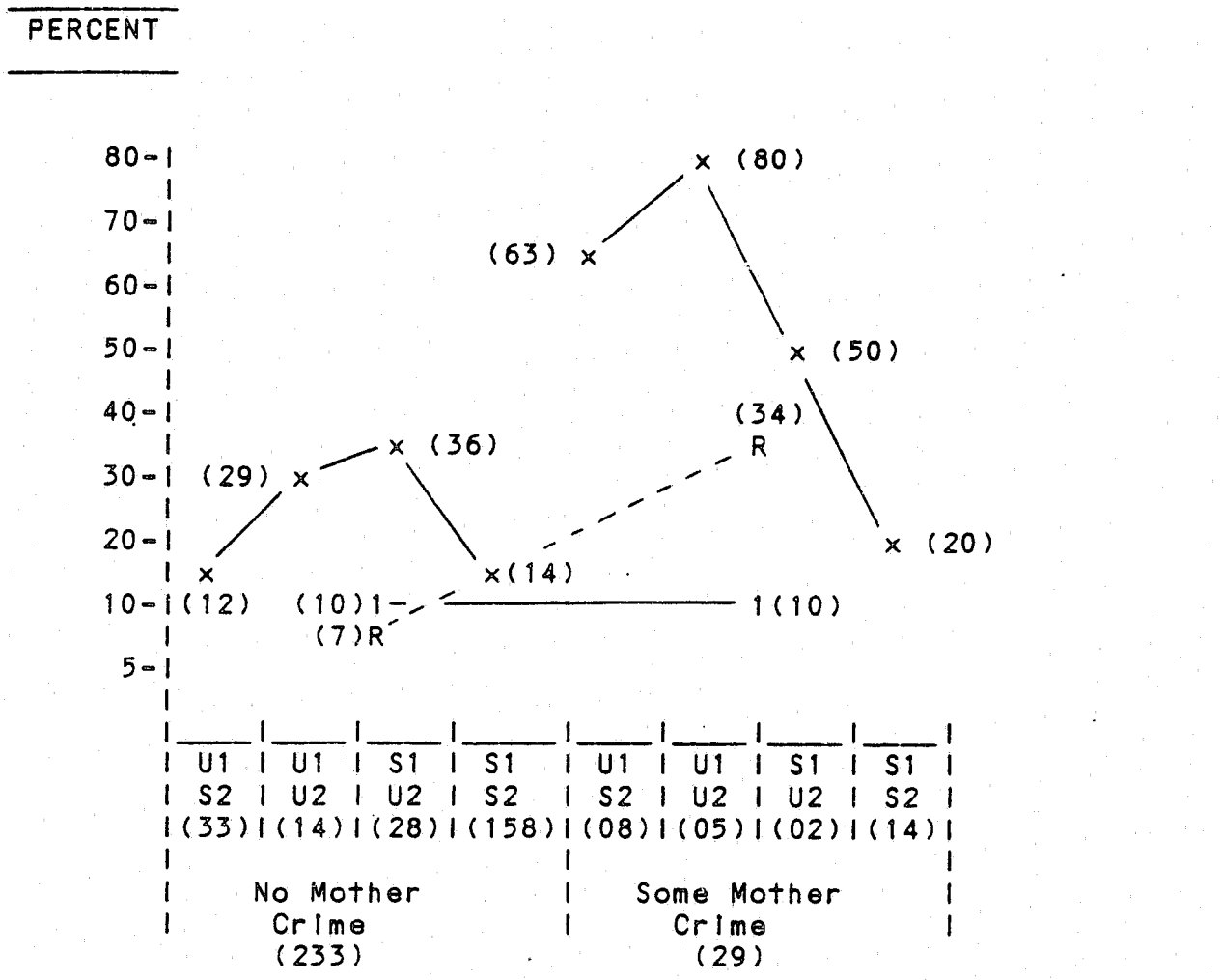
LOG-LINEAR ANALYSIS: VIOLENCE(N) x FAMILY STABILITY(S) x MOTHER CRIME(M)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NS,NM,SM	10.25	6	.11	32.39	8	< .01
FAMILY STABILITY	NS,SM	23.48	8	.01	19.06	6	< .01
MOTHER CRIME	NM,SM	26.68	12	.01	15.86	2	< .01
BASELINE	N,SM	42.54	14	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
FAMILY STABILITY CONTROLLING FOR MOTHER CRIME	16.43	6	<.05
MOTHER CRIME CONTROLLING FOR FAMILY STABILITY	13.23	2	<.01

Figure 17



NOTE:

U1 = unstable 5-12 years
U2 = unstable 12+ years
S1 = stable 5-12 years
S2 = stable 12+ years
R = 2+ offenses
1 = 1 offense

Variables: Mother Crime, Family Stability, Child Violence

TABLE 30

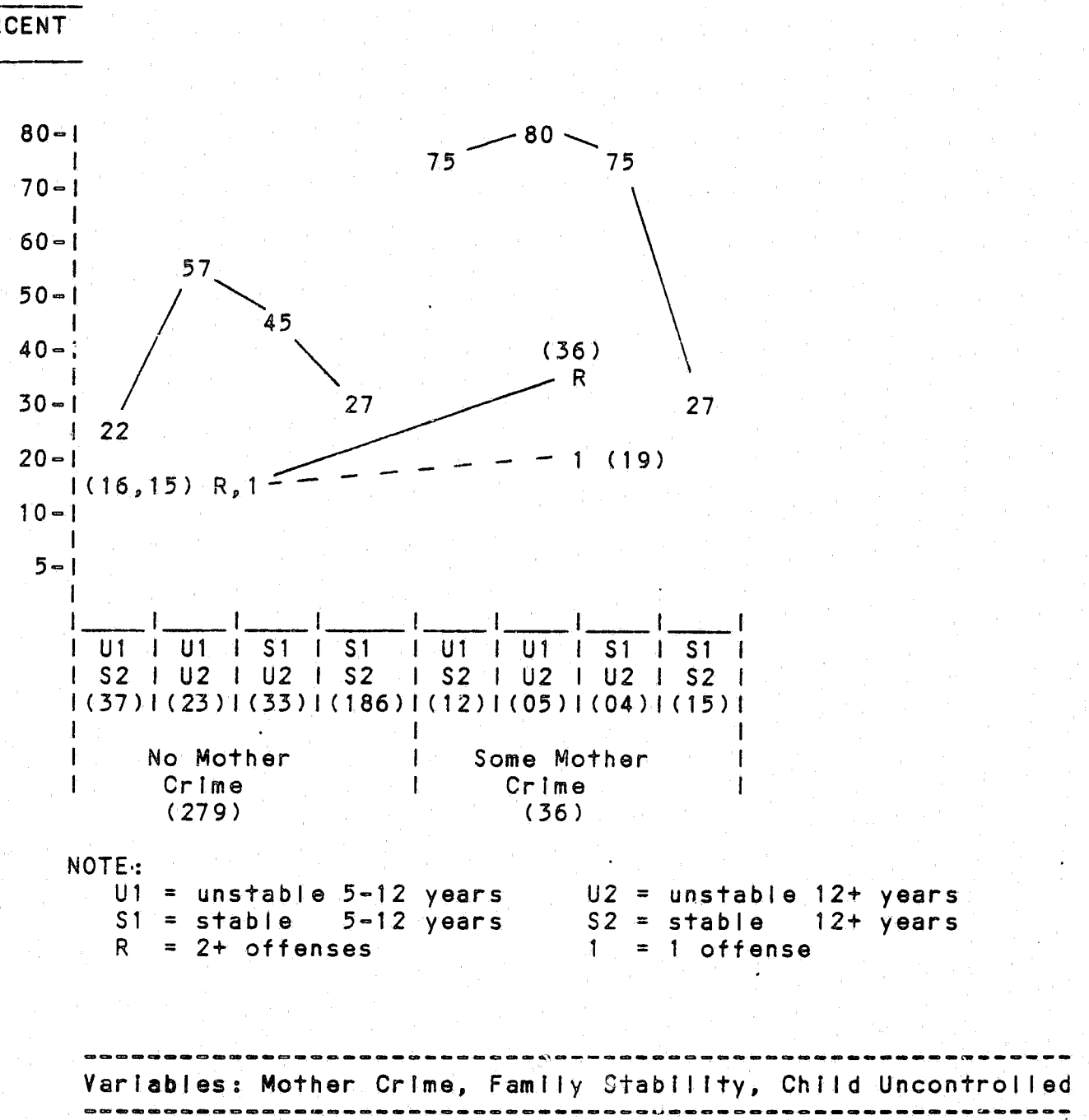
LOG-LINEAR ANALYSIS: UNCONTROLLED BEHAVIOR(N) x FAMILY STABILITY(S) x MOTHER CRIME(M)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NS,NM,SM	7.84	6	.25	28.13	8	<.01
FAMILY STABILITY	NS,SM	15.45	8	.05	20.52	6	<.01
MOTHER CRIME	NM,SM	26.46	12	.01	9.51	2	<.01
BASELINE	N,SM	35.97	14	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
FAMILY STABILITY CONTROLLING FOR MOTHER CRIME	18.62	6	<.01
MOTHER CRIME CONTROLLING FOR FAMILY STABILITY	7.61	2	NS

Figure 18



NOTE:

U1 = unstable 5-12 years	U2 = unstable 12+ years
S1 = stable 5-12 years	S2 = stable 12+ years
R = 2+ offenses	1 = 1 offense

Variables: Mother Crime, Family Stability, Child Uncontrolled

Family Size and Young Adult Thievery

Table 31 shows the analysis for mother crime, family size, and child thievery. All three components yield significant independent effects. However, when the models were tested with controls only mother crime remained significant. Family size did not quite reach significance at the .05 level (G^2 df_4 = 7.02). Figure 19 graphs all three factors. The findings may be summarized as follows:

1. The association of mother crime with child crime is very robust within each family size cell.
2. Even though it isnot significant, the two child family size cell appears to have a somewhat smaller incidence of child thievery. This, of course, is consistent with previously reported findings.

Family Size and Young Adult Violence

Table 32 shows the analysis for this set of factors. Figure 20 graphs all factors. The results are very similar to those for child thievery when the small N in the some mother crime cell of the one child family is discounted.

Family Size and Young Adult Uncontrolled Behavior

Table 33 shows the log-linear analysis for these factors; Figure 21 graphs all three factors. Again, the results are quite similar to those for child thievery and child violence.

TABLE 31

LOG-LINEAR ANALYSIS: THIEVERY(N) x MOTHER CRIME(M) x FAMILY SIZE(S)

MODEL TESTED	MARGINALS	G2 residual	D.F.	p	G2 component	D.F.	p
COMBINED	NM,NS,SM	6.02	4	.20	37.15	6	<.01
FAMILY SIZE	NS,SM	32.88	6	.01	10.29	4	<.01
MOTHER CRIME	NM,SM	13.04	8	.11	30.13	2	<.01
BASELINE	N,SM	43.17	10	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G2 component	D.F.	p
FAMILY SIZE CONTROLLING FOR MOTHER CRIME	7.02	4	NS
MOTHER CRIME CONTROLLING FOR FAMILY SIZE	26.86	2	<.01

Figure 19

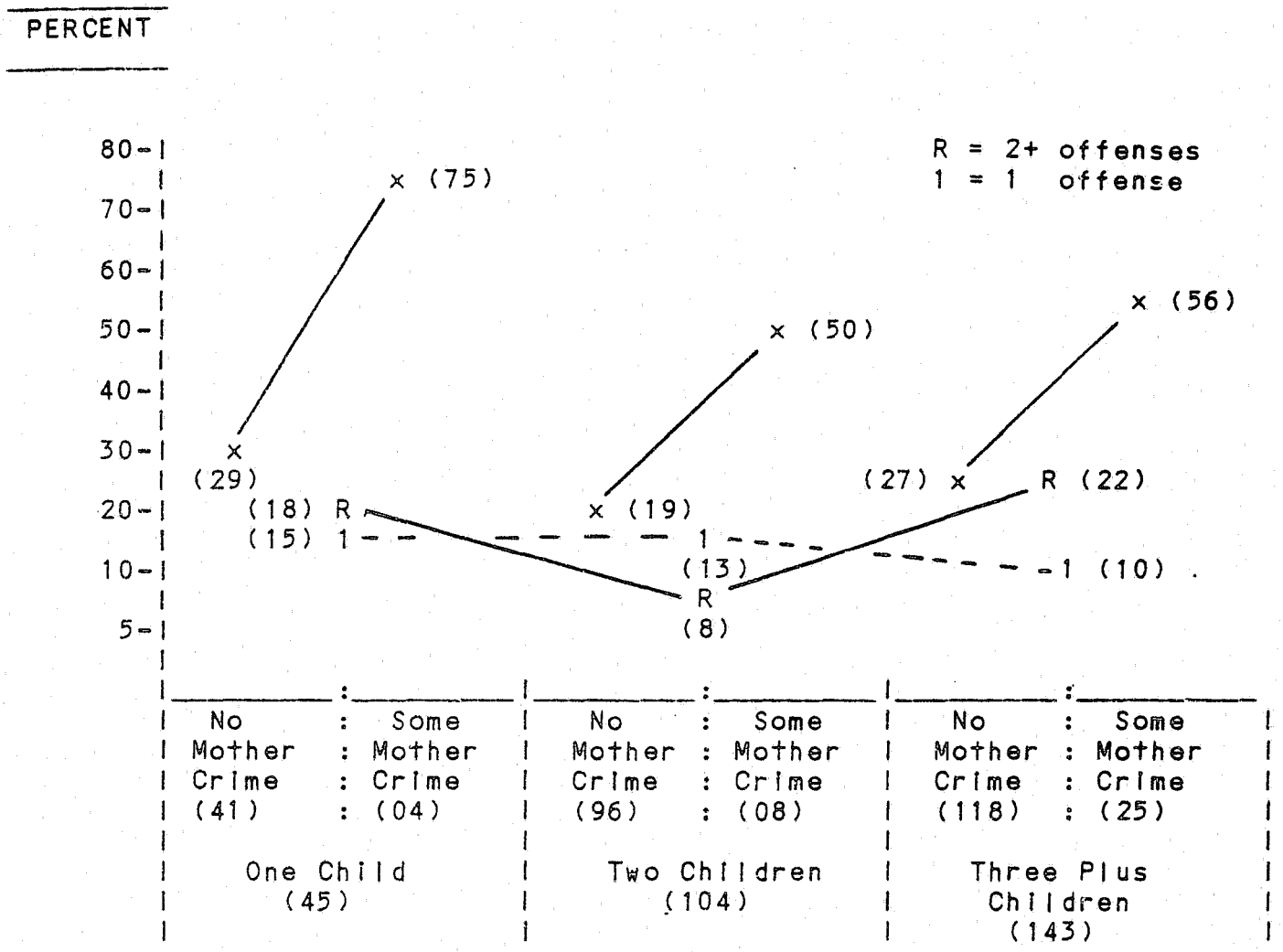
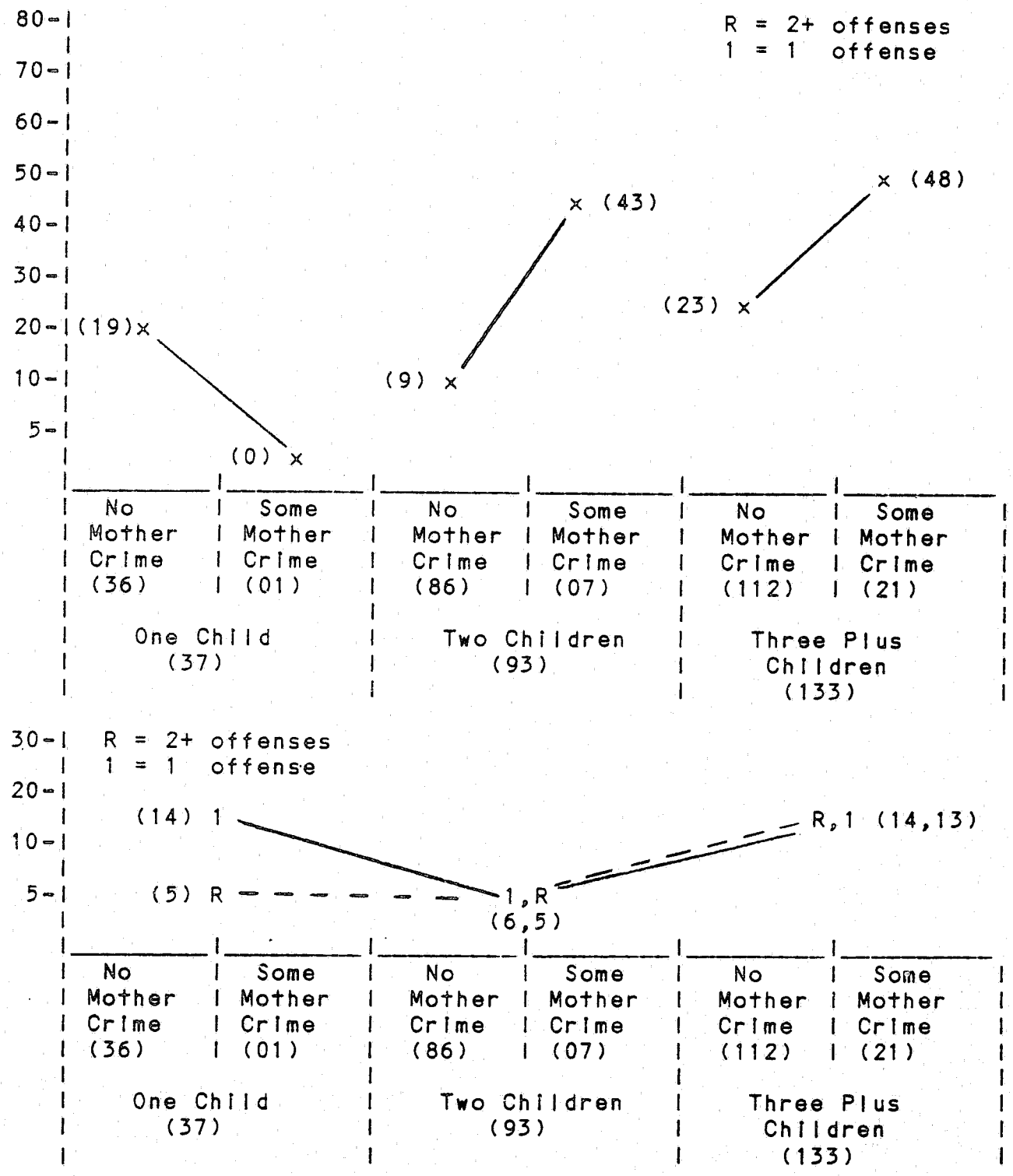

PERCENT
R = 2+ offenses
1 = 1 offense
80
70
60
50
40
30
20
10
5
(75)
(50)
(56)
(29)
(18) R
(15) 1
(19)
(27)
R (22)
(13)
R
(8)
1 (10)
No Mother Crime (41)
Some Mother Crime (04)
No Mother Crime (96)
Some Mother Crime (08)
No Mother Crime (118)
Some Mother Crime (25)
One Child (45)
Two Children (104)
Three Plus Children (143)
Variables: Mother Crime, Family Size, Child Thievery

TABLE 32

LOG-LINEAR ANALYSIS: VIOLENCE(N) x FAMILY SIZE(S) x MOTHER CRIME(M)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NS,NM,SM	2.07	4	.72	22.85	6	< .01
FAMILY SIZE	NS,SM	15.24	6	.02	9.68	4	NS
MOTHER CRIME	NM,SM	9.05	8	.34	15.87	2	< .01
BASELINE	N,SM	24.92	10	.01			

Figure 20



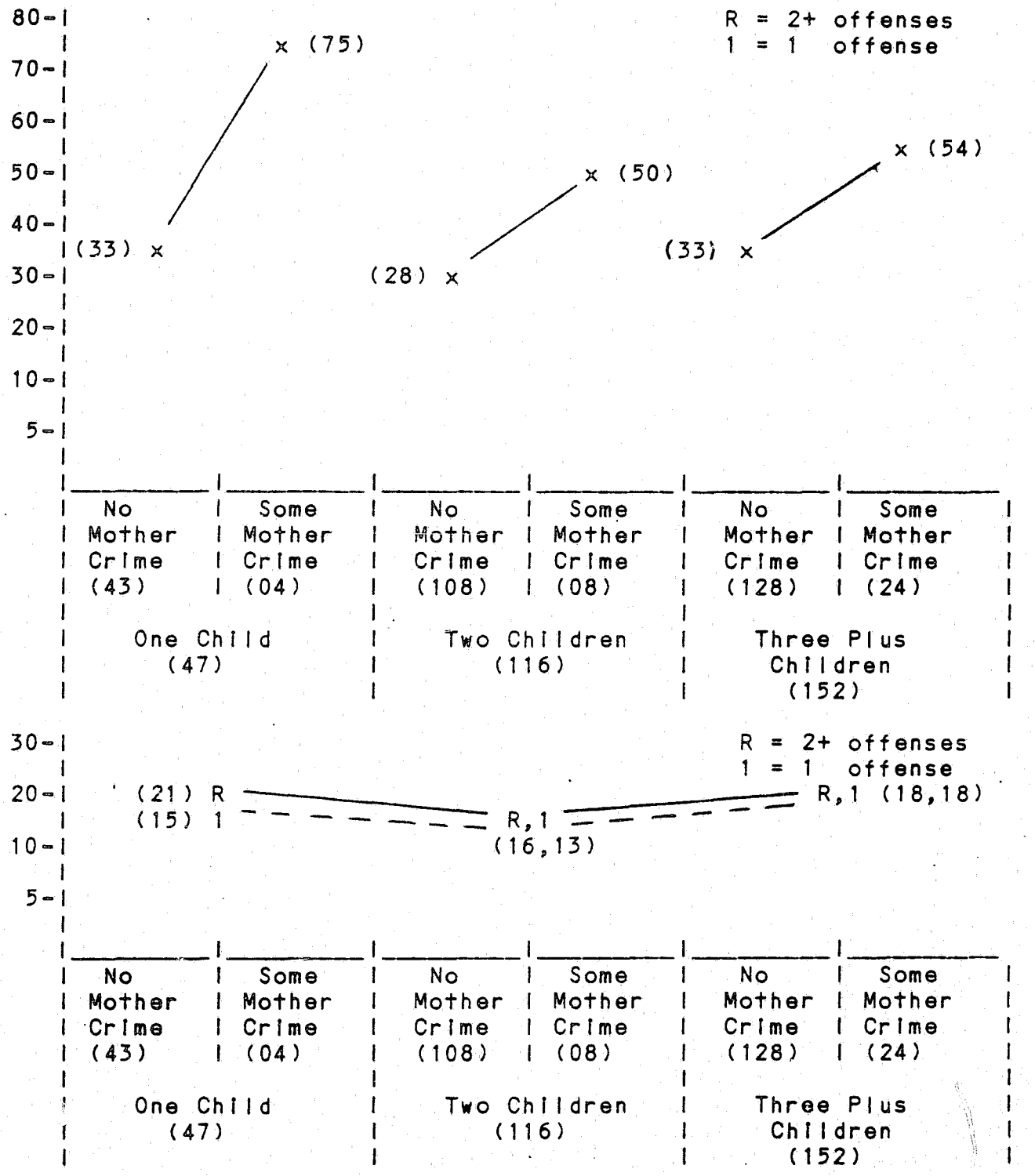
Variables: Mother Crime, Family Size, Child Violence

TABLE 33

LOG-LINEAR ANALYSIS: UNCONTROLLED BEHAVIOR(N) x FAMILY SIZE(S) x MOTHER CRIME(M)

MODEL TESTED	MARGINALS	G2 residual	D.F.	p	G2 component	D.F.	p
COMBINED	NS,NM,SM	5.77	4	.22	11.13	6	NS
FAMILY SIZE	NS,SM	14.92	6	.02	1.98	4	NS
MOTHER CRIME	NM,SM	7.39	8	.50	9.51	2	<.01
BASELINE	N,SM	16.90	10	.08			

Figure 21



Variables: Mother Crime, Family Size, Child Uncontrolled

Socio-economic Status and Young Adult Thievery, Violence and Uncontrolled Behavior

The log-linear analyses and patterns for all three criminal types are sufficiently similar that one statement of results will suffice. Tables 34, 35, and 36 show the log-linear analyses for mother crime, socio-economic status and three crime categories Figures 22, 23, and 24 show the corresponding graphs. The principal difference in the analyses is that the mother criminality factor is a statistically significant contributor for child thievery only when the models are tested with controls. Inspection of the graphs indicates a slightly steeper slope for incidence of thievery recidivism from the no mother crime to the some mother crime cells (10 percent to 46 percent) than for either the child violence or uncontrolled behavior analyses. Aside from that difference, the patterns are actually the same for all criminal types: decreasing incidence of child crime as SES increases, within each mother crime type, and increased incidence of child crime across SES cells (except high SES) in the some mother crime category. The high SES cell of the some mother crime category contains only two children, and thus is not amenable to interpretation.

Father Crime and Young Adult Thievery, Violence, and Uncontrolled Behavior

Again, the log-linear analyses and patterns for all three criminal types are sufficiently similar that one

TABLE 34

LOG-LINEAR ANALYSIS: MOTHER CRIME(M) x SES(T) x THIEVERY(N)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NT,NM,TM	2.76	4	.59	40.98	6	<.01
SES	NT,TM	17.67	6	.01	26.07	4	<.01
MOTHER CRIME	NM,TM	25.31	8	.01	18.43	2	<.01
BASELINE	N,TM	43.74	10	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
SES CONTROLLING FOR MOTHER CRIME	22.55	4	<.01
MOTHER CRIME CONTROLLING FOR SES	14.91	2	<.01

Figure 22

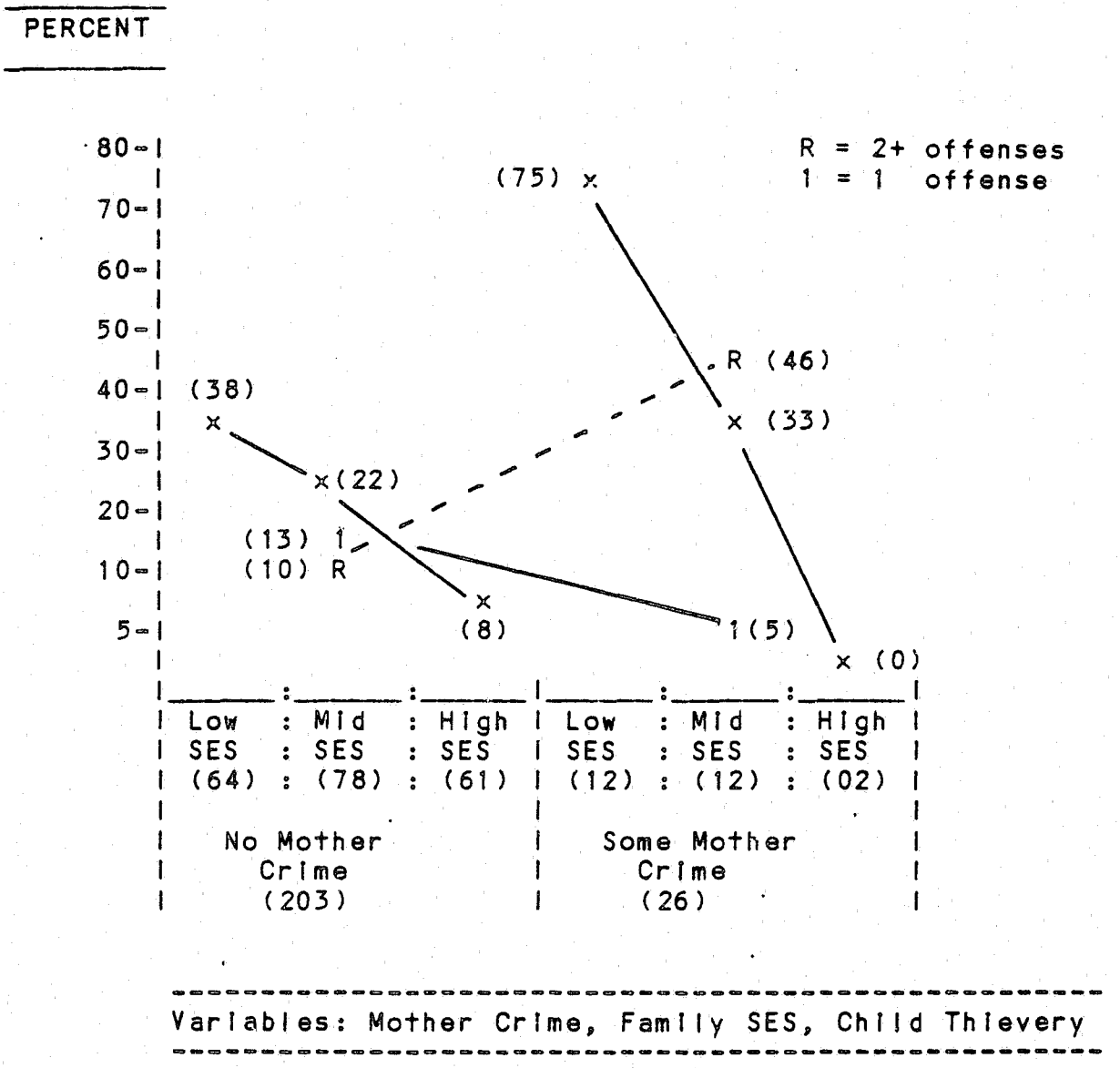

PERCENT
R = 2+ offenses
1 = 1 offense
80
70
60
50
40
30
20
10
5
(75)
R (46)
(38)
(33)
(22)
(13) 1
(10) R
(8)
1 (5)
(0)
Low SES (64)
Mid SES (78)
High SES (61)
Low SES (12)
Mid SES (12)
High SES (02)
No Mother Crime (203)
Some Mother Crime (26)
Variables: Mother Crime, Family SES, Child Thievery

TABLE 35

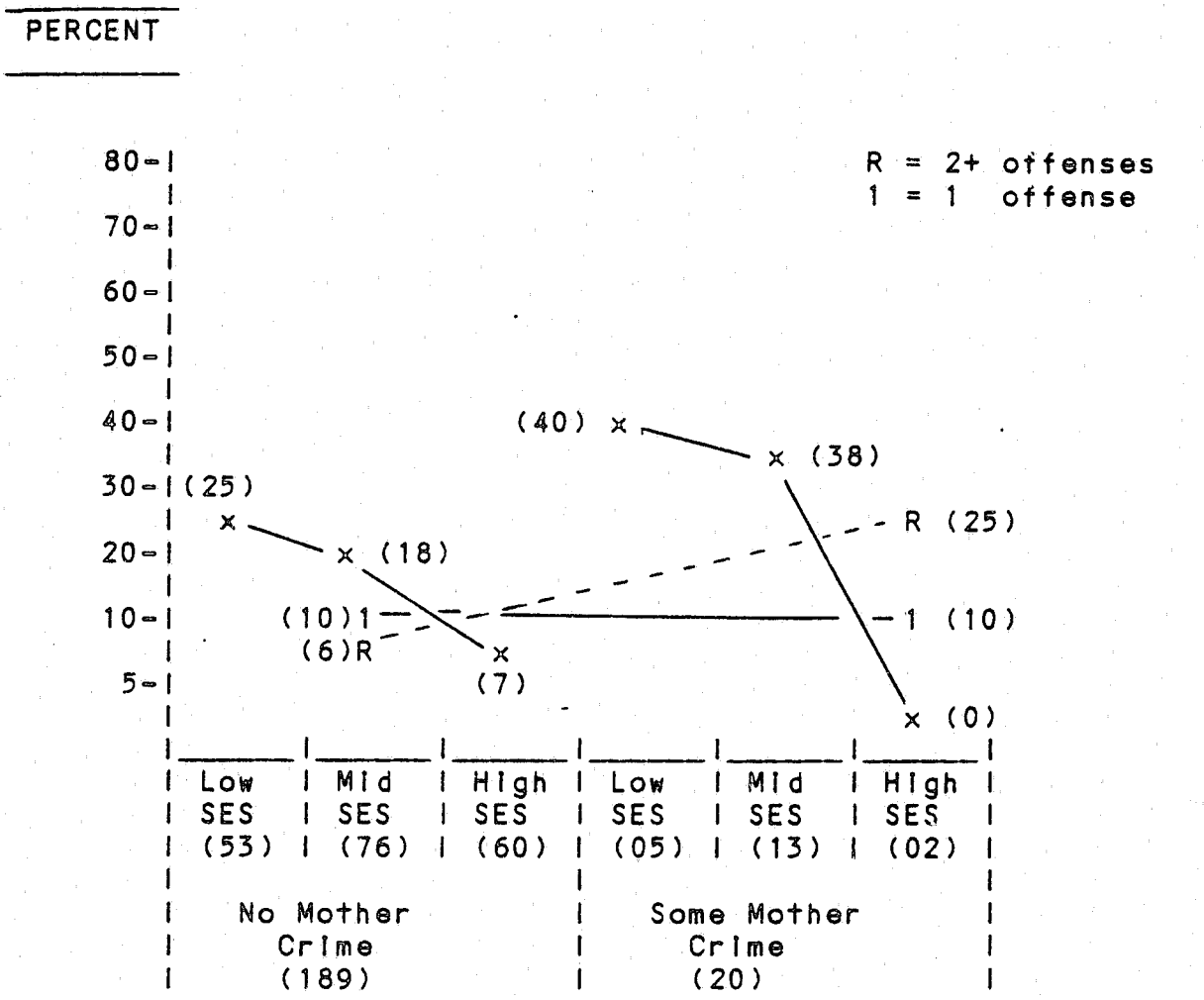
LOG-LINEAR ANALYSIS: VIOLENCE(N) x SES(T) x MOTHER CRIME(M)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NT,NM,TM	6.74	4	.15	17.88	6	< .01
SES	NT,TM	11.25	6	.08	13.37	4	< .01
MOTHER CRIME	NM,TM	18.52	8	.02	6.10	2	< .05
BASELINE	N,TM	24.62	10	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
SES CONTROLLING FOR MOTHER CRIME	11.78	4	<.05
MOTHER CRIME CONTROLLING FOR SES	4.51	2	NS

Figure 23



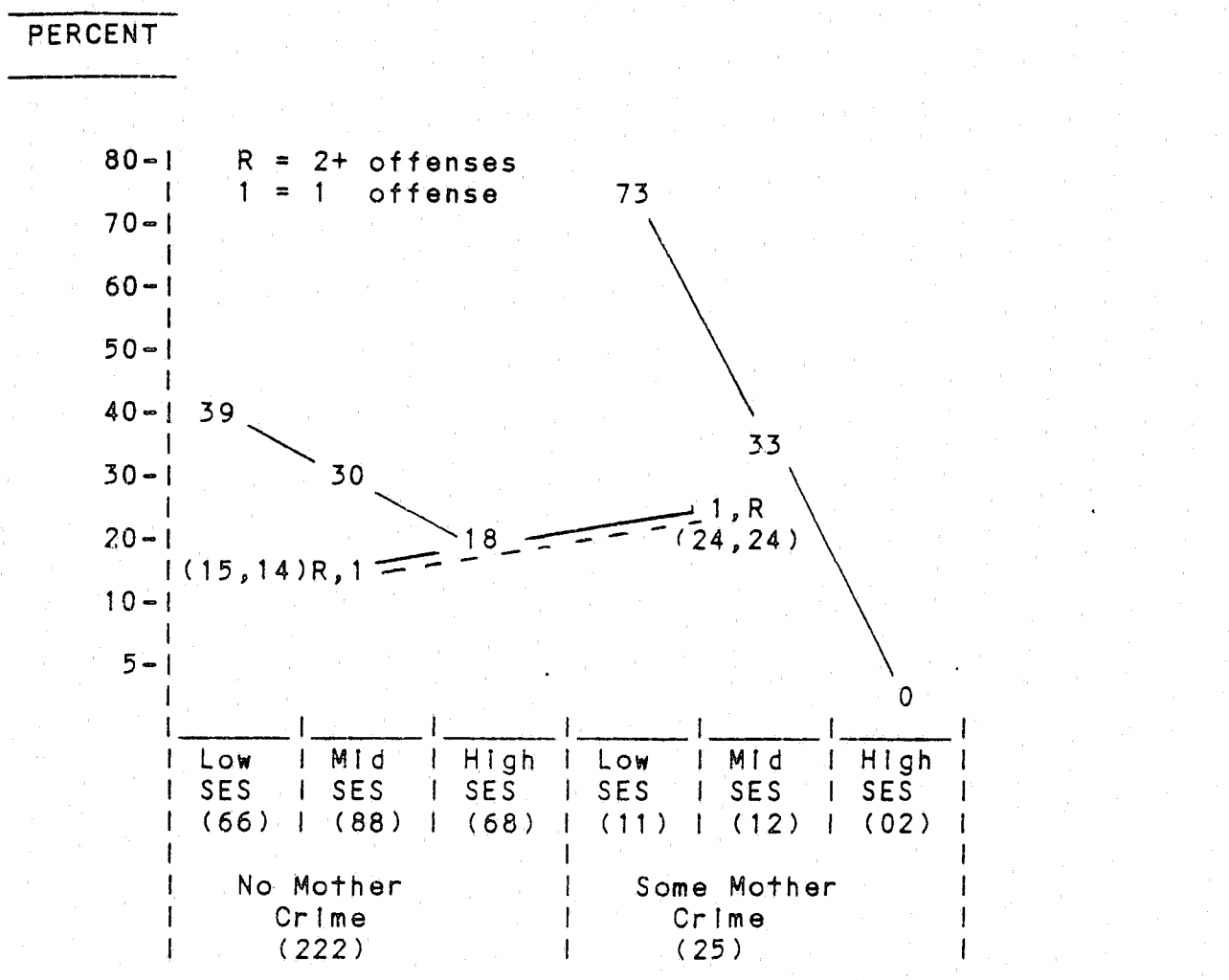
Variables: Mother Crime, Family SES, Child Violence.

TABLE 36

LOG-LINEAR ANALYSIS: MOTHER CRIME(M) x SES(T) x UNCONTROLLED BEHAVIOR(N)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NT,NM,TM	4.37	4	.36	15.82	6	<.05
SES	NT,TM	6.46	6	.37	13.73	4	<.01
MOTHER CRIME	NM,TM	16.55	8	.04	3.64	2	NS
BASELINE	N,TM	20.19	10	.03			

Figure 24


PERCENT
R = 2+ offenses
1 = 1 offense
80
70
60
50
40
30
20
10
5
39
30
18
(15,14)R,1
73
33
1,R
(24,24)
0
Low SES (66)
Mid SES (88)
High SES (68)
Low SES (11)
Mid SES (12)
High SES (02)
No Mother Crime (222)
Some Mother Crime (25)
Variables: Mother Crime, Family SES, Child Uncontrolled

statement of results will suffice. Tables 37, 38 and 39 show the log-linear analyses for mother crime, father crime and each of the three crime types. In all cases, each component makes a statistically significant contribution and remains significant when tested with controls. Figures 25, 26, and 27 graph the three factors for each crime type. As suggested in the results of the initial regression analyses, the mother's criminal status may be as important an element as the father's status:

1. As reflected in all of the graphs, the mother may have an influence on how much impact the father's criminal status has on the incidence of child crime. Although she is unable to neutralize the effects of father recidivism (e.g., 42 percent in the father recidivism-no mother crime cell), the proportionate incidence of child crime increases dramatically when father recidivism is combined with some mother crime (e.g., 62 percent in the child thievery graph).

2. Related to the above, it should be noted that in this three factor context the father is not able to neutralize the effects of a criminal mother. The father appears to have as much counteractive influence (or lack of it) when his spouse has a criminal record as the mother does under father recidivism conditions. For example, note in Figure 25 that the incidence of child thievery for

TABLE 37

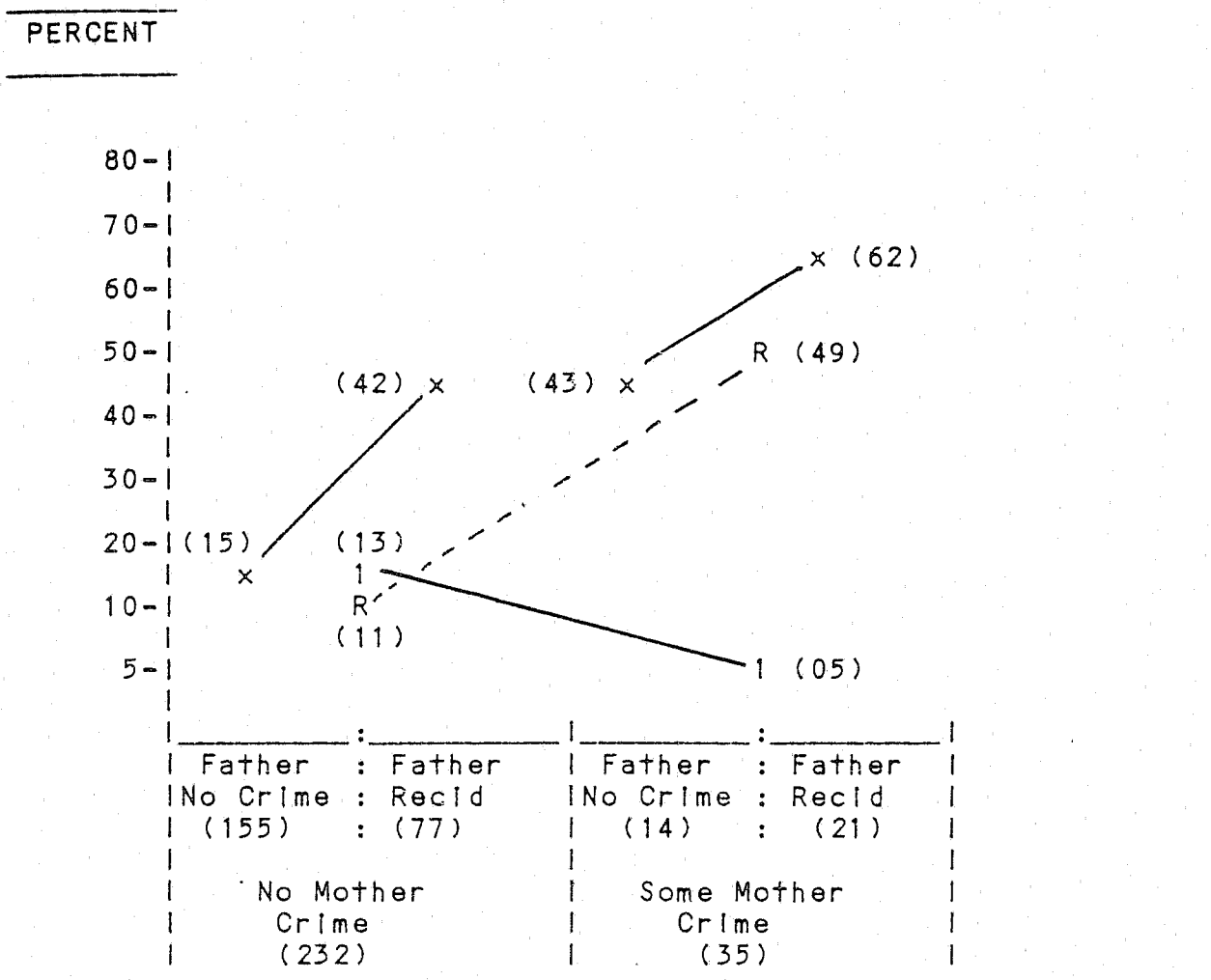
LOG-LINEAR ANALYSIS: THIEVERY(N) x MOTHER CRIME(M) X FATHER CRIME(F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NF,NM,FM	1.99	2	.37	43.76	4	<.01
MOTHER CRIME	NM,FM	21.15	4	.01	24.63	2	<.01
FATHER CRIME	NF,FM	21.91	4	.01	23.84	2	<.01
BASELINE	N,FM	45.75	6	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
MOTHER CRIME CONTROLLING FOR FATHER CRIME	19.92	2	<.01
FATHER CRIME CONTROLLING FOR MOTHER CRIME	19.16	2	<.01

Figure 25



NOTE:
R = 2+ offenses
1 = 1 offense

Variables: Mother Crime, Father Crime, Child Thievery

TABLE 38

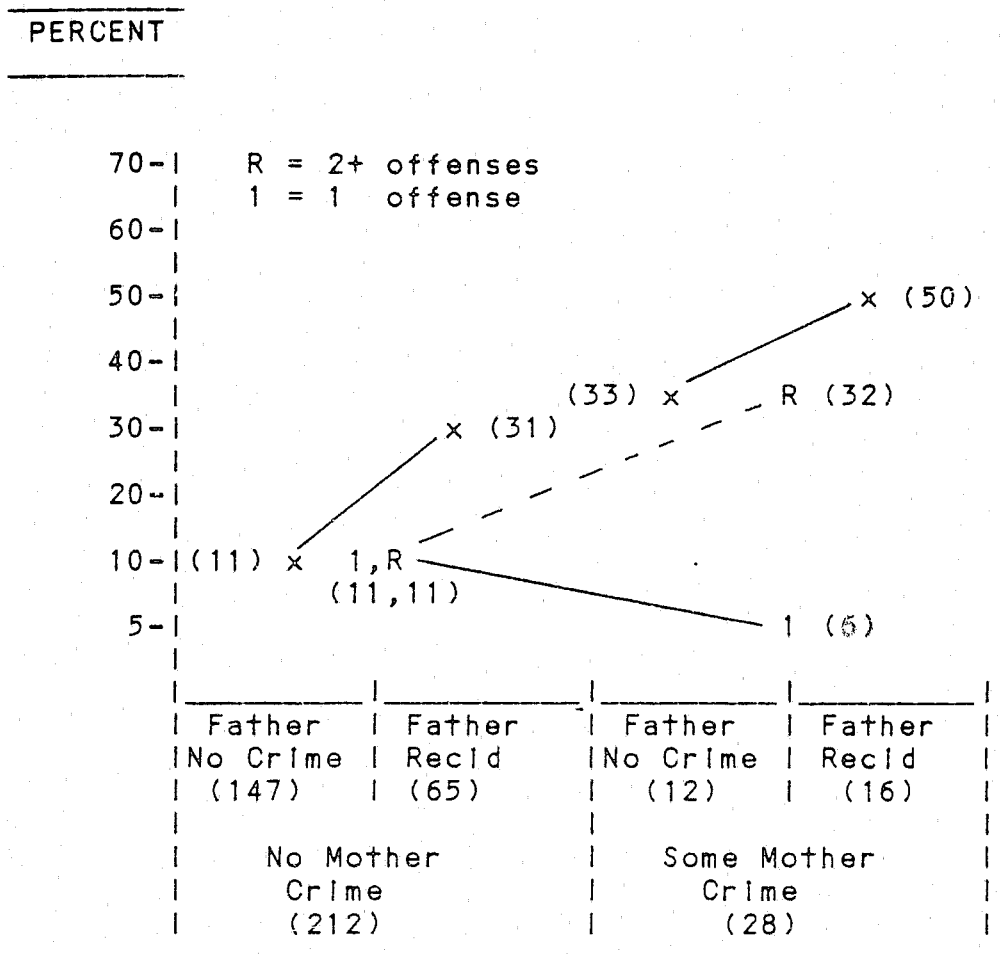
LOG-LINEAR ANALYSIS: VIOLENCE(N) x MOTHER CRIME(M) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G2 residual	D.F.	p	G2 component	D.F.	p
COMBINED	NM,NF,MF	.38	2	.83	26.60	4	<.01
MOTHER CRIME	NM,MF	12.57	4	.01	14.41	2	<.01
FATHER CRIME	NF,MF	11.52	4	.02	15.46	2	<.01
BASELINE	N,MF	26.98	6	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G2 component	D.F.	p
MOTHER CRIME CONTROLLING FOR FATHER CRIME	11.14	2	<.01
FATHER CRIME CONTROLLING FOR MOTHER CRIME	12.19	2	<.01

Figure 26



NOTE:
R = 2+ offenses
1 = 1 offense

Variables: Mother Crime, Father Crime, Child Violence

TABLE 39

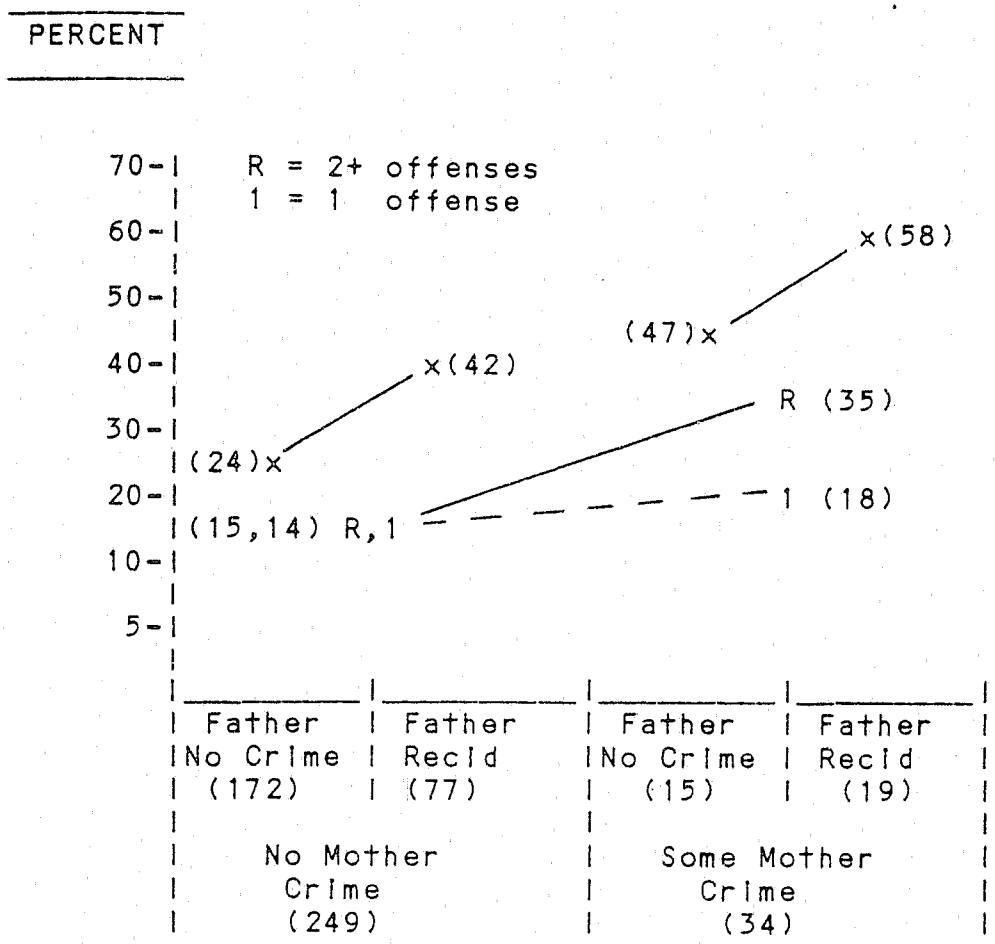
LOG-LINEAR ANALYSIS: UNCONTROLLED BEHAVIOR(N) x MOTHER CRIME(M) x FATHER CRIME(F)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NM,NF,MF	.50	2	.78	17.03	4	<.01
MOTHER CRIME	NM,MF	8.83	4	.07	8.70	2	<.05
FATHER CRIME	NF,MF	6.51	4	.16	11.02	2	<.01
BASELINE	N,MF	17.53	6	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
MOTHER CRIME CONTROLLING FOR FATHER CRIME	6.01	2	<.05
FATHER CRIME CONTROLLING FOR MOTHER CRIME	8.33	2	<.05

Figure 27



NOTE:
R = 2+ offenses
1 = 1 offense

Variables: Mother Crime, Father Crime, Child Uncontrolled

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the father recidivism-no mother crime category is 42 percent. This is almost identical to the incidence for the no father crime-some mother crime category of 43 percent.

Analysis of SES and Family Stability

As the two parental criminality variables, SES and family stability were analyzed in combination with each of the remaining independent variables; e.g., family stability in combination with SES, family size, father presence, etc. In each case child crime was the third factor. As expected on the basis of the previously reported analyses, most of these analyses yielded little significant new information. That is, most of the variables, such as family size, family structure, and father presence, had already been shown to have no independent influence on child crime when analyzed in combination with the two parental crime variables. Only in the analyses including SES and family stability were there significant results; and both of them had already shown independent effects in previous analyses.

Young Adult Thievery

Table 40 shows the analysis relating SES and family stability to young adult thievery. The baseline model is significant beyond the .01 level (G^2 =73.58). Both SES and family stability showed significant independent associations with child thievery. In the model testing with controls, both SES and family stability remained significant

TABLE 40

LOG-LINEAR ANALYSIS: THIEVERY(N) x FAMILY STABILITY(S) x SES(T)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NT,NS,TS	15.78	12	.20	57.80	10	<.01
SES	NT,TS	46.77	18	.01	26.81	4	<.01
FAMILY STABILITY	NS,TS	33.07	16	.01	40.51	6	<.01
BASELINE	N,TS	73.58	22	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
FAMILY STABILITY CONTROLLING FOR SES	30.99	4	<.01
SES CONTROLLING FOR FAMILY STABILITY	17.29	6	<.01

beyond the .01 level. Figure 28 presents the results in graphic form. The influence of family stability has already been well described. The only new information obtained from these data is that within each stability category decreasing SES is associated with increasing thievery in the males.

Violence

Table 41 presents the results of the analysis combining SES and stability with violent crimes in a three factor contingency analysis. The baseline model was significant at the .01 level ($G^{2=}$ 42.64). Both SES and family stability presented significant independent association with child violence. In the model testing with controls only family stability turned out to be significant ($P<.05$). See Figure 29.

Uncontrolled Behavior

The findings for uncontrolled behavior (Table 42) were similar to those for violence. The baseline model, as well as the independent relationships of SES and family stability reached significance. In the model testing with controls only stability remained significant, and SES ceased to be significant once controls for stability were imposed. See Figure 30.

Figure 28

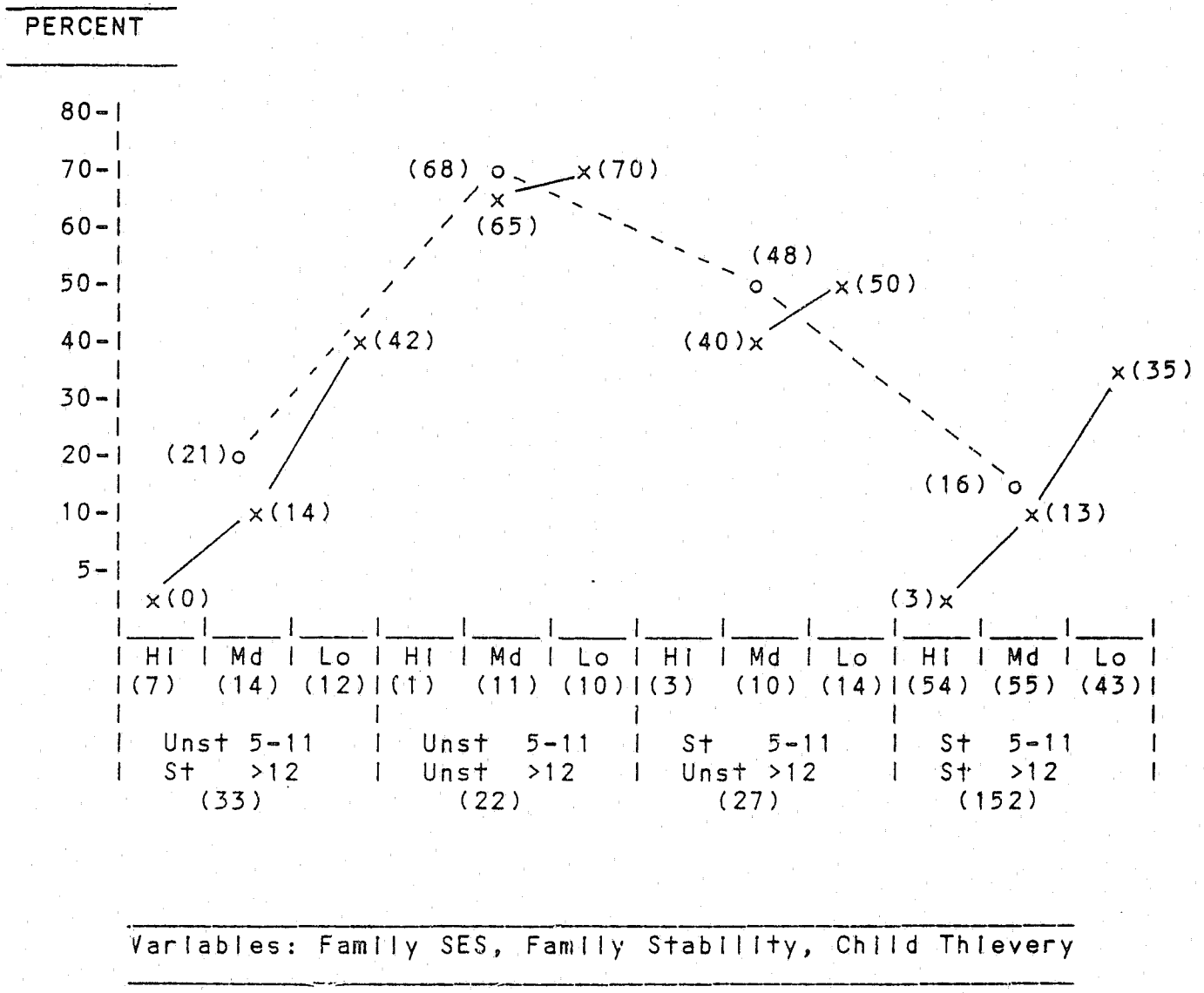

PERCENT
80
70
60
50
40
30
20
10
5
(68)
(70)
(65)
(48)
(50)
(42)
(40)
(35)
(21)
(16)
(14)
(13)
(0)
(3)
HI Md Lo HI Md Lo HI Md Lo HI Md Lo
(7) (14) (12) (1) (11) (10) (3) (10) (14) (54) (55) (43)
Unst 5-11 St >12
(33)
Unst 5-11 Unst >12
(22)
St 5-11 Unst >12
(27)
St 5-11 St >12
(152)
Variables: Family SES, Family Stability, Child Thievery

TABLE 41

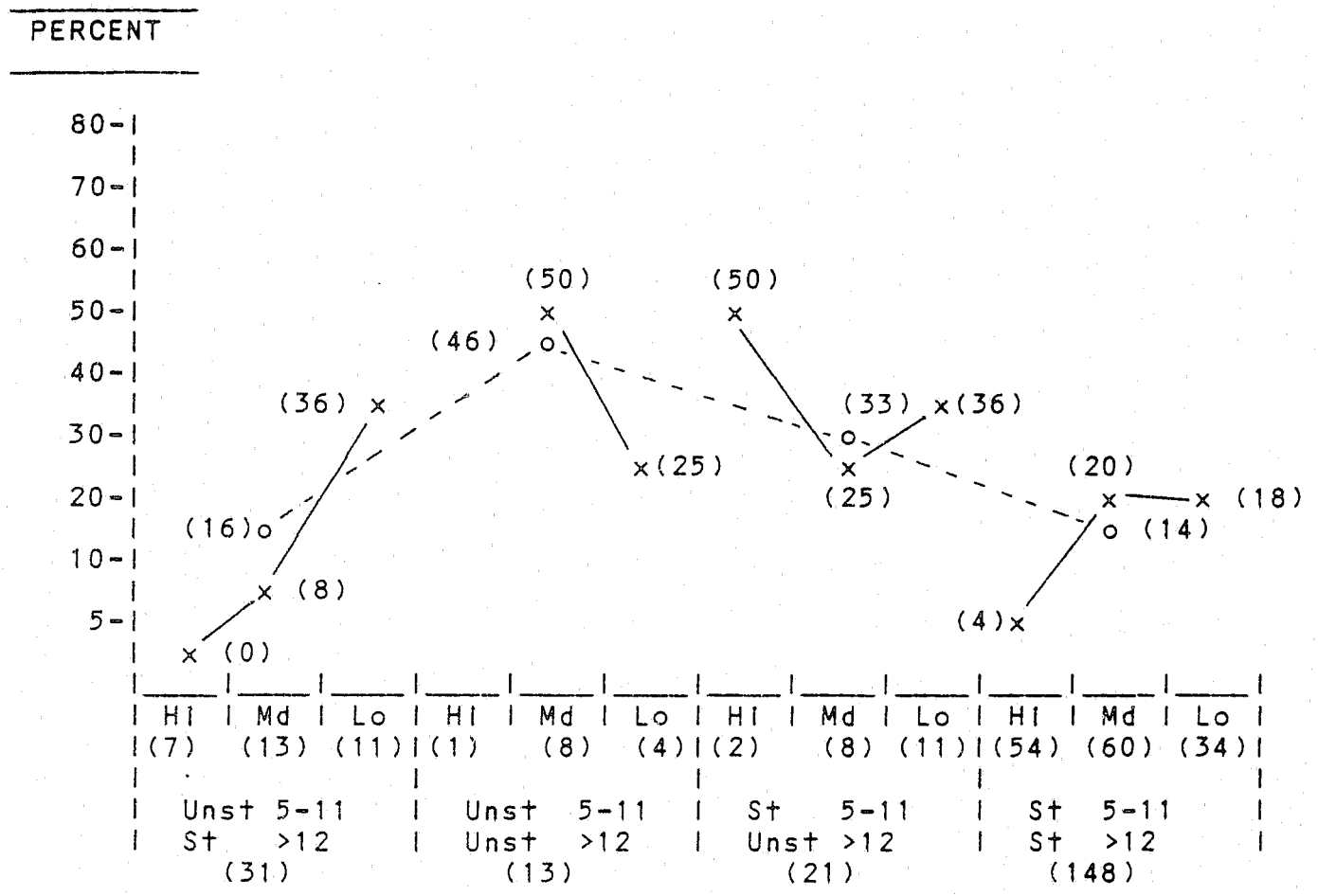
LOG-LINEAR ANALYSIS: VIOLENCE(N) x FAMILY STABILITY(S) x SES(T)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NT,NS,TS	17.27	12	.14	25.37	10	<.01
SES	NT,TS	29.12	18	.05	13.52	4	<.01
FAMILY STABILITY	NS,TS	27.50	16	.04	15.14	6	<.05
BASELINE	N,TS	42.64	22	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
FAMILY STABILITY CONTROLLING FOR SES	11.85	4	<.05
SES CONTROLLING FOR FAMILY STABILITY	10.23	6	NS

Figure 29


PERCENT
80
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60
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40
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(0)
(8)
(16)
(36)
(46)
(50)
(25)
(50)
(25)
(33)
(36)
(4)
(20)
(14)
(18)
Hi (7)
Md (13)
Lo (11)
Hi (1)
Md (8)
Lo (4)
Hi (2)
Md (8)
Lo (11)
Hi (54)
Md (60)
Lo (34)
Unst 5-11
St >12
(31)
Unst 5-11
Unst >12
(13)
St 5-11
Unst >12
(21)
St 5-11
St >12
(148)
Variables: Family SES, Family Stability, Child Violence

TABLE 42

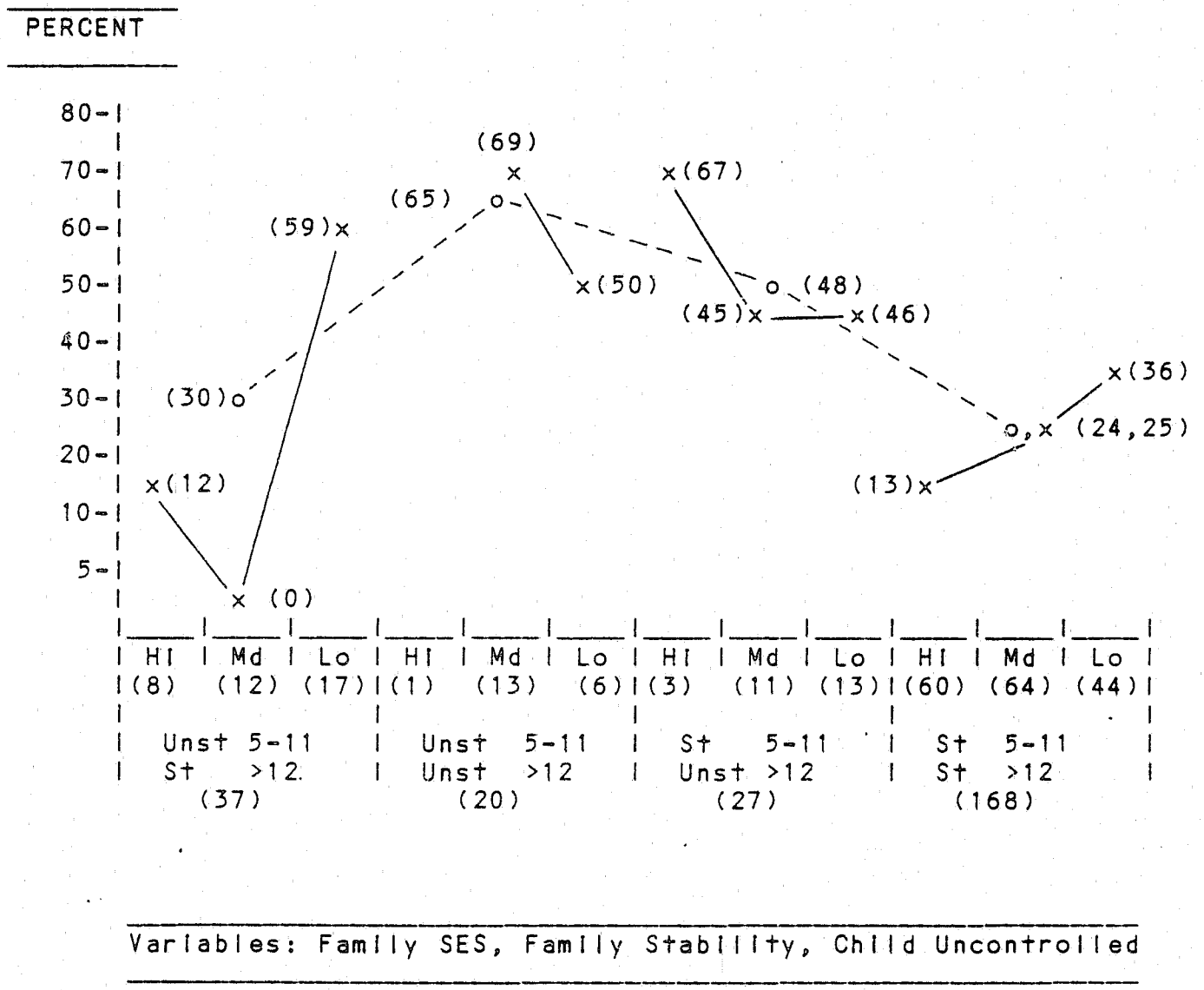
LOG-LINEAR ANALYSIS: UNCONTROLLED BEHAVIOR(N) x FAMILY STABILITY(S) x SES(T)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NT,NS,TS	25.43	12	.01	30.23	10	< .01
SES	NT,TS	41.26	18	.01	14.40	4	< .01
FAMILY STABILITY	NS,TS	35.66	16	.01	20.00	6	< .01
BASELINE	N,TS	55.66	22	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
FAMILY STABILITY CONTROLLING FOR SES	15.83	4	<.01
SES CONTROLLING FOR FAMILY STABILITY	10.23	6	NS

Figure 30


PERCENT
80
70
60
50
40
30
20
10
5
(69)
(65)
(59)
(67)
(50)
(48)
(45)
(46)
(30)
(36)
(24,25)
(12)
(13)
(0)
HI Md Lo HI Md Lo HI Md Lo HI Md Lo
(8) (12) (17) (1) (13) (6) (3) (11) (13) (60) (64) (44)
Unst 5-11 St >12 (37)
Unst 5-11 Unst >12 (20)
St 5-11 Unst >12 (27)
St 5-11 St >12 (168)
Variables: Family SES, Family Stability, Child Uncontrolled

Commentary on Results of Log-Linear Analyses

As described previously, the log-linear analytic approach permitted us to homogenize subgroups of the sample in terms of definable descriptive categories related to specified variables or factors. The size of our sample precluded analysis of more than three factors or variables at once. However, the prespecified series of three-factor log-linear analyses served to approximate any additive and interactive associations the predictor variables might have with the criminal-type outcomes. While this was not the primary focus of this inquiry, the outcome variable was defined in terms of three criminal types in order that the differential patterns of predictors for each criminal "specialization" might be identified.

With few exceptions (which will be discussed later), the patterns of predictors and factor associations across the criminal types as we defined them were quite similar. Our findings are consistent with those of Wadsworth (1979), who found both property and violent offenses to be related to similar environmental factors. They are also consistent with the findings of Norland et al. (1979), although Norland et al. did identify some differences in the patterns of environmental predictors for the two types of crime.

Models for Predicting Child Criminal Activity

The discussion here is intended to extend and possibly add further clarification to the results of the discriminant

analyses reported in the previous section. As noted above, the log-linear analytic approach permitted us to assign the index children to specific descriptive categories related to variables or factors of interest and to analyze the associations of selected categories of one component or factor in combination with those of two additional factors.

Paternal Criminality

Paternal criminality was among the strongest predictors of child crime, particularly thievery, in the discriminant analyses. These results have also been demonstrated in previous studies (West and Farrington, 1973, 1977; and others). While the log-linear analyses certainly confirm the general importance of parental crime as a predictor of child crime, they also suggest a number of other correlates that help to clarify more specifically the patterns of social and family conditions that may define child at risk for criminality.

In the multivariate analyses as well as the log-linear model testing with controls, the robustness of father crime masked what appears to be an interaction of father crime and father presence. If the father is never present, his criminal status appears to make no difference in the incidence of child crime (see Figure 7). However, the lack of difference in crime rate between the group with never-present fathers who were criminals and that with never present non-criminal fathers is not only due to an absence

of the usual influence of paternal criminality, but also to a clearly heightened incidence of criminality in the group with non-criminal fathers. This may, for example, be due to the higher instability of the family which is likely to result from a never-present father. Finally, one could speculate that while the added pressure on the mother (characteristic of the one-parent family) will show its usual disadvantages, it could be beneficial to remove the recidivist father from the home immediately; the mother can handle it, but with some risk.

When family instability is introduced into the log-linear analyses, it is clear that early adolescence is the most vulnerable period for the possibility of increased child crime. Instability during the other two periods covering the first 11 years was not directly associated with increased child crime. This finding is consistent with Offord's (1979) finding that divorces prior to age ten are associated with later child crime. Interestingly, the father's non-criminal status is associated with decreased risk of later child crime <u>only</u> if there is stability during the adolescent period (see Figure 4). This is probably related to the fact that the father was not present during part or all of this period, resulting in considerable uncertainty and stress for both mother and child during a time when the child needs systematic attention, supervision, and support. Our findings support and emphasize the importance of a more qualitative understanding of the family

TABLE 42

LOG-LINEAR ANALYSIS: UNCONTROLLED BEHAVIOR(N) x FAMILY STABILITY(S) x SES(T)

MODEL TESTED	MARGINALS	G^2 residual	D.F.	p	G^2 component	D.F.	p
COMBINED	NT,NS,TS	25.43	12	.01	30.23	10	<.01
SES	NT,TS	41.26	18	.01	14.40	4	<.01
FAMILY STABILITY	NS,TS	35.66	16	.01	20.00	6	<.01
BASELINE	N,TS	55.66	22	.01			

MODELS TESTED WITH CONTROLS

MODEL TESTED	G^2 component	D.F.	p
FAMILY STABILITY CONTROLLING FOR SES	15.83	4	<.01
SES CONTROLLING FOR FAMILY STABILITY	10.23	6	NS

dynamics associated with pre- and post-divorce stability (Hetherington, 1979).

Socioeconomic status in the Danish sample was derived from a scale defined in terms of occupations rather than income. Scaling of the occupations was made on the basis of prestige; that is, the Danish populace in effect ranked the occupations according to their perceptions of importance and prestige.

The log-linear analysis reported here reflects an association between SES and later child crime. However, where a non-criminal father in the high SES category apparently can provide the wherewithal (money, modeling, supervision) needed to reduce the risk of child crime, such is not the case with the non-criminal father in the low SES category (see Figure 13).

The previously reported discriminant analyses clearly indicated that paternal crime and SES share a sizeable amount of variance in the prediction of child criminality. The tables presenting the log-linear analysis of father recidivism and SES constitute reasonable documentation of this relationship; that is, whereas 12 percent of the fathers in the high SES group had a criminal record, close to four times as many in the low SES group had records.

The apparent immunity of only children to the effects of paternal criminality is not readily explainable on the basis of the literature. One possible explanation for this point is that the only child category includes a

disproportionate number of never-present fathers (38 and 36 percent for the father crime and no crime cells respectively, as opposed to 14 percent for the total sample). This would account for both the elevated crime rate in this group and for the lack of influence of paternal recidivism. As mentioned in the previous section, the analyses combining family size with paternal crime did not yield any additional information to that already obtained from the family structure analysis.

Maternal Crime

The pattern of associations noted between maternal crime and child criminality were quite similar to those reported for paternal crime. In some analyses, maternal crime failed to reach significance, but this is likely due at least in part to the small number of mothers with criminal records (N=34). There is some indication that maternal criminality is not significantly related to uncontrolled behavior, although there was a tendency toward a positive relationship. The log-linear analyses, as well as the discriminant analyses, support this statement. Results related to the question of a differential etiology for the three crime types suggests that the three crime types possess considerable similarity, at least using the data items described here.

The analyses combining maternal and paternal crime deserve special comment. In all three analyses the two

parental crime variables showed a clear additive contribution. As mentioned above, absence of criminality in either parent does not neutralize the influence crime in the other parent has on the criminal tendencies of the child. If both parents have a background involving criminal activities the incidence of criminality in sons is dramatically increased. Sixty-two percent of the subjects with criminal records for both parents had themselves committed thievery; 58 percent had engaged in uncontrolled behavior and 50 percent in violent criminality.

Family Stability

As described previously, family stability showed a significant independent association with child crime when analyzed in combination with parental criminality. The association of family stability with child crime held in the discriminant analyses in which parental crime and SES were controlled. Thus, the log linear analyses underscore the point made in the discussion of these analyses, that is, that family instability is among the most powerful predictors of criminal behavior in male children. Analyses of data from the Danish sample reported here also seem to indicate a considerably heightened vulnerability to family instability if the changes occur during the pre- and adolescent period (12-18). This is not consistent with the findings of other studies (Wadsworth 1979). The strong relationship between family instability and child

criminality lends support to the notion that the increased instability which characterizes many post divorce homes may in part be mediating the frequently reported association between non-intact homes and child criminality. The findings from our analyses indicate there is considerable variability with respect to post-divorce conditions among the non-intact families studied. Such heterogeneity of specific conditions is likely also to characterize samples shared by other researchers and may well contribute to the discrepancies in reported results as well as to the overall lack of significance from a practical view of this research area (Johnstone, 1980).

SES

Based on the results of the discriminant analyses, SES has to be acknowledged as a significant correlate of child criminality. This was further supported by the log-linear analyses. Although the contribution of SES was reduced by controlling for specified environmental variables, the residual or unique SES contribution remained significant in the majority of analyses.

Family Structure and Family Size

Analyses of family structure and family size factors with father crime and young adult crime revealed a pattern not particularly consistent with other reported findings. While family structure did not approach statistical

significance as an independent factor, it did reflect a statistically significant additive effect in the log-linear analysis (see, for example, Table 13 and Figure 1). The additive effect undoubtedly may be attributed to a number of factors which were impossible to analyze as fourth factors in the log-linear analyses. As an example, the elevated criminality recorded for the only child category irrespective of father crime status may have been mediated via the father-presence factor, in that a disproportionate percentage of fathers were never present in either cell (37 and 36 percent respectively). This may have contributed to the father crime cell having a lower incidence of crime in the only child category than in the other birth positions and the no father crime cell having a higher incidence. It is likely that similar explanations lie behind what appear to be discrepancies between our findings and those reported in the literature related particularly to the first-born and middle-born positions. Unlike variables such as parental criminality, family structure itself does not impact directly on the child. The more important considerations when analyzing structural variables involves making some reasonable inferences about what the etiological elements might be that are masked or bounded by partcular structural conditions, but may not have been directly observed or analyzed. Characteristics of the samples used and methodological differences represented in the birth-order studies have not tended to get to the level of analysis

necessary to empirically ferret out the determining elements or agents. Thus, the literature represents a sort of mixed bag in terms of how birth position is associated with young adult criminality.

Family size was among the significant predictors, albeit weak, predictors in the discriminant analyses. However, it did not reliably show up as having an independent effect in the log-linear analyses. When family size did approach significance it was usually reduced to non-significance when the models were tested with controls for other predictors.

Essentially, then, one could speculate that with increased family density the presence of negative conditions would serve to exacerbate the danger of risk beyond the effect of the negative condition itself. The importance here, as with family structure, is to more thoroughly describe how the effects of other negative conditions might interact with and be magnified by increased family size. The findings, as well as the interpretation, seem consistent with those represented in the literature. The interpretations of family size effects all involve the presence of negative environmental conditions: effects of overcrowding (Ferguson, 1952); social deprivation and poverty resulting in poor supervision (West and Farrington, 1973); lack of internal and indirect contol (Nye, 1958); and so on.

In summary, our findings generally fit those reported

in the review of literature. However, the findings of this study extend the literature by demonstrating the additive and interactive character of the predictor variables. The common demoninator across the significant predictors seems to be that the development of pro-social behavior in teenagers and young adults is dependent upon how the predictor variables influence the general quality of the family milieu, and the character of the adult-offspring interaction and identification. In this regard it should be further emphasized that paternal criminality has its greatest negative impact on criminality of the offspring when the criminal father is present and in continuous contact with the offspring. This again underscores the importance of adult-child interaction in the etiology of criminal behavior.

Severity of Criminal Behavior as a Predictable Outcome Category

As evidenced by the findings reported, data from the Danish sample of recidivist criminals does not reflect specialization in criminal profiles. With few exceptions, the recidivists in the sample tended to have committed crimes of more than one type. This helps to explain our difficulty in demonstrating differential etiological patterns for the crime categories as they were defined.

In addition to those studies already cited, Loeber's (1982) review points to considerable empirical support for

the "variety hypotheses" that "chronic adult offenders usually show a variety of delinquent acts and do not specialize in particular types of crimes." If this is the case, it might be productive to describe the outcome in terms of another dimension. One such organizing dimension is the judged severity of the crime. For the purpose of exploring this dimension, we collapsed the categories of criminal types and quantified the severity of all of the criminal acts by applying a modified version of the ranking system suggested by Rossi et al (1974). The Rossi ratings were divided into five equal intervals, resulting in a rating of from 1-5 for each criminal act. The severity score assigned to each recidivist was simply the highest individual crime severity score recorded. The disadvantages of this scheme are: 1) the range of possible scores is restricted, and 2) we are ignoring frequency or volume of criminal acts. For preliminary comparison purposes another severity score was defined. A dichotomous severity rating was made for each of the criminal acts. The starred items in Table 1 show the criminal acts judged to be "severe" by the coinvestigators in this study in consultation with Buickhuisen (1982, Note 1). The score recorded for each offender was the number of starred items. The two severity scores, plus the total number of arrest dates, were as follows:

	Zero-Order Correlations	
Measure	2	3
1. Number of arrest dates	.33	.92
2. Highest (most severe) Rossi Rating	-	.40
3. Number of starred offenses		-

Clearly, the correlation between the number of starred (severe) offenses and the total number of arrest dates suggests that these two measures are interchangeable. Where the previous reference to Loeber's (1982) review deals with the volume of crime, he also references Shannon as evidence that chronic offenders commit more serious crimes. The rather modest correlations between the highest Rossi ratings and the other two measures are understandable in view of the restricted range and absence of the influence of frequency in the modified Rossi measure.

Number of Arrest Dates as a Predictable Outcome

There are obvious frailties inherent in using simply the highest severity score recorded for each offender. This, coupled with the very high correlation between the number of severe offenses and the numbers of arrest dates, supports focusing further analytic attention only on the number of arrest dates as a meaningful outcome variable.

It should be emphasized that the scores on the variable number of arrests were arrived at by summing the total

number of arrest dates for each subject. Thus, this variable is not a measure of the total number of charges listed against each subject. However, the correlations between number of arrests and the total number of charges in each crime category summed across all arrests justifies the use of arrest dates as the variable measure. The correlations between charges and dates follow:

Total Number Charges	Correlation With Total Arrests
Violence	.55
Thievery	.62
Uncontrolled Behavior	.42
Traffic	.32

Due to the fact that the obtained sample distribution of number of arrests exceeded acceptable limits for skewness and kurtosis, a log transformation of the scores was used as the dependent measure. A step-wise regression analysis, was completed, including a simultaneous solution, using the same set of predictors as were used in the previously reported discriminant analyses. In contrast with the discriminant analyses, this analysis was concerned only with prediction within the criminal group; thus, only subjects with at least one offense were included (N=157).

Table 43 presents the results of the analysis. The strongest predictor is maternal non -recidivistic crime which accounted for approximately eight percent of the variance. The second variable to enter was mother's

contentment, followed by mother's orderliness. The last statistically significant variable to enter the equation was family size. The multiple R for the four significant variables was .41. Thus, for criminal males the predictors of the amount of recidivism are somewhat different from those that discriminate between criminals and non-criminals. While number of family constellations or family stability and parental crime are the strongest contributors to the discrimination between criminals and noncriminals, once a criminal career is established maternal characteristics and family size become more important indicators of whether or not it will continue. Of course, the speculation is that in order to recover from a period of delinquency or criminality it is necessary to introduce a relatively well-adapted mother who herself adheres to traditional social norms and has the capacity to create an orderly home environment. Extending the speculation, the significance of family size could be an indication that even with order and contentment, the necessary maternal attention to the child could be diluted as a consequence of larger family size. Conversely, given lack of order and contentment, small family size might even contribute a bit to recovery from a criminal interlude.

Separation of Thievery and Violence

The findings reported in this study, substantiated by the literature, seem to show considerable support for a

"non-specialization" position. Further attempts to clarify the criminal categories would seem to be a questionable investment. Nonetheless, before dismissing the issue in this data set, one last analysis was completed based on a "purer," less overlapping set of criminal descriptors. Essentially, the alternative definition of the criminal outcome variable provides a different kind of separation between and among the crime categories. The primary focus was on separating thievery and violence, permitting other criminal activity to vary. Initially, the 123 recidivists were used to form the following three groups:

1. two or more violent offenses with no thievery offenses.
2. two or more thievery offenses with no violent offenses.
3. one or more thievery offenses with one or more violent offenses.

Of the total 123 cases, 49 could be assigned to one of the "purified" thievery or violence crime pattern groups; 35 could be assigned to the thievery and violence group.

Using the crime pattern factor just described, it was our original intent to complete a series of log-linear analyses of three-factor contingencies involving selected combinations of antecedent factors. However, zero and small cell Ns, coupled with the number of required categories within factors, would not support the analyses. Thus, single factor descriptors had to suffice at this point. The

factors used and their codings were:

1. Mother Orderliness - derived from the scale previously defined, three-categories were defined: 1, disorderly; 2, uneven; and 3, orderly
2. Family Stability - categories defined as: 1, unstable during adolescent period 12 on; and 2, stable during the period.
3. Family size - categories defined as 1, only child; 2, two children; and 3, three or more children.
4. Socio-economic status - categories were based on the Danish seven-point scale, collapsing then into two categories: 1, low, 0-1 on the Svalastoga scale; and 2, middle and high, 2-6 on the scale.
5. Age at first offense - categories were defined as: 1, under age 18; and 2, age 18 or above.
6. Father Criminality - categories defined as: 0, no father crime; and 1, some father crime.
7. Mother Criminality - categories defined as: 0, no mother crime; and 1, some mother crime.

Table 44 shows the frequency tabulations of all of the variables for each crime pattern. Tabulations for non-criminals was also included for reference purposes only. Figure 31 recasts the tabulations into crime pattern profiles for each status characteristic identified in previous analyses as predictive of crime in general. The temptation is to interpret the profiles on the basis of their visual impact. However, before teasing out

Table 43

Stepwise Regression, number of Log Transformation Dates '81 for Criminal Males

Degrees of Freedom First Step: 1,155
R^2 for Significant Steps Only = .1509 ; R^2 for all variables = .2093

Independent Variable	Simple r	R^2 Increment (Stepwise)	F-Ratio (Stepwise)	Unique Contribution (Simultaneous)	F-Ratio Unique Contribution
Mo. Cr. Once	.2905	.0844	14.286	.0746	13.44
Mo. Content	-.2243	.0421	7.429	.0412	7.43
Mo. Order	-.2039	.0244	4.393	.0244	4.393*
Family Size	.1557				
Fa. Recid.	.1680				
Fa. Presence	.0257				
Mo. Health	.1527				
SES	-.0858				
Mo. Recid.	.1118				
Fa. Cr. Once	-.0398				
No. Constellation After Age 4	.1286				
Mo. Age	.0412				

* $p < 0.05$

TABLE 44

Frequency Tabulation for Status Variables
by Male Crime Pattern Group(Recidivists only)

Variable & Category	Thievery-NO Violence		Violence-NO Thievery		Thievery-Violence		Across Criminal Totals		Non-Criminal Totals	
	N	%	N	%	N	%	N	%	N	%
1. Mother's Orderliness										
*disorderly	6	17.1	4	28.6	15	42.9	25	29.8	26	12.2
*more orderly	29	82.9	10	71.4	20	57.1	59	70.2	187	87.3
2. Family Stability										
*unstable >12	16	45.7	3	21.4	16	45.7	35	41.7	31	14.6
*stable >12	19	54.3	11	78.6	19	54.3	49	58.3	182	85.4
3. Family Size										
*only child	7	20.0	2	14.3	5	14.3	14	16.7	31	14.5
* 2 children	10	28.6	2	14.3	6	17.1	18	21.4	83	39.0
* 3 or more	18	51.4	10	71.4	24	68.6	52	61.9	99	46.5
4. Socio-economic status										
*low	20	60.6	4	28.6	10	38.5	34	46.6	45	25.0
*middle/high	13	39.4	10	71.4	16	61.5	39	53.4	136	75.0
5. Age at first offense										
*under 18	25	71.4	10	71.4	32	91.4	67	79.8	-	-
*over 18	10	28.6	4	28.6	3	8.60	17	20.2	-	-
6. Father criminality										
*none	11	34.4	4	28.6	14	42.4	29	36.7	139	67.8
*some	21	65.6	10	71.4	19	57.6	50	63.3	66	32.2
7. Mother criminality										
*none	29	85.3	14	100	30	85.7	73	87.9	196	93.8
*some	5	14.7	0	0	5	24.3	10	12.1	13	6.2

provocative differences, it should be noted that there were only three instances in which statistical significance was achieved:

1) The thievery only pattern possesses lower SES than the violence only pattern (x^2 df_1 = 4.17, $p<.05$.)
2) When the thievery only and violence only patterns are combined and compared with the thievery plus violence pattern, the latter pattern has a higher proportion of "disorderly" mothers (x^2 df_1 = 4.96, $p<.05$).
3) When the thievery only and violence only patterns are combined and compared with the thievery plus violence pattern, the latter pattern has a higher proportion of cases who started their criminal career prior to age 18 (x^2 df_1 =4.61, $p<.05$).

Ignoring scientific caution and pretending analytic power (sample size), the graphs do tend to suggest the following with respect to comparing thievery and violence:

1) similar age at onset of crime
2) similar coincidence of father crime
3) the violence pattern has slightly more disorderly mothers
4) the thievery pattern has a greater incidence of family instability during adolescence
5) the thievery pattern has a greater number of low SES members
6) the thievery pattern has a greater incidence of mother crime

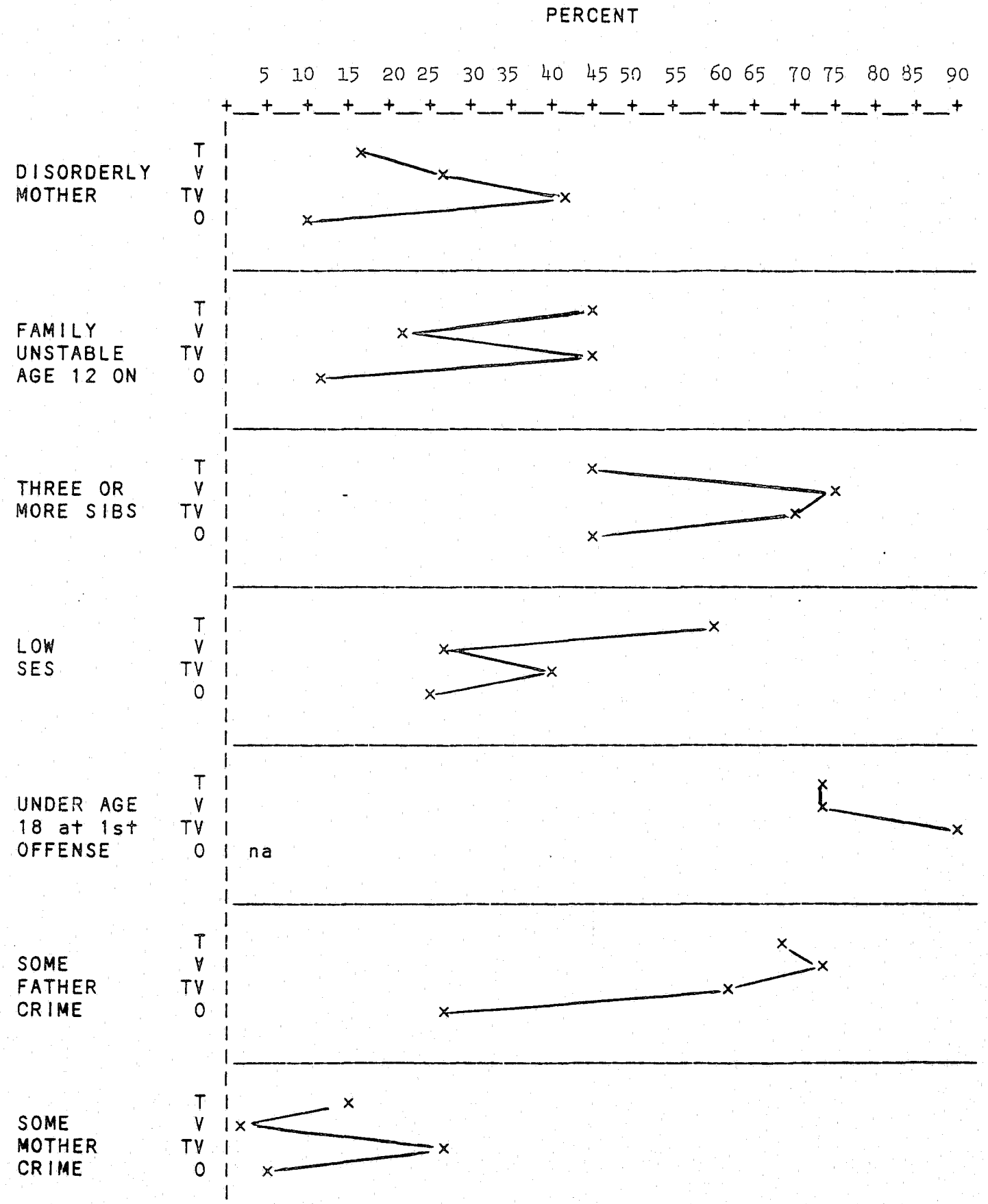


Figure 31 Percentage of Recidivists in Each Crime Pattern who Possess the Specified Characteristics (T = Thievery only; V = Violence only; TV = Thievery and Violence; O = No Crime Record

7) the violence pattern has a greater number of three-plus sib families

If confidence could be placed in the above distinctions, there are several summary statements that would seem reasonable. First, when the competition and rivalry that results from high family density is coupled with a primary caretaker who lacks the supervisoral control necessary to establish an authority and values framework, violence could become a prepotent crime choice. If, on the other hand, economic duress is coupled with a lack of stable and/or traditional adult models during adolescence the chances of adequate social control being established is reduced and thievery could well become a prepotent crime choice. As one would expect, the recidivists who have recorded both thievery and violence seem to possess the worst of all conditions. They start their criminal careers earlier and seem never to get back on track.

While it is certainly far from adequately substantiated empirically (statistically), there does appear to be some evidence that if criminals who specialize at least in thievery or violence can be identified, there may be differential patterns of antecedent events associated with each. This statement does <u>not</u> refute Wadsworth's (1979) finding that both property and violent offenses are related to similar environmental factors; for, indeed they seem to be. Rather, it suggests, as do Norland et al (1979), that if sufficiently homogenous classes of offenders can be

defined, different predictive patterns of the environmental factors may be identifiable. Short of doing clinical analyses of individual protocols, the trick is to define sufficiently meaningful criminal patterns and still have a large enough N for the power requirements of statistical analysis. In the analysis just described, 49 of the 123 (40 percent) recidivists could be assigned to thievery-only or violence-only. However, if we had not permitted other criminal activity to vary (e.g., uncontrolled behavior, traffic, drugs, etc.), we would have been able to assign only 9 (7 percent) to the two crime patterns. At any rate, this analysis strongly suggests that while the non-specialization notion remains intact, there is strong evidence that there may indeed be reliably definable patterns of criminal activity that possess differential characteristics in terms of the patterns of environmental variables that are associated with them. However, so long as the analytic methodology employed is restricted to multivariate procedures the chances of unmasking reliable differences is remote.

A Note On Female Criminality

While very few females in the sample had recorded arrests or charges the report would not be complete without a comment on female criminality. Table 45 presents the data for the female offenders in the sample. A total of only 32 females had one or more charges recorded. The most frequent charges made against the females were uncontrolled behavior

(17) and thievery (14). The female offenders showed a lower proportion of recidivism in comparison to the males, that is, of the 17 subjects charged with uncontrolled behavior only six were recidivists; the comparable numbers for thievery were six out of 14. Although the total number of violent charges in the female sample is small (4), the distribution of recidivism is noticably different in this group. Only one female charged with a violent offense had only committed that one offense. Table 46 presents the female offenders grouped according to character of crime (similar to the grouping used for the male sample in Table 44). The distribution of the criminals on the major predictor variables is presented in the table. When the table is compared with the parallel table for the male offenders, it appears that the females tended to begin their criminal careers later and that paternal criminality constituted a stronger influence on the development of criminality in females.

Table 45

Danish Cohort Females With Criminal Activity

Number of Offenses		1. Thievery	2. Uncontrolled Behavior	3. Violence	4. Traffic	5. Other
I. One only (N=21)		7	11	0	0	3
Recidivists (N=11)						
II. Thievery	a. one	0	2	0	0	0
	b. two +	1	1	2	0	0
III. Uncontrolled Behavior	a. one	3	0	0	1	0
	b. two +	0	1	1	0	0
IV. Violence	a. one	1	1	0	0	0
	b. two +	1	0	0	0	0
V. Traffic	a. one	0	1	0	0	0
	b. two +	0	0	0	0	0
VI. Other	a. one	0	0	0	0	0
	b. two +	0	0	0	0	2

Table 46

Frequency Tabulation for Status Variables
by Female Crime Pattern Group(1)

Variable & Category	Thievery with NO Violence		Violence with NO Thievery		Thievery & Violence		Across category Totals	
	N	%	N	%	N	%	N	%
1. Mother's Orderliness								
*less orderly	3	27.3	1	100	0	0	4	26.7
*more orderly	8	72.7	0	0	3	100	11	73.3
2. Family Stability								
*unstable >12	3	27.3	1	100	1	33.3	5	33.3
*stable >12	8	72.7	0	0	2	66.7	10	66.7
3. Family Size								
*only child	1	9.0	0	0	0	0	1	6.7
*two children	4	36.4	0	0	1	33.3	5	33.3
*three or more	6	54.6	1	100	2	66.7	9	60.0
4. Socio-economic status								
*low	5	55.6	0	0	2	66.7	7	53.9
*middle/high	4	44.4	1	100	1	33.3	6	46.1
5. Age at first offense								
*under 18	3	27.3	0	0	1	33.3	4	26.7
*over 18	8	72.3	1	100	2	66.7	11	73.3
6. Father criminality								
*none	2	18.2	0	0	1	33.3	3	20.0
*some	9	81.8	1	100	2	66.7	12	80.0
7. Mother criminality								
*none	10	90.9	1	100	3	100	14	93.3
*some	1	9.1	0	0	0	0	1	6.7

(1) NOTE: THIS TABLE INCLUDES ALL VIOLENCE AND THIEVERY OFFENSES

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SECTION II

BIOLOGICAL, PSYCHOLOGICAL AND SOCIOFAMILIAL FACTORS IN CRIME

By

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INTRODUCTION

This section of the final report deals with our analyses of data from the Intensive Examination (IE) study. In 1972 we examined 265 children who were drawn from the same Danish Perinatal Cohort as the subjects of the Family Study (only seven subjects overlap). The purpose of this 1972 examination was to prepare the base for a longitudinal, prospective study of the origins of delinquency and criminal behavior. The examination included a variety of measures of certain individual (including biological) characteristics of the children as well as sociofamilial indices.

In 1981 when the sample was between 18-20 years of age we ascertained their arrest records from the files of the National Police Register. The purpose of this section of the report is to determine what individual factors (including biological factors) measured in 1972 predict to criminal behavior ascertained nine years hence. Because of the prospective nature of this analysis variables which we find to be predictive may be considered among the factors which might be involved in the etiology of criminal behavior. The etiological implications of these analyses are, therefor, of some special interest.

Structure of report. The family literature has been reviewed earlier in this report. We will provide a brief review of research on biological and psychological factors in crime. This initial review will be somewhat general but will suffice to indicate the reasons for our choice of analyses from the data bank available on the IE sample. More detailed reviews will be

presented when we discuss specific measures.

We will then describe the special characteristics of the IE sample, the measures obtained at age 11-13 and the criminal behavior ascertainment in 1981.

Having set the scene, we will then describe the results with the selected variables: skin conductance (SC), electroencephalography (EEG), laterality, minor physical anomalies, and intelligence. Before each of these results statements we will review the relevant literature and state specific hypotheses.

LITERATURE REVIEW: PSYCHOLOGY, BIOLOGY AND CRIME

The data bank of the IE Study is massive. Each type of biological measure (e.g., EEG, SC) often includes hundreds of separate variables. The social interview material includes hundreds of separate items. In order to avoid misleading ourselves with spurious findings we have decided to review the literature with an eye toward generation of a limited number of specific hypothesis in each area. In this section we will provide a background; in later sections we will review the specific literature relating to these measures and formulate specific hypotheses.

Genetic Factors

Genetic factors are not considered directly in this study. But it is useful to note their importance since if some types of criminal behavior are predisposed by genetically transmitted characteristics, this argues conclusively for the importance of biological factors in the etiology of crime.

There are three types of genetic studies of the etiology of crime: family, twin, and adoption studies.

Family and Twin Studies. It has long been observed that antisocial parents raise an excessive number of children who become antisocial. In the classic study by Robins (1966), father's criminality was one of the best predictors of antisocial behavior in a child. In terms of genetics, very little can be concluded from such family data as it is difficult to disentangle hereditary and environmental influences. The criminogenic effects of social and economic adversity mask the possible influence of genetic factors.

A review of twin studies (Mednick and Volavka, 1980) suggests that identical twin evidence greater concordance for cimi-nal behavior than do fraternal twins. In the first eight twin studies we were able to find in the literature, identical (monozygotic, hereafter referred to as MZ) twins evidence about 60 percent concordance and fraternal (dizygotic, DZ) twins about 30 percent concordance for criminality. These eight studies are summarized in Table 1.

In the largest and best designed of the twin studies of criminality, Christiansen (1977b) reports 35 percent pairwise concordance for male MZ pairs and 13 percent concordance for the male DZ pairs. In this unselected twin population, the MZ concordance rate is lower than in previous studies. More cases are discordant than concordant. Nevertheless, the MZ rate is 2.7 times the DZ rate. This result suggests that MZ twins show some genetically controlled biological characteristic (or set of characteristics) which in some unknown way increases their common risk of being registered for criminal behavior.

Table 1

Twin Studies of Psychopathy and Criminality

MZ and Same-Sexed DZ Twins Only

Study	Location	Monozygotic			Dizogotic		
		Total Pairs	Pairs Concordant	% Concordant	Total Pairs	Pairs Concordant	% Concordant
Lange 1929	Bavaria	13	10	77	17	2	12
Legras 1932	Holland	4	4	100	5	1	20
Rosanoff 1934	U.S.A.	37	25	68	28	5	18
Stumpfl 1936	Germany	18	11	61	19	7	37
Kranz 1936	Prussia	32	21	66	43	23	54
Borgstrom 1939	Finland	4	3	75	5	2	40
Slater 1935 (Psychopathy)	England	2	1	50	10	3	30
Yoshimasu 1961	Japan	28	17	61	18	2	11
	Total	138	92	67.2	145	45	31.0

This is not some mysterious force, as implied by the title of the first twin study, "Crime and Destiny" (Lange, 1931). For example, if alcohol addiction increased the probability of anti-social behavior, and alcohol addiction had some partial genetically based predisposition, the twin research might yield positive genetic findings; or positive genetic findings may be observed if the child's learning of law abidance is facilitated by some neurophysiological characteristic, the functioning of which is influenced by genetic factors.

Adoption Studies. One great weakness of twin studies is that in most of the cases, genetic and environmental factors are not easily separated. A design that does a better job in this regard studies individuals adopted at birth. A register of all nonfamilial adoptions in Denmark in the years 1924-1947 has been established in Copenhagen at the Psykologisk Institut by a group of American and Danish investigators (see Kety et al., 1968). The register records 14,427 adoptions and includes information on the adoptee and his biological and adoptive parents. Thus, the register contains information on approximately 72,000 persons. (Only about 80 percent of the biological fathers are definitely identified.)

This adoption register may help us determine whether genetic factors influence human characteristics. For example, if male criminal fathers have disportionately high numbers of criminal biological adoptees (given appropriate controls), this would suggest a genetic factor in criminality. This is especially true since in almost all instances the adoptee has never seen the

biological father and does not know who he is; the adoptee may not even realize he has been adopted. Another research possibility is to study adoptees whose biological parents are criminal and who were placed with noncriminal adoptive parents; or we can take adoptees whose biological parents are not criminal and who were placed with criminal adoptive parents. This design is called the "cross-fostering" model and is useful for comparison of the effectiveness of genetic and certain environmental criminogenic forces. The adoptive method permits reasonable separation of environmental and herditary influences.

Because of the size of the population it is possible to segregate subgroups of adoptees who have combinations of criminal and non-criminal biological and adoptive parents. Table 2 presents the four groups in a design which is analogous to the cross-fostering paradigm used in behavior genetics. As can be seen in the lower right hand cell, if neither the biological nor adoptive parents are criminal, 13.5% of their sons are criminal. If the adoptive parents are criminal and the biological parents are not criminal this figures rises to only 14.7%. Note that 20.0% of the sons are criminal if the adoptive parents are <u>not</u> criminal and the biological parents are criminal. If <u>both</u> the biological and adoptive parents are criminal we observe the highest level of criminality in the sons, 24.5%. The comparison analogous to the cross fostering paradigm favors a partial genetic etiology assumption. We must caution, however, that simply knowing that an adoptive parent has been convicted of a crime does not tell us how criminogenic the adoptee's environment has been.

Table 2

"Cross Fostering" Analysis:
Percent of Adoptive Sons Who Have Been
Convicted of Criminal Law Offenses

	Are Biological Parents Criminal?	
	Yes	No
Are Adoptive Parents Criminal?		
Yes	24.5% (of 143)	14.7% (of 204)
No	20.0% (of 1226)	13.5% (of 2492)

Note: The numbers in parentheses are the total Ns for each cell.

On the other hand, at conception, the genetic influence of the biological father is already complete. Thus this analysis does not yield a fair comparison between environmental and genetic influences included in the table. But this analysis does indicate that sons with a criminal, biological parent have an elevated probability of becoming criminal. This suggests that some biological characteristic is transmitted from the criminal biological parent which increases the sons's risk of obtaining a court conviction for a criminal law offense.

A log-linear analysis of the data in Table 2 is presented Table 3. Adoptive parent criminality is not associated with a significant increment in the son's criminality. The effect of the biological parents' criminality is marked. Study of the model presented in Table 3 reveals that considering only the additive effect of the biological parent and the adoptive parent, the improvement in the chi square leaves almost no room for improvement by an interaction effect.

A third adoptee project has been completed by Crowe (1975) in Iowa. This investigation finds evidence of a relationship between criminality in an adopted child and its biological mother.

Cadoret (1978) reports on 246 children adopted at birth. He indicates that antisocial behavior in the adoptees is significantly related to antisocial behavior in the biological parents. His data were gathered by telephone interview with the adoptive parents and adoptee. It is difficult to judge how this method influenced the reported results. Bohman (1978), in a study of

Table 3

Log Linear Analysis:

The Influence of Adoptive Parent and Biological Parent

Criminality upon Male Adoptee Criminality

Model	Model Chi-Square	df	p	Improvement Chi-Square	df	p
Baseline (S,AB)	32.91	3	.001			
Adoptive Parent (SA,AB)	30.71	2	.001	2.20	1	n.s.
Biological Parent (SB,AB)	1.76	2	.415	31.15	1	.001
Combined Influence (SB,SA,AB)	0.30	1	.585	32.61	2	.001
Biological Parent given Adoptive Parent (SB/SA,AB)				30.41	1	.001
Adoptive Parent given Biological Parent (SA/SB,AB)				1.46	1	n.s.

Note: S means adoptee sex effect; A means adoptive parent effect; B means biological parent effect.

Swedish adoptees, first reported no significant relationship between criminality in the biological parents and the adoptees. When he takes recidivism into account, however, a genetic effect becomes apparent (Bohman, Cloninger, Sigvardsson, and von Knorring, 1982).

These genetic findings implicate some biological factors in the etiology of criminal behavior. In the following sections we will discuss biological facators which are related to criminal behavior; some of these biological factors have been shown to be genetically influenced. 1978).

Autonomic Nervous System (ANS)

The psychopath and serious criminal have been described by Hare (1978a) and Cleckley(1976) as being the most aggressive dangerous and recidivistic clients of a prison. Most clinicians will agree; descriptions of the chronic criminal run as follows: callous, feels no guilt, lacks emotion. The ANS mediates physiological activity related to emotions. The discipline of psychophysiology is most concerned with studying peripheral signs of ANS activity such as skin conductance, heart rate and blood pressure. The most commonly studied peripheral indicant is skin conductance both in the area of crime and in the general scientific study of the ANS.

The skin conductance response as it is usually measured is most heavily dependent on the activity of the sweat glands of the palms. Individuals who are often emotionally aroused, anxious, and fearful tend to have clammy, wet handshakes because their emotional responsiveness is reflected in the overactive sweat

glands of their palms. Such emotional individuals usually exhibit high skin conductance even when they are not stimulated. Very calm, unemotional types typically have very low skin conductance. (This "emotional" perspiration is also abundant in the soles of the feet but is typically less evident, since people we encounter are usually wearing shoes. The soles and palms are called volar areas.)

When frightened or otherwise emotionally aroused, normally calm individuals will evidence episodes of volar sweating. This sweating moistens the skin with a salt solution that increases its electrical conductivity. (More detailed information can be found in Venables and Christie, 1975). If a weak current (generated by a battery) is leaked through the fingers we can monitor the electrical resistance (or its inverse, conductance) of the skin to the passage of this current. If we stimulate the individual to become emotionally aroused (e.g., shoot off a gun behind his back) his ANS will activate his volar sweat glands. The skin will be suffused with perspiration, which will increase its conductance; if we are monitoring this conductance on a polygraph we will see an excursion of the pen that (all other things being equal) will be proportionate to the extent of ANS arousal experienced by our subject. Subjects who are relatively unaroused by stimulation will produce little or no pen excursion. Individuals who are highly aroused by the gunshot will evidence a substantial pen excursion. The extent of pen excursion can be calibrated so that it can be expressed in electrical units of conductance. This process yields an objective score that reflects, at least to

some substantial extent, the subject's degree of emotional arousal and ANS activation. There is a considerable body of methodological literature describing application of this technique; despite some complaints on details in the literature, there is good standardization of technique, which makes it possible, with due caution, to compare results from different laboratories.

We have recently reviewed the literature on SC in antisocial individuals (Mednick, Pollock, Volavka, and Gabrielli, 1982). It would be inappropriate to repeat this lengthy review here. Suffice to say that in more than 25 studies examining differences between antisocial individuals (psychopaths, criminals, delinquents) and controls the antisocial individuals evidence a consistent pattern of sluggish ANS behavior. This pattern includes lack of responsiveness, slow latency, low amplitude and slow recovery. Some of these studies are prospective; that is the ANS measures were obtained in childhood some years prior to the onset of the offending. These prospective studies have established reduced responsiveness, slow latency and slow recovery as predictors of delinquency or recidivism (Loeb and Mednick, 1977, Hare, 1978; Wadsworth, 1976). As will be indicated below, the responsiveness (amplitude and frequency of responses) measures are best observed in stimulus tests with quiet tones while the timed measures (latency and recovery) are best observed under surprise or stress conditions.

EEG

The EEG reflects electrical activity of the brain. Electrochemical processes in the living brain produce periodic voltage

oscillations that can be detected by recording from the scalp in humans. The detected brain activity is described in terms of its amplitude (size) and its frequency (rhythmicity). EEG amplitudes are generally 20-100 microvolts (1/1000 of a volt). Frequency of EEG activity, usually discussed in current literature, ranges between .5 and 40 Hz (cycles per second). For descriptive convenience, the frequency range is, by convention, classified according to the following scheme: delta, .5-3 Hz; theta, 4-7 Hz; alpha, 8-12 Hz; beta, 13-40 Hz (Kooi et al., 1978).

The occurrence and amplitudes of activities within these frequency ranges are known to be dependent on characteristics of the subject (such as age and sex) as well as behavioral state (asleep or awake). Clinically, EEG evaluation has proven most useful in the diagnosis of epilepsy (Kooi et al., 1978). Much current research is directed toward elucidating associations between EEGs, subject characteristics, and behavioral states. Current research is also under way to discover the specific relationship between EEG and neuronal activity.

EEG records can be evaluated in two ways. First, they can be inspected visually by an electroencephalographer and rated according to some classification scheme. Usually, such ratings result in EEG records being classified as normal, abnormal, or "borderline." Second, EEGs can be quantitatively analyzed, typically by computers. Such a procedure results in a set of parameters with numeric descriptors that can be used for direct comparison of EEGs. These two methods of analyses are complementary.

Quantitative computer analysis is not as effective as the

human eye in detection of aberrant wave complexes (as are found in epilepsy). Estimates generated by quantitative computer analysis of EEG parameters (e.g., of wave frequency and amplitude) are more precise than is possible by qualitative evaluation.

In general criminals (typically studied in prisons) evidence dramatically elevated rates of abnormalities in the clinically (visually) evaluated EEG records. Almost all of this research which has found abnormal EEGs, (visual evaluation) has been completed with violent criminals. These studies suggest some form of underlying organic dysfunction. The issue of the origins of the dysfunctions are not addressed by these studies since the brain dysfunction might precede and be part of the cause of the violence or it may be the result of participation in violent activities. The advantage of the current study is the fact that the EEGs were taken during childhood before the subjects were involved in illegal violent acts or other law infringing behavior.

Two studies in the literature are prospective. One, conducted in the IE sample, noted that among delinquents slowing of the EEG was specifically related to later thievery (Mednick, Volavka, Gabrielli and Itil, 1981). In an independent replication study Peterson, Matousek, Volavka, Mednick and Pollock (1982) found that slowing of the EEG in childhood was also related to thievery in a large sample of Swedish men.

Alcohol-related offenses comprise an important category of transgressive behavior. In our earlier work we have noted that children at risk for alcoholism tend to evidence high levels of

fast EEG activity in the resting state (Gabrielli and Mednick, 1980). In our data analyses we must separate alcohol-related offenders from thievery offenders.

Neuropsychological Evidence

Neuropsychological test results allow inferences relevant to localization and lateralization of brain dysfunction. The reliability and validity of various neuropsychological test batteries have been demonstrated in the identification of specific types of organic brain impairment (Filskov and Goldstein, 1974). Agreement in diagnosis of neuropsychological test results and more conventional neurological techniques is quite high (Filskov and Goldstein, 1974; Schrieber et al, 1976).

Spellacy (1977, 1978) assessed neuropsychological functioning in violent and nonviolent juvenile and adult males. Performance by violent patients was poorer on approximately two-thirds of 31 test variables. Berman (1978) reports impairments of verbal, perceptual, and nonverbal functioning indicative of neuropsychological deficiency among violent males.

Yeudall (1977) provides neuropsychological test results for various criminal groups classified according to their past offenses. Discriminant function analyses were used to distinguish criminal subtypes from controls. Thirty neuropsychological tests measures were used to compare psychopaths to controls (sample sizes for different analyses varied, but were generally 25 subjects per group). Approximately 91 percent of psychpaths exhibited significant neuropsychological dysfunction. Neuropsychological abnormalities were detected in 94 percent of those

convicted of homicide, 87 percent of those convicted of physical assault, and 100 percent of those convicted of rape. The results have not yet been replicated. Performance deficits exhibited by psychopaths suggest frontal and temporal brain area dysfunction.

Lateralized Deficits. Studies in the difference of functioning of the left and right brain hemispheres have provoked efforts to identify a lateralized focus for brain dysfunction especially in violent individuals. Flor-Henry (1979) proposes a theory relating psychopathology to lateral dysfunction. According to Flor-Henry, psychopaths (and schizophrenics) suffer from irregularities of the dominant (left, in most right-handed individuals) hemisphere. Yeudall and Flor-Henry (1975) studied neuropsychological profiles of 25 aggressive psychopaths. Of the 25, 15 exhibited impairments and the majority of these suggest deficits localized in the dominant frontal temporal region. Further attempts to establish a relationship between violent behavor and lateral dysfunction have been more equivocal (Andrew, 1980; Fitzhugh, 1973). Krynicki (1978) compared six adolescents suffering from organic brain impairments to eight who had committed assault. These subjects' neuropsychological test performances were quite similar; both groups exhibited deteriorated performance in two tasks lateralized to the left hemisphere. It has also been reported that delinquents tend to be left-handed more frequently than controls (Gabrielli and Mednick, 1980). Such results are compatible with Flor-Henry's hypothesis.

The neuropsychological evidence suggests the hypothesis that violent individuals predominantly suffer impairment of frontal

and temporal brain regions. Dysfunction in these brain regions (especially in the frontal lobes) is associated with impaired self control and inability to comprehend the consequences of one's own actions (Pincus and Tucker, 1978). These characteristics are compatible with our expectations regarding violent individuals.

Perinatal Factors in Violence. Damage to the brain has been suggested as a possible factor in the etiology of violence. In view of the fact that aggressive behavior is a consistent pattern for many boys from early childhood, we might entertain the possibility that the brain damage occurs early in life. Perinatal difficulties could be an important source of such damage. We have examined this possibility in a longitudinal study of a birth cohort in Copenhagen, Denmark. While later property offenders experienced relatively poor social conditions during their pregnancies, their medical, physical, and neurological progress in the pregnancy, delivery, neonatal period and at one year of age were superior to that of the nondelinquent. The more offenses with which an adolescent was credited, the better was his perinatal and one-year status. This finding is consistent with other data we have observed in longitudinal research.

When one examines the perinatal data for the Copenhagen delinquents who manifested violence, the picture changes. Like the other delinquents, they evidence poorer social conditions during pregnancy. But at one year of age, those individuals who have committed more than one violent offense have a significantly worse one-year physical status and worse neurological status.

The most severe neurological problems are observed in those recidivistic violent offenders whose social conditions were more stable (parents married). This type of biosocial interaction has been observed before, especially with perinatal variables. Where the social experiences of antisocial individual are not especially criminogenic, biological factors should be examined. The value of the biological factors is more limited in predicting antisocial behavior in individuals who have experienced criminogenic social conditions in their rearing.

The one-year neurological problems evidenced by those infants who later were violent offenders are most likely due to disturbances in pregnancy rather than delivery. Excluding instances of extreme levels of anoxia or mechanical damage to the brain, infants show good recovery from delivery complications, not so for serious pregnancy disorders. Signs of pregnancy difficulties, however, are more difficult to record than signs of delivery complications. Teratogenic factors during embryonic development are frequently indexed at birth and later by small easily, observable aberrancies in the development of the infant's external physical characteristics. These aberrancies involve visible growth anomalies of the arms, hands, toes and hair which can be counted. Research has noted a significant positive relationship between such minor physical anomalies and later attention disorders, impulsivity and aggressiveness in boys. In fact, the new born count of anomalies explains almost half the variance in hyperactivity at age three (Waldrop, Bell, McLaughlin and Halverson, 1978). Since children with these anomalies are judged to

be as attractive as those without anomalies the disturbed behavior is not likely to be due to peer mistreatment (Bell and Waldrop, 1982). It is reasonable to assume that the teratogenic agents which caused the visible physical anomalies during fetal development, also produced covert anomalies in the central nervous system. Thus a count of such physical anomalies may be seen as an index of CNS damage to the fetus during the pregnancy.

Intelligence

There is a consistent literature indicating that the offender, especially the recidivist, tends to be of lower intelligence than the non offender. One explanation of this finding suggests that the lower level of intelligence (especially verbal intelligence) of the future criminal produces frustration in school. This frustration in interactions with an important socializing agent may lead to the youth to seek after alternate forms of reinforcement. A more detailed review will be presented below.

THE IE SAMPLE

The subjects for the IE sample were drawn from a Danish Perinatal Cohort (N=9,125) consisting of all children born between September, 1959 and December, 1961 at Rigshospitalet in Copenhagen (Zachau-Christiansen and Ross, 1975). Children with deviant parents were selected so as to increase the yield of antisocial behavior in the children. The psychiatric hospitalization records for all of the parents were obtained. All children (N=72) with schizophrenic mothers or fathers were included in the study. To this group were matched a group of children with psychopathic fathers or character disorder mothers (N=72). The

remainder of the subjects (121 matched controls) in the sample had parents who had never had a psychiatric hospitalization. Details of the nature of the populations can be found in Mednick, Mura, Schulsinger, and B. Mednick (1971).

The subjects were contacted in 1972 and invited in for assessment in connection with their participation in the Danish Perinatal Cohort study. The assessment took a full day consisting of psychological, neurological, psychophysiological, medical and social-familial measures. The psychophysiological measures included measures of autonomic nervous system activity. The social-familial measures included information about the family structure and home environment.

As mentioned, children with deviant parents were selected so as to increase the yield of delinquent and criminal behavior in the sample. As will be seen in the results section, this strategy was successful. But the special nature of the sample makes generalizations of results somewhat problematical. In order to deal with this problem all analyses conducted on the full sample will be repeated with the controls only to assess the degree to which the deviance in the parents contributed to the pattern of results.

Criminality

Criminality was assessed and coded in exactly the same manner as has been described for the Family Study. The criminal behavior noted in the National Police Register for the IE sample is presented in Table 4 in a manner analogous to Table 2 in the Family Study. As in the Family Study, criminals do not exclu-

TABLE 4

Cell N's for Each Pattern of Criminality Recorded

IE SAMPLE

Number of Offenses			1 Thievery	2 Uncontrolled Behavior	3 Violence	4 Traffic	5 Other
I. One only			17	20	20	20	16
Recidivists							
II. Thievery	a.	one		8	3	6	3
	b.	two +	(2)	15	11	9	12
III. Uncontrolled Behavior	a.	one	7		4	7	11
	b.	two +	16	(3)	11	9	12
IV. Violence	a.	one	6	7		3	4
	b.	two +	8	8	(0)	4	5
V. Traffic	a.	one	7	6	1		3
	b.	two +	8	8	6	(2)	8

sively specialize in a single type of crime. However, the fact that many criminals commit more than one type of crime, should not be immediately interpretted as an argument that all criminals are alike. For example only a small proportion commit violent crimes or crimes involving uncontrolled behavior. While it is possible (or even likely) that the violent criminal has certain characteristics of the thief it is also very possible that the violent individual has additional features or experiences which predispose him to violent acts. In the Family Study very few family factors were found which helped to differentiate types of criminals. Perhaps the critical differentiating characteristics are biological or psychological. This possibility will be explored.

The One-Time Offender

For many of the analyses to be presented we will trichotomize the dependent variable, criminal behavior, into those with zero, one and two or more arrests. We have certain reservations concerning predictions of the characterisitcs of the individual and who as been arrested for one offense and who has apparently stopped offending.

1. Such an individual may have an unusually high level of sensitivity to punishment. It is possible to hypothesize that he may be highly autonomically sensitive. Perhaps he became involved in an antisocial act because of the influence of friends or because he lives in a high-crime area. The fact that he has not been rearrested must give us pause.

2. It is also conceivable that an individual with one

arrest may eventually earn additional arrests.

Because of these considerations our primary predictions will involve differences between characteristics and experiences of non-offenders and recidivists.

SKIN CONDUCTANCE

The literature review suggests that the antisocial individual evidences relatively diminished responsiveness and slow recovery of skin conductance. Diminished responsiveness is especially evidenced in orienting stimulus conditions (mild stimulation). The recovery differences are noted in response to loud, surprising or stressful stimuli which elicit ANS defensive reaction. Venables interprets this pattern in line with Lacey, Kagan, Lacey and Moss (1963) as an indicant of "closedness" to the environment. Venables suggests that the slow recovery and diminished orienting response of the criminal reflects a perceptual rejection of stimuli. Long recovery time corresponds to a defensive "tuning out" of stimulus input. Schizophrenics tend to have short recovery times; Patterson (1976) states "everything gets through to the schizophrenic and little to the psychopath" or criminal. As indicated, it is posited that the retarded skin conductance recovery time represents a defensive delay of the perceptual processing system. In addition to recovery time we also examined latency of the skin conductance response as another indicant of delay in processing.

The stimulus series utilized in this study consisted of both orienting trials and trials with loud noises. In terms of the Venables interpretation we hypothesize that the recidivists will evidence reduced orienting skin conductance amplitude and a reduced number of orienting responses as well as slow skin conductance latency and recovery in response to the loud noise stimulus.

Method

Physiological recording. A 12-channel Beckman R dynograph was used to monitor the various physiological parameters. Eight channels were employed for EEG, and four were devoted to cardiac and electrodermal recording. Skin conductance was (SC) measured bilaterally with two constant voltage couplers as described by Lykken and Venables (1972). Calibration was carried out on a daily basis, and all measures were recorded on an FM precision instrument PI6200 eight-channel tape recorder. Analog recordings were monitored downstream via a Tektronix dual beam oscilloscope (R5031). A paper writeout was also obtained.

Beckman biopotential skin electrodes (AgCl) of 0.3 cm diameter were used to record SC parameters. The electrolyte used was 0.5% KCl in an agar 2 medium. The electrodes were attached to the medial phalangae of the index and middle fingers of each hand with standard Beckman electrode collars.

Stimulus Material. Each subject listened to a stimulus tape. The stimuli used in the experiment were a series of tones that comprised an orienting (OR) and a differential conditioning (COND) paradigm. There were 14 presentations of the OR stimulus, a 75-db tone of 1 second's duration. The interstimulus interval varied between 34 and 42 seconds. In the COND section of the tape there were 12 presentations of a conditioned stimulus (CS) paired with an unconditioned stimulus (UCS): the CS was a 1-KHz,60-db tone of 10 seconds' duration, and the UCS was 4.5 seconds of noise presented at 96-db. The interstimulus interval was similar to that during orienting. Calibration of the volume

control for stimulus output to the subject was made with a Bruel and Kjaer precision sound level meter 2203 with an artifical ear-piece (type 4152).

Nonreinforced and generalization trials were also included on the tape; however, because of the low frequency of responding in these conditions a reliable analysis of these data cannot be made. Table 6 presents full information on the stimulus series.

Procedure. The subjects were tested in the afternoon of their visit to the laboratory. Each subject removed any articles from his hands and arms which were then washed with a proprietary brand of soft soap; the electrode sites were then cleansed with acetone. The subject sat in a reclining armchair, which was placed in a copper-shielded room immediately adjacent to the equipment area. After the physiological tranducers had been applied together with the headphones (TDH-39 with 10 ohms resistance), calibration of the polygraph was carried out. The room-temperature and humidity were then noted. The light above the subject was extinguished and he was told to relax. The experimenter told the subject over the headphones to listen to the prerecorded instructions and the series of tones which would follow.

Presentation of the stimulus tape was completed within 30 minutes, during which continuous recording of electrodermal and cardiac activity took place.

Data Quantification. Data reduction of the analog tapes was carried out with a special purpose program developed for use with a Linc-8 computer. This procedure was carried out at the Depart-

Table 5

Trigger Count, Inter-stimulus Interval, and Stimuli Presented for Each Trial

Trigger Count	Stimulus	UCS	ISI	Trigger count	Stimulus	UCS	ISI
1	OS	No	34	21	CS1	Yes	42
2	OS	No	36	22	CS1	No	38
3	OS	No	41	23	CS2	No	38
4	OS	No	38	24	CS1	Yes	34
5	OS	No	35	25	CS2	No	38
6	OS	No	40	26	CS1	Yes	42
7	OS	No	38	27	CS1	No	34
8	OS	No	42	28	CS1	Yes	42
9	OS	No	40	29	CS1	Yes	38
10	OS	No	36	30	CS2	no	34
11	OS	No	42	31	CS1	no	34
12	OS	No	34	32	CS1	Yes	42
13	OS	No	37	33	CS1	no	42
14	OS	No	39	34	CS1	Yes	38
15	None		120	35	CS2	no	38
16	CS1	Yes	42	36	CS1	Yes	34
17	CS1	Yes	38	37	CS1	Yes	38
18	CS2	No	34	38	CS2	No	42
19	CS1	No	34	39	CS1	No	34
20	CS1	Yes	42				

responsive or quick recovering ANS are recidivists. In this sense, being an active ANS responder is protective against engaging in recidivistic behavior. In another study we examined ANS functioning in sons of serious criminals. Those sons of criminals who were relatively invulnerable to the criminogenic paternal influence also were distinctively characterized by high levels of ANS responsiveness (Mednick et al, 1977).

In summary, in aggreement with a considerable literature, level of ANS responsiveness and latency and recovery observed in 12-year old boys taps some characteristic which is related to the likelihood those boys will be registered for recidivistic criminal behavior nine years hence. Examination of plots of ANS factors against number of registrations for criminal acts are consistent with the hypothesis that high levels of ANS responsiveness and fast ANS latency and recovery are protective factors against recidivistic criminal involvement.

Thievery, violence, uncontrolled behavior. The pattern reported for number of offenses is almost completely reflected in analyses of number of thievery offenses. Neither violent nor uncontrolled behavior offenses relate to skin conductance response patterns.

CENTRAL NERVOUS SYSTEM ACTIVITY

Electroencephalogram (EEG) recordings from the scalp reflect central nervous system activity. Such recordings have been used to investigate criminal populations since the early 1940's (Hill and Sargant, 1943; Silverman, 1944; Hill and Pass, 1952). Most of these studies indicate that criminals' EEGs are more frequently classified as abnormal than those of non-criminal subjects. Slowing of the EEG frequency was a principal finding in these studies. The slowing is usually observed as increased activity in the slow alpha range (8-10 Hz).

Forssman and Frey (1953) and Verdeaux (1970) found significant amounts of slow alpha activity in juvenile delinquents relative to the levels in non-delinquents. Similar findings have been reported for a group of 97 adult murderers (de Boudouin et al, 1961). A number of other studies have reported EEG slowing in criminals. Mednick and Volavka, (1980) provide additional review of studies of the EEG in criminals. In two independent prospective studies we have demonstrated that relative amount of slow alpha activity in childhood is predictive of later thievery (Mednick, Volavka, Gabrielli and Itil, 1981; Petersen, Matousek, Mednick, Volavka and Pollock, 1982).

One hypothesis which could explain the observed relationship between alpha slowing and criminality is that a relatively slow frequency EEG pattern reflects a developmental lag. Slower EEG frequencies tend to predominate in childhood. As individuals mature, their average EEG frequency increases (Lindsley, 1939;

Matousek and Petersen, 1973; John et al, 1980). Predominantly slower activity observed in criminals could therefore be reflective of immaturity of brain development of criminals.

Another related hypothesis is that criminals have lower arousal. Slow EEG activity is known to increase with relaxation and drowsiness and decrease in states of tension (Kooi, Tucher, and Marshall, 1978). If criminals show less arousal (as autonomic nervous system studies suggest), the observed EEGs may reflect this pattern (Mednick and Volavka, 1980).

It is perhaps worth noting that this slow EEG activity is not seen as a sign of a damaged brain. It is more a reflection of a customary pattern of brain activity. Brain immaturity may very well predict poor judgement, poor school performance and other characteristics which would not be inconsistent with certain criminal behaviors. Low arousal has been linked theoretically with a reduced ability to learn avoidance and inhibition of antisocial behaviors. The type of crime which would be consistent with a slowing of the EEG would not likely involve violent or alcohol-related offenses such as are included in the category "Uncontrolled Behavior".

Alcoholics, for instance, have been observed to show EEG differences from non-alcoholics. Their EEGs tend to contain excessive <u>fast</u> EEG activity and <u>deficient</u> alpha. (Davis et al, 1941; Little and McAvoy, 1952; Funkhouser et al, 1953; Naitoh, 1973; Jones and Holmes, 1976). This pattern is generally consistent with increased cortical arousal. It has been demonstrated in children at high risk for alcoholism (Gabrielli and Mednick,

1982.) On this basis, we could expect individuals who commit crimes which are primarily related to alcohol (e.g., drunk driving) not to be characterized by slow alpha activity. The individual who tends to commit alcohol-related crimes should, exhibit relatively faster frequency EEG activity (beta; 13-25 Hz).

These considerations lead us to hypothesize that thieves will tend to exhibit a predominance of slow alpha activity while those exhibiting uncontrolled behavior offenses will evidence increased faster (beta) activity.

EEG RECORDING AND ANALYSES

Electrodes were placed according to the ten-twenty system (Jasper, 1958) over the right and left parietal, temporal, central and occipital areas. The electrode connections (i.e., EEG derivations) used were: T3-P3, T4-P4, C3-A1, C4-A2, P3-01, P4-02, 01-A1, 02-A2. The EEG was recorded while the 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 those tape records were later subjected to computerized period analysis by Itil et al. (1974). The analysis yielded 22 variables for each of the 8 derivations used. Since we had no hypothesis about superimposed EEG frequencies above 18 Hz, we have not utilized the variables based on the first derivative of the EEG but concentrated only on the primary wave analyses. These analyses yielded the relative amounts of EEG activity (expressed as percent time) in the following frequency bands (in Hz): 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.

For purposes of this analysis we have only examined relative percents of slow alpha (8-10 Hz), beta I (13-26 Hz), and beta II (27-40 Hz). Recordings were done in the afternoon in the same session, and under the same conditions as for the skin conductance measures.

Results

Mean differences. In the present sample, we examined relative percents of slow alpha (8-10 Hz), beta I (18-26 Hz), and beta II (26-40 Hz) activity. We acquired data from eight derivations (four on each side of the head). We averaged scores for each side for purposes of analysis. We compared non-offenders, one-time offenders and recidivists for total number of offenses, theft, uncontrolled behavior, and violence. The means are reported in Table 7. As the results suggest, the average relative slow alpha is greater for the recidivistic thieves, but not so for the violent offenders or for uncontrolled behavior offenders. (Tests of significance as indicated in Table 7 reflect the relationship after partialling the actual age at testing). Patterns observed for overall means were also observed for specific derivations.

Thieves. The results for our young adult property offenders are consistent with our earlier findings (Mednick et al, 1981) in which we examined the relation of EEG slow alpha to delinquent thievery in our subjects. The results have also been replicated by a prospective study conducted on Swedish thieves (Petersen et al, 1982).

In view of the fact that there are many thieves we separated

Table 7

Mean Percent EEG Activity; Slow Alpha, Beta I and Beta II by Offense Number and Type

			Slow Alpha		Beta I		Beta II	
		N	left Hemisphere	right Hemisphere	left Hemisphere	right Hemisphere	left Hemisphere	right Hemisphere
Total Number of Offenses	0	(64)	18.3	18.5	3.98*	4.03*	3.58**	3.52**
	1	(27)	18.9	18.8	3.57	3.42	3.16	3.00
	2 or more	(38)	18.3	19.1	4.84	4.64	4.61	4.25
Number of Thievery Offenses	0	(93)	17.8	17.9*	4.06	4.05	3.74	3.65
	1	(17)	18.6	19.2	4.47	4.21	3.92	3.57
	2 or more	(19)	21.3	22.0	4.11	4.11	3.93	3.52
Number of Uncontrolled Behavior Offenses	0	(90)	18.2	18.3	3.98***	3.99*	3.60**	3.51
	1	(20)	19.5	19.3	3.96	3.56	3.41	3.25
	2 or more	(19)	18.5	19.7	5.40	5.07	5.10	4.56
Number of Violent Offenses	0	(109)	18.3	18.4	4.10	4.10	3.76	3.65
	1	(17)	19.4	20.8	4.43	3.97	4.00	3.47

Note: Stars placed near a column of three numbers indicate that that type of EEG activity was significantly different as a function of number of offenses (*p<.05; **p<.01; ***p<.001)

All analyses completed controlling for age at time of testing.

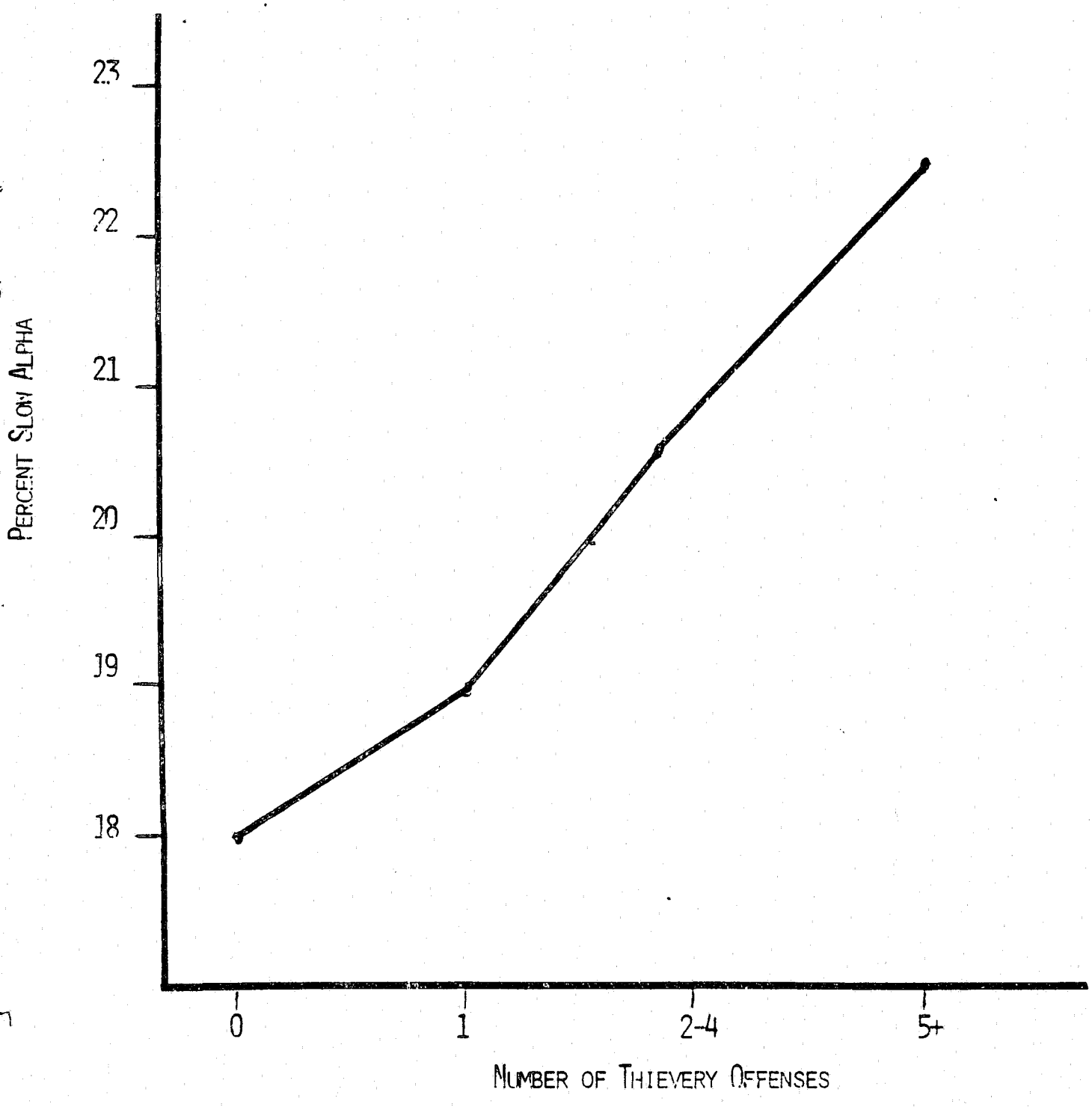
out a group of nine who were chronic offenders (five or more theft offenses). We expected that these chronic thieves would be most highly differentiated by relative slow alpha activity. We calculated mean activity for four categories of thieves (non offenders, one time offenders, two or three or four thefts, and five or more thefts). These means are plotted in Figure 1. Taking the groups of thieves as a scale, regression results support the hypothesis that the progression is significant ($F(1, 123)=5.41$, $P<.05$). When tested as children (age 12) the later chronic offenders evidenced markedly more slow alpha activity than controls.

Uncontrolled behavior offenders. It is important to note that the uncontrolled behavior category (in our sample) heavily involves alcohol-related crime (e.g. drunkeness, loitering, drunken driving, irresponsible driving). The crimes in this category were primarily committed while individuals were under the influence of alcohol. In agreement with our hypothesis, at 12 years of age, those who later were involved in recidivist uncontrolled behavior offenses evidenced faster EEG activity (see Table 7).

Comment

We have observed a pattern of slower EEG activity (more slow alpha) in thieves and a pattern of fast activity in uncontrolled behavior offenses which heavily involve alcohol-related offenses. Both results are consistent with the hypothesis that criminal behavior is associated with level of cortical arousal, less arousal in the thieves and high arousal in the uncontrolled

FIGURE 1


23
22
21
20
19
18
PERCENT SLOW ALPHA
0
1
2-4
5+
NUMBER OF THIEVERY OFFENSES

behavior offenders. Of course, the EEG was taken at age 12 under sober conditions. Most of the uncontrolled behavior offenses were committed after alcohol ingestion. Alcohol results in a marked increase in EEG slow alpha power and a general reduction in fast frequency activity. It is possible that the thieves and the uncontrolled behavior offenders both were being influenced by high levels of slow alpha at the time of their offenses.

It is perhaps of interest to speculate regarding the origins of those slow and fast EEG patterns. Both types of patterns are known to be heritable (Vogel, 1958, 1970; Young et al, 1972; Propping, 1977, 1980). These patterns can also be produced by brain trauma.

As in the SC analysis, the data in Table 7 were also subjected to analysis within the control subjects. The results are even more striking in this subgroup.

NEUROLOGICAL FUNCTIONING

In this section we will consider two potentially criminogenic factors relating to brain functioning: cerebral dominance and minor physical anomalies (MPA). In line with control theory models, it is our general hypothesis that antisocial behavior is an intrinsic characteristic of man; to become truly civilized the child must learn to inhibit antisocial behavior. There are many sources of inhibition, both social-familial and individual-biological. Most (if not all) of these sources of control require an adequately functioning central nervous system (CNS). When CNS functioning is less than adequate, control of impulses may suffer. Some of these poorly controlled impulses may lead to illegal acts.

In other research we have found evidence for a genetic component in the etiology of criminal behavior (Mednick, Gabrielli and Hutchings, in press). Interestingly, genetic factors only related to property offenses, not violent offenses. A series of studies (Elliott, 1982; Buikhuisen, in press) has suggested that neurological disturbance is a very common finding among criminals who have committed violent offenses. Because of this evidence and because most violent crime has a particularly impulsive character we hypothesize that signs of less than adequate neurological control will be especially related to violent offending.

Laterality. It has been suggested that individuals characterized by left cerebral hemisphere dominance exhibit more planned, rational, verbal and a less emotional and impulsive pattern

of behavior than those who are right hemisphere dominant (Berent, 1981; Gazzaniga, 1970; Sperry, 1974).

We have published a study earlier which remarked on the increased likelihood of delinquent activity from members of the IE sample who were left side (right hemisphere) dominant (Gabrielli & Mednick, 1980). Of the left handers (as determined by the 12-year old intensive assessment) 64.7% were later arrested (by age 18); only 29.5% of the right handed individuals were arrested. Almost all of these offenses were property crimes. These results are consistent with previous findings (Fitzhugh, 1973; Andrew, 1978; & Krynicki; 1978).

Flor-Henry (1979) has presented a theory which posits that antisocial behavior disorders are related to left hemisphere damage. (Some left handedness, or right hemisphere dominance, may be genetically determined; it is believed, however that a large proportion of those with right hemisphere dominance suffered perinatal left hemisphere damage with subsequent taking over of dominance by the relatively intact right hemisphere.)

These facts lead us to hypothesize that signs of deviation from left hemisphere dominance will be related to increased probability of criminal behavior especially violent behavior.

Minor Physical Anomalies (MPA). The IE sample as well as the family study sample are drawn from the larger Danish Perinatal cohort (Zachau-Christiansen & Ross, 1975). In a pilot analysis using the entire cohort, Moffitt & Mednick noted a weak but significant relationship between perinatal difficulties, early neurological symptoms and later arrests for violent acts (and not

property offenses). This pilot result has suggested that perhaps pregnancy and delivery factors may be responsible for early brain damage which may be among the causes of later violent behavior. Pregnancy disturbances during fetal development may be especially important. It is difficult to find adequate indices of pregnancy disturbance. If such disturbances are serious enough, however, they can produce anomalies in the developing fetus. (Waldrop, Bell, McLaughlin and Halverson, 1978). This opens the possibility of indexing the effects of disorders in embryonic development by noting and counting the resultant visible minor physical anomalies (MPAs). There are as many as 87 MPAs which have been studied. Most research, however, focusses on a list of 16-18 anomalies: head circumference beyond normal range; more than one hair whorl; fine electrostatically-charged hair; epicanthus; hypertelorism; malformed ears; low-set ears; asymmetrical ears; soft pliable ears, no ear lobes; high steepled palate; furrowed tongue; smooth tongue with rough spots; curved fingers; single palmar crease; wide gap between first and second toes; partial syndactylia of toes; and third toe longer than second. While some heritability of MPAs has been demonstrated, Rapoport, Quinn & Lamprecht (1974) and Waldrop & Halvorsen (1971) have noted that MPAs are strongly associated with disorders of pregnancy (e.g., rubella during pregnancy or bleeding during the first trimester).

The measurement of MPAs is reliable; high stability has been demonstrated from the newborn period up to seven years of age (Waldrop, Bell, McLaughlin & Halverson, 1978). There is some evidence that MPAs measured in the newborn period predict to later

hyperactivity. "Boys with high newborn anomaly scores were almost always seen as hyperactive at age 3" (Bell & Waldrop 1982, page 212). Hyperactivity in boys is highly related to later serious delinquency (Satterfield, in press). In the Bell & Waldrop paper MPAs are found to be related to poor attention span, and impulsivity-aggressiveness.

These considerations suggest that some teratogenic factors which affect the developing physical characteristics of the fetus also damage unspecified CNS structures or processes that are related to the inhibition of aggression, activity level and attentional processes. We hypothesize that subjects in the IE sample who have MPAs will have suffered CNS damage which will reduce their ability to inhibit impulses (including antisocial impulses). In terms of criminal behavior this increased level of impulsiveness should be seen later chiefly as an increase in number of violent offenses.

Methods

Laterality-Handedness. Five measures were used as indicators of degree of sinistrality: two measures of hand dominance, two measures of foot dominance, and a measure of eye dominance. The first measure of hand dominance was the score that the subject received on the Danish translation of the Annett (1970) questionnaire (possible range: 0-11). The questions attempted to determine preference in hand use, for example, Which hand do you use to throw a ball to hit a target? Which hand do you use to unscrew the lid of a jar? Which hand do you use to deal playing cards? The second measure of handedness was a neurologist's

judgment of the subject's hand of dominant use. The judgement was based on a 1 1/2-hour neurological examination (Mednick & Michelsen, 1977).

Laterality-footedness. The first measure of foot dominance was based upon which foot subjects used to kick a ball, balance, and hop. The subjects' foot dominance score ranged from 1 to 3 based upon the number of these tasks that he performed with the left foot. The second measure of foot preference was a judgement made by the neurologist. Both for this measure and for the handedness measure, the neurologist was allowed to score the individual as having no dominant hand or foot.

Minor physical anomalies. As mentioned,an extensive neurological examination and a test of motor impairment (Stott, 1966) were administered. The examination procedure consisted partly of items from adult neurological examinations (Paine & Oppe, 1966; Touwen & Prechtl, 1970), partly of subtests from pediatric neurological examination procedures and motor performance tests (Backwin, 1968; Rutter, Graham, & Yule, 1970. Test order was similar to that used by Touwen and Prechtl (1970).

As part of this neurological examination MPAs listed above were assessed. In view of the low frequency of anomalies no attempt was made to scale this characteristic. We simply counted the number of anomalies noted; This is the usual practive in this research.

RESULTS

Laterality. Our results with adult crime are quite similar to those we observed with delinquency with this sample. A significant proportion of the offenders are left-handed and left footed. The pattern is true for thieves (handedness: chi square(1)=9.40, $p < .005$; footedness: chi square(1)=6.41, $p < .05$) as well as for violent offenders (handedness: chi square(1)=7.51; p .01; footedness: chi square(1)=10.34, $p < .001$). Of left handers, 35% were arrested for some violent crime while 10% of the right handed individuals were arrested for a violent crime. The pattern is virtually the same for footedness (36% and 7%, respectively).

MPAs. The mean number of MPAs for the various offender and non offender groups is given in Table 8. As can been seen MPAs are significantly increased only for violent offenders.

Summary

We have examined two factors relating to neurological functioning. Left side lateral preference (right hemisphere dominance) relates to both thievery and violent offending and not to uncontrolled behavior. We have earlier noted that left hemisphere dominance has been associated with more planful, rational, less impulsive behavior. It is reasonable to expect that violent offenders might evidence deficits in these left brain characteristics. It would be interesting if we were able (in a

TABLE 8

MEAN NUMBER OF MINOR PHYSICAL ANOMALIES BY TYPE OF OFFENSE

Type of Offense	N Mean Number of Anomalies					
	Number of Offenses			f	df	p
	0	1	2+			
Thievery	2.9	2.9	3.2			ns
Uncontrolled Behaivor	2.9	2.8	3.2			ns
Violence	2.9	3.6	3.6	5.81	1.95	<.02

future study) to see if the level of plannedness or impulsiveness of thefts is related to lateral preference. For purposes of this future study it will be necessary to read and rate the original police records.

The greater number of MPAs in violent individuals suggests that they suffered some teratogenic influence during fetal development. The relationship of MPAs to certain behavioral problems has indicated the likelihood that CNS damage to the fetus must have been suffered simultaneously. We have interpretted this damage as serving to reduce the ability of the individual to inhibit antisocial acts.

INTELLECTUAL PERFORMANCE

A number of studies have reported that delinquents, and adult criminals tend to have lower than average IQ scores (Caplan, 1965; Prentice and Lelly, 1963; Thomas and Thomas, 1928; Tuchin, 1939; Woodward, 1955; Hirschi and Hindelang, 1977). Low intelligence has also been found to be predictive of criminality in prospective, longitudinal cohort studies (Moffitt et al, 1981; McGarvey et al, 1981; Van Dusen and Mednick, 1983). Violent criminals have been observed to be of the lowest intelligence among offenders (Guttridge et al, 1983). The difference in intelligence appears primarily on verbal and not performance tests.

Several mechanisms have been suggested to explain the role of IQ in the etiology of crime. One of the early ideas suggested that criminals have difficulty distinguishing right from wrong (moral retardation) (Goddard, 1914; Goring, 1913). The difference in IQ, however, is hardly enough to relate to moral retardation, especially since many low IQ individuals seem to have little trouble behaving morally or indicating a knowledge of moral codes.

Another suggestion was that individuals with low intelligence are more easily apprehended than others and are therefore disproportionately represented in samples studied (Haskell and Yablonsky, 1974). Self-report studies, however, disconfirm this possibility because self-reported criminals also have lower intelligence than non-offenders (Hirschi and Hindelang, 1977; Weis, 1973; West and Farrington, 1973). It has also been sug-

gested that IQ is a spurious variable in the relationship between socio-economic status (SES) and delinquency (Chambliss and Ryther, 1975); Simons, 1978; Sutherland and Cressy, 1939; 1974; Woodward, 1955). Lower class children are more likely to perform less well on intelligence tests and are also more likely to commit crimes. In contrast with this view, a number of studies have shown that the IQ-criminality relationship holds even with SES held constant. (Moffitt et al, 1981; McGarvey et al, 1981; Gabrielli and Mednick, 1980, Hirschi and Hindelang, 1977; Kirkegaard-Sorensen and Mednick, 1977; Rhodes and Reiss, 1969; Short and Strodtbeck, 1965).

In the present investigation, we attempt to determine how IO measures obtained at age 12 discriminate the offender groups. From our own and others work we hypothesize that verbal ability will be poorer in the criminal especially the recidivist.

In 1972, when the subjects were intensively assessed, they were administered five subtests of a Danish translation of he Wechsler Intelligence Scale for Children (WISC): Vocabulary, Similarities, Block Design, Object Assembly, and Mazes.

RESULTS

Table 10 shows the Full Scale IQ, Performance IQ and Verbal IQ scales and five subscale scores for our subjects by whether they have been arrested zero, one, or 2 or more times for each of the types of crimes. Full Scale and Verbal IQ scores are higher than would be expected for a comparable group of American children When Danes are evaluated by U.S. norms, the IQ scores are inflated; the difference can be attributed to the substitution of

TABLE 9

MEAN INTELLIGENCE TEST RESULTS FOR NON-OFFENDER AND OFFENDER GROUPS

		N	Maze	Object Assembly	Block Design	Vocabulary	Similarities	Verbal IQ	Performance IQ	Total IQ
Total	0	(64)	10.63	13.14	12.98	12.08*	11.44**	111.44**	115.78	114.78*
Number of	1	(27)	10.70	12.19	12.19	11.52	10.93	108.04	111.96	110.81
Offenses	2+	(38)	10.05	12.92	12.21	10.40	9.89	100.96	111.96	106.76
Number of	0	(93)	10.57	12.97	12.72	11.68	11.17*	108.41*	114.67	113.04
Thievery	1	(17)	10.41	12.81	12.59	11.53	10.53	106.65	113.47	110.82
Offenses	2+	(19)	10.05	12.47	11.95	10.37	9.42	99.53	110.37	105.16
Number of	0	(112)	10.54	12.88	12.66	11.53	10.96	108.13	114.24	112.09
Violent	1 +	(17)	10.06	12.82	12.12	11.06	10.12	104.06	111.47	108.29
Offenses										
Number of	0	(90)	10.42	12.87	12.71	11.62	11.08	108.83	114.02	112.39
Uncontrolled	1	(20)	10.65	13.60	12.65	11.40	10.90	107.50	116.30	112.70
Behavior	2+	(19)	10.53	12.16	11.95	10.79	9.68	101.79	110.63	106.63
Offenses										

* $p < .05$

** $p < .01$

NOTE: The p value relates to the column of these three means associated with the stars

some less difficult verbal items in the Danish form of the WISC (Hess, 1973). Examining the results in Table 9 we see that, for each type of crime measure, non-offenders score consistently higher than offenders. Significant differences appear for Verbal IQ and verbal subtests for overall crime and for thievery. Duncan-multi range tests indicate that the recividists are significantly lower in verbal ability than the other two groups of offenders. Recidivists in each type of crime evidenced significantly inferior verbal IQ in contrasts with the non-offenders.

Comment

This finding is in keeping with a fairly consistent literature. Why is verbal ability so poor in offenders especially recidivists? Camp, (1977) has noted that young (6-8 years of age) aggressive boys exhibit poor verbal ability. She finds that they fail to use mediating verbal signals to control their behavior. Camp suggests that verbal tools are critical for the cognitive control of behavior. She in part ascribes aggressive behavior to "a high threshold for activating self regulating verbalizations." (p 152) If a boy is deficient in verbal skills and vocabulary this could very well prove to have the same consequences for self regulation as the functional deficit implied by the "high threshold". We could therefore suggest that the poor verbal ability of the criminals (especially recidivists) may serve to weaken the capacity of these individuals to use linguistic control systems to inhibit their antisocial behavior.

FAMILIAL FACTORS

The family study has presented a detailed analysis of the family-related variables which predict to criminal behavior in the male offspring. These include paternal recidivism, family instability, SES and maternal crime. The purpose of this section of the report is to determine to what degree these findings are mirrored in the data of the IE study. Both samples were drawn from the same birth cohort which implies a similarity of age and political and social period of development. In addition the methods used to define and score family factors are almost identical for the two samples.

There are, however, important differences between the two samples which must be considered before launching into a comparison of findings. The family study sample is drawn from a random selection of subjects from the total birth cohort. The IE sample, on the other hand, consists of children of schizophrenics, children of psychopathic fathers and character disordered mothers as well as controls. The heavy emphasis on psychopathology in this sample means that for a majority of these children family life was unusually unstable and deviant. Offord (1978) has shown that for unstable families, other social-familial factors predict very poorly to delinquency and crime in the children. The reader must therefore be prepared for a relatively modest level of relationship in the IE sample between family factors (other than family stability) and criminal behavior. In the Family Study nonintact families evidenced poor or nonexistent relationships

between other family characteristics and criminality in the children. The level of broken homes is considerably higher in the IE sample than in the Family Study. This is seen in the mean number of constellations and the level of stability of the families (see Table 2, Family Study and Table 11, IE Study).

It is also worth noting that while the interview methods and materials were quite similar in the two studies, the IE Family Interview was taken when the children were 11-13 years of age; in the Family Study the interview was held when the children were 17-19 years of age. At the very least this means that the IE data bank does not have family information after the age of 13 years.

In view of the disturbed nature and smaller size of the IE sample we will not follow all of the detailed analysis plan of the Family Study. We will restrict ourselves to a comparison of corresponding discriminant analyses in the two samples examining familial factors predicting to thievery, uncontrolled behavior, violence, and total number of offenses.

Table 10 compares the family variables examined in the two samples. Table 11 presents the means and standard deviations for these variables in the IE sample; Table 12 presents the intercorrelations among these variables.

Thievery. The family variables of the IE sample (Table 10) were entered as independent variables into a discriminant analysis to predict number of thievery offenses (0, 1, or 2+). Table 13 indicates that mother's age at the birth of the child (mother's age) and family stability are significant predictors with a

TABLE 10

FAMILY VARIABLES

VARIABLE	SAMPLE FAMILY STUDY	IE
Number of constellations after child's fourth year	Yes	Yes
Mother one-time offender	Yes	No
Mother recidivist	Yes	No
Father one-time offender	Yes	Yes
Father recidivist	Yes	Yes
Number of years with biological father	Yes	Yes
Mother's age at birth of child	Yes	Yes
Family size	Yes	Yes
Mother's contentment	Yes	No
Mother's health	Yes	No
SES	Yes	Yes

TABLE 11

Means and Standard Deviations
for Predictor Variables

Variable	Number	Mean	Standard Deviation
Total Number of Offenses	129	.80	.87
SES	126	2.27	1.80
Number Constellations	126	2.40	1.76
Family Size	121	1.40	1.11
Mother's Age	128	25.63	7.13
Years with Father	129	7.29	4.63
Father Recidivist	107	0.44	.50
Unstable Family	126	.81	.77
Father Once	128	.15	.36

TABLE 12

CORRELATION MATRIX FOR PREDICTOR VARIABLES

Variables	1	2	3	4	5	6	7	8	9
1. Total Number of offenses	--	-.18	.13	.06	-25	-.07	22	20	-08
2. SES		--	-.35	-18	21	32	-34	-32	-11
3. Number of Constellations			--	17	-14	-44	29	66	-04
4. Family Size				--	-21	,02	,08	-01	-02
5. Mother's Age					--	19	-01	-12	-03
6. Years with Father						--	-26	-64	-01
7. Father's Recidivism							--	27	-30
8. Unstable Family								--	-.01
9. Father's Criminality Once									--

Table 13

TEPWISE DISCRIMINANT ANALYSIS: Thievery
EGREES OF FREEDOM FIRST STEP: 2,85

STEP	PREDICTOR VARIABLE	F-RATIO TO ENTER	DF	WILK'S LAMBDA	F-MATRIX			DF
					NONE ONCE	NONE RECID	ONCE RECID	
1	Mother's age at Birth	6.76	2,85	0.86	10.64	5.52	0.80	1,85
2	Family Stability	3.85 *	2,84	0.79	5.27	6.61	2.43	2,84
3	Father's Recidivism	1.55	2,83					
4	Years with Father	1.54	2,82					
	Father's Criminality Once	1.10	2,81					
6	SES	0.89	2,80					
7	N of Constellations After 4	0.22	2,79					
8	Family Size	0.03	2,78					
9								
10								
11								
12								
13								
14								

* - last entry significant at the $p < .05$

Wilks Lambda of .79. The two significant variables discriminate the non-offenders from the other two groups. This analysis has features which both distinguish it from the Family Study thievery analysis (see Family Study, Table 7) and which are similar. One of the most consistent and most powerful predictors in the Family Study is father's recidivism. This is in accordance with previous research by others and our own studies (Kirkegard-Sorensen and Mednick 1977; Mednick, Gabrielli and Hutchings, in press.) In each analysis in the IE study the father's recidivism variable only approaches significance.

This difference in results was anticipated. The IE sample was selected to be at high risk for criminal behavior. In many cases in which the father is not registered as an offender the mother is severely schizophrenic or is suffering from character disorder, both at levels which required hospitalization. Some fathers who are not recidivists have psychiatric hospital diagnoses of "psychopath". Such diagnosed psychopaths are usually severely alcoholic and have extremely weak attachments to society. It is clear that our "controls" for recidivistic fathers are often at least as deviant as our index group. For this reason we anticipated that the variable father's recidivism would have weak to moderate effects.

We indicated already that mother's age and family instability are significant predictors of amount of thievery. Father's recidivism is the next most important predictor but it does not reach statistical significance. This is doubtless due to the already mentioned difficulties in the non-recidivistic groups of

parents. In the control group (non-deviant parents), however, father's recidivism was a significant predictor of thievery in the children.

The literature review on family influences suggested that family stability is a powerful predictor of criminality. This suggestion is strongly supported by the discriminant analysis presented in Table 13. The Family Study also found that family stability (indicated in that analysis by number of constellations) was an important predictor. In the IE analysis family stability entered on the second step of the discriminant analysis as a significant predictor.

Mother's Age entered on the first step of the discriminant analysis. The younger the mother at the birth of her son the greater the likelihood that son would be arrested as a thief. In the IE sample, mother's age ranges from 14-46 years. The younger mothers tend to be unmarried, of low SES and eventually have larger families. (See Table 12). The pattern of family factors apparently contributing to a predisposition to thievery offenses in the IE sample includes family instability and young, unmarried mothers. The latter variable implies low SES and the large family size. These findings agree quite well with the comparable Family Study analysis (Table 8). When this analysis was repeated for the controls only the same predictors were noted except that father's recidivism and family stability reversed positions.

Uncontrolled Behavior.

An analogous discriminant analysis was completed predicting to uncontrolled behavior offenses (Table 14). The results were

Table 14

TEPWISE DISCRIMINANT ANALYSIS: Uncontrolled Behavior
EGREES OF FREEDOM FIRST STEP: 2, 87

STEP	PREDICTOR VARIABLE	F-RATIO TO ENTER	DF	WILK'S LAMBDA	F-MATRIX			DF
					NONE ONCE	NONE RECID	ONCE RECID	
1	Mother's age at birth	3.75 *	2,87*	0.92	5.25	3.93	0.04	1,87
2	N of Constellations After 4	2.84	2,86					
3	FOMCE	1.00	2,85					
4	Family Stability	0.78	2,84					
	Family Size	0.96	2,83					
6	Father's Recidivism	0.58	2,82					
7	SES	0.34	2,81					
8	Years With Father	0.08	2,80					
9								
10								
11								
12								
13								
14								

* - last entry significant at the $p < .05$

Table 15

STEPWISE DISCRIMINANT ANALYSIS: Violent Offenses
DEGREES OF FREEDOM FIRST STEP: 1,69

STEP	PREDICTOR VARIABLE	F-RATIO TO ENTER	DF	WILK'S LAMBDA	F-MATRIX			DF
					NONE ANY	NONE RECID	ONCE RECID	
1	N of Constellations after 4	4.85*	1,69	0.93	4.85			1,69
2	SES	2.21	1,68					
3	Father Crime Once	1.04	1,67					
4	Family Stability	0.96	1,66					
5	Family Size	0.66	1,65					
6	Mother's age At Birth	0.49	1,64					
7	Father Recidivism	0.24	1,63					
8	Years with Father	0.06	1,62					
9								
10								
11								
12								
13								
14								

* - last entry significant at the $p < .05$

quite similar to the thievery analysis. Mother's age entered at the first step with number of constellations as the next step (not quite significant). In the comparable Family Study analysis SES and number of constellations were the two significant predictors. In view of the relationship between mother's age and SES the two analyses are comparable. In fact in the Family Study analysis of uncontrolled behavior which is restricted to intact families, mother's age appears as a significant predictor, further indicating the agreement between the results of these two independent projects.

Violent Offenses. A similar discriminant analysis was completed for violent offenders (Table 15). Number of constellations entered at the first step followed by SES (not significant).

Summary

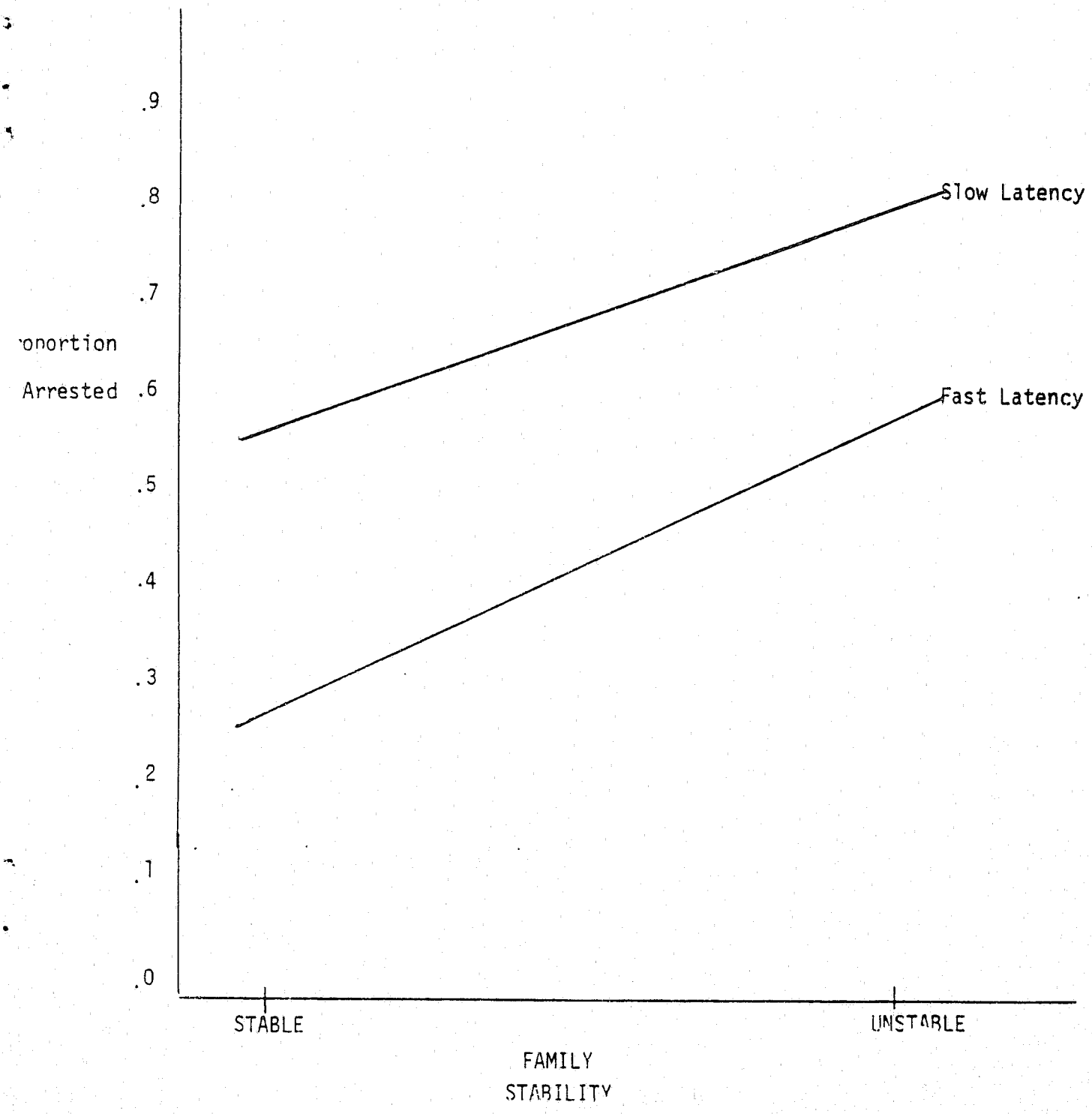
It is clear that family instability is a critical variable associated with all of these three forms of criminal behavior (thievery, controlled behavior and violence). The family variables do not present differential patterns of factors predicting to the different types of crimes. Family instability seems to provide a general predisposition to criminal behavior.

BIOSOCIAL INTERACTION

In this section we will examine how family factors combine with biological and psychological factors in relating to criminal behavior. The analyses of the Family Study and the family factors of the IE sample revealed that the variable Family Stability summarized very well the family influences on criminal behavior. Consequently we decided to see how Family Stability combined with the biological measures in influencing future criminal behavior. The variables chosen for this analysis therefore, include Family Stability (up to age 11 years) in combination with ANS factors (latency, recovery and number of OR), CNS factors (relative amounts of alpha and beta activity), verbal intelligence, and neurological factors (MPAs and laterality). The relationships are depicted in Figures 1-11. In Table 16 we present the F values associated with the Family Stability variable, the biological or psychological factor and the interaction. These analyses were performed as stepwise regressions with the variables entered in the following order: family stability, biological factor, interaction. We will first describe the relationships in the figures and then consider their interpretations.

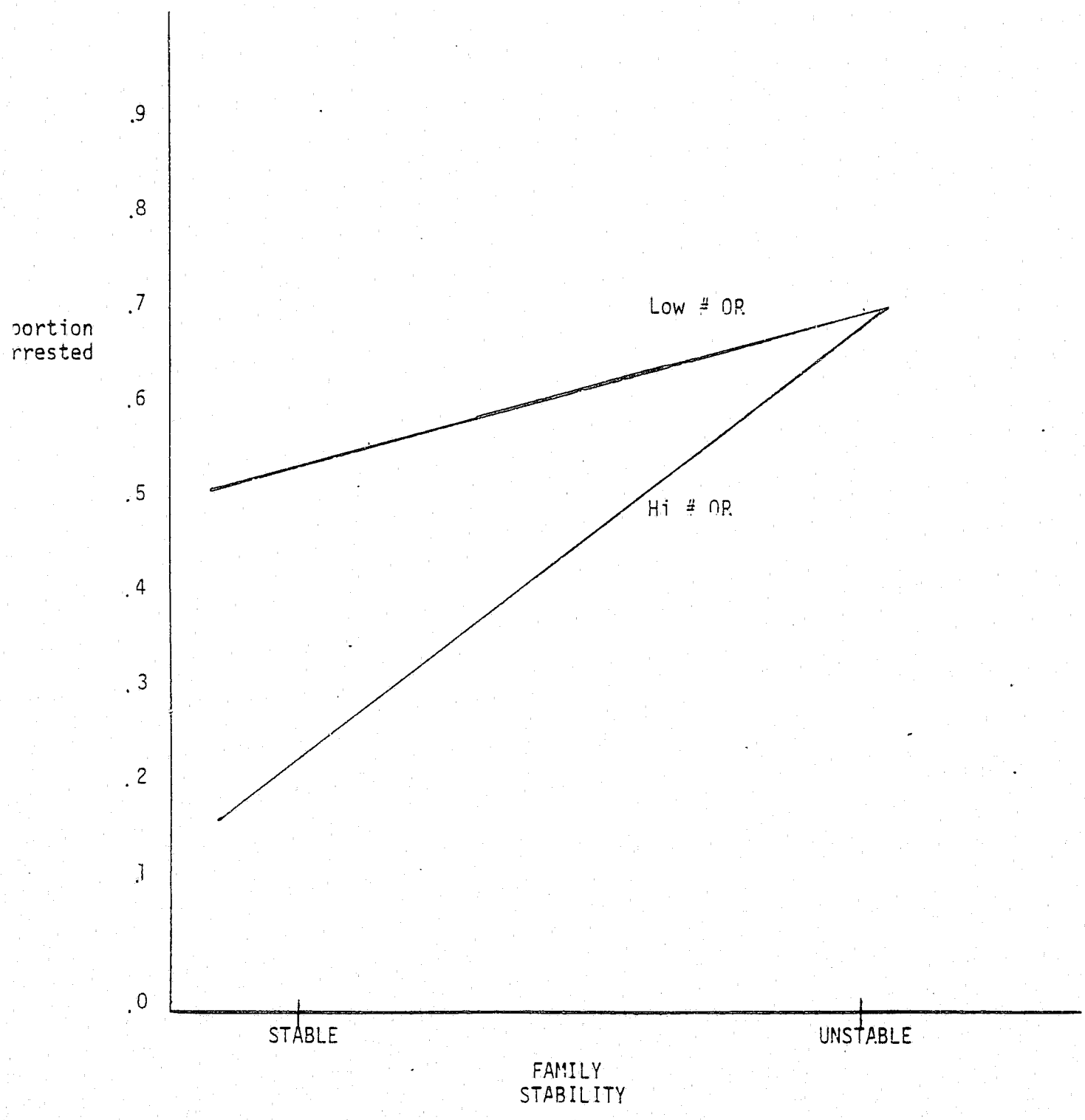
Skin Conductance. In Figures 1, 2 and 3 we have plotted the proportion arrested as a joint function of family stability and properties of the skin conductance response (dichotomized at the mean). (The skin conductance data did not differentiate between types of criminal activity.) As mentioned above in Table 16, we present the ANOVA for stability and skin conductance latency, and

FIGURE 1



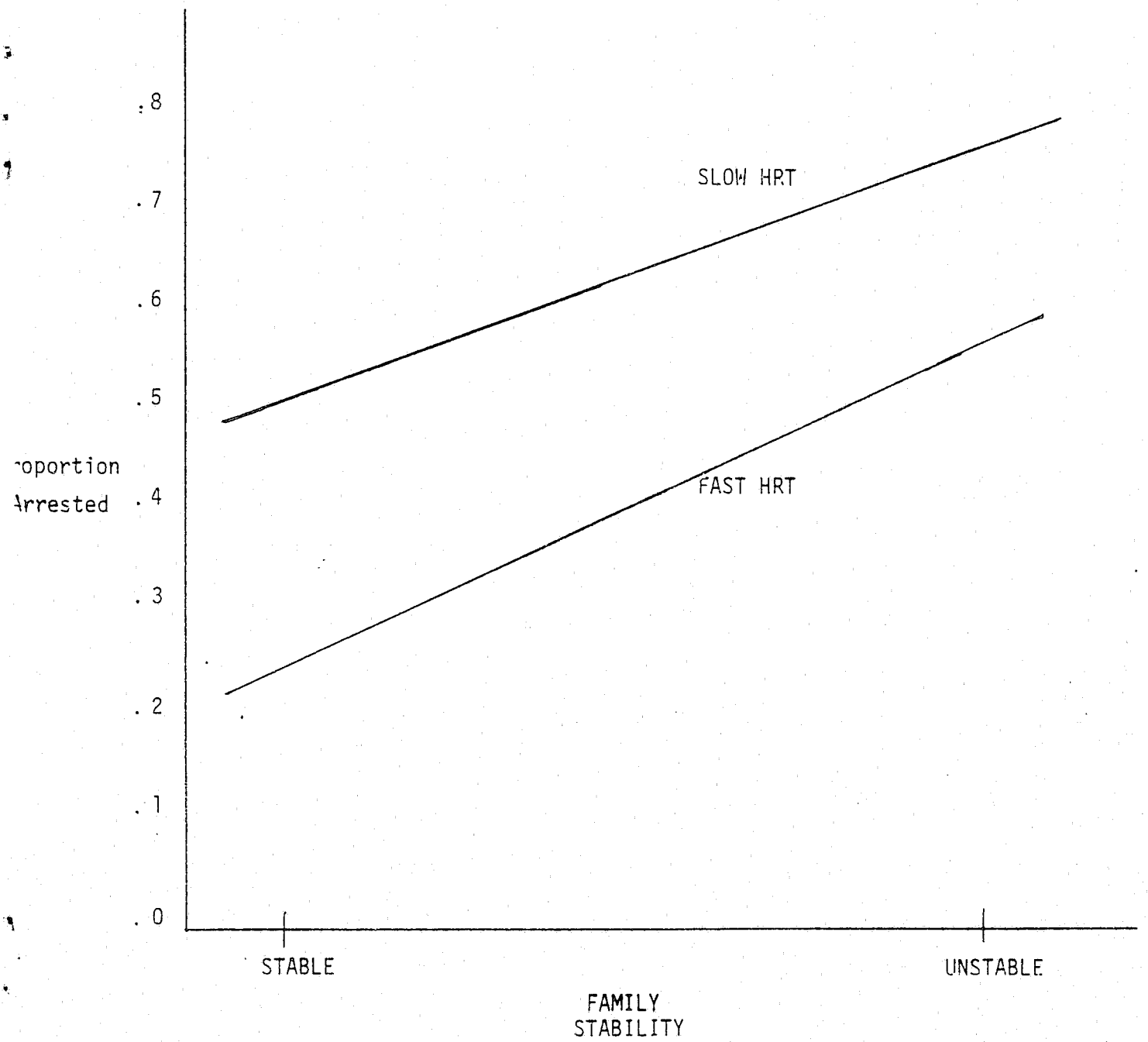
Proportion arrested by family stability and skin conductance latency

FIGURE 2



Proportion arrested by family stability and number of orienting (OR) skin conductance responses

FIGURE 3



Proportion arrested by family stability and skin conductance half recovery time (HRT)

responsiveness and recovery, and for interactions of the family and biological factors.

The subjects with greater family instability and slower ANS latency tend significantly to commit more criminal acts. There is no statistical interaction; the independent variables have an additive effect. The highest proportion of subjects arrested is attained by the subgroup with both slow ANS latency and unstable family conditions. Somewhat the same pattern is seen for family stability and number of OR responses. While the plot suggests an interaction it does not reach statistical significance. The same additive relationship seen for latency is seen for half recovery time.

EEG. The most interesting finding with the EEG relates to uncontrolled behavior offenses. Figure 4 presents the proportion of subjects with uncontrolled behavior offense arrests as a joint function of family stability and relative amount of beta activity. Inspection of the ANOVA and the Figure indicates that there is no significant statistical interaction. The role of family stability and fast brain activity in uncontrolled behavior offenses is additive. The greatest proportion of uncontrolled behavior offenders is reached by the group with relatively large amounts of fast beta activity who are raised in unstable families. The EEG did not relate to violence.

Neurological Factors. Figures 5 and 6 plot the proportion of subjects with thievery arrests and uncontrolled behavior arrests as a joint function of family stability and lateral preference. Figures 7 & 8 plot the same data, replacing lateral

preference with MPAs. Significant statistical interactions are observed in Figures 6 and 7. While laterality is not related to thievery or uncontrolled behavior in those raised in stable families, in the context of an unstable family background, right brain dominance is associated with increased thievery and uncontrolled behavior. Interestingly enough, the other neurological factor, MPAs, evidences the same type of interactive relationship with family stability. Those reared in a stable family do not evidence increased levels of arrests if they have a large number of MPAs; those reared in unstable families have a relatively large number of arrests if they have a large number of MPAs (Figure 10). What is of special interest is the fact that MPAs interact with family stability in predicting violence. Almost 70% of those with unstable families and a relatively large number of MPAs are arrested for at least one violent offense (Figure 9).

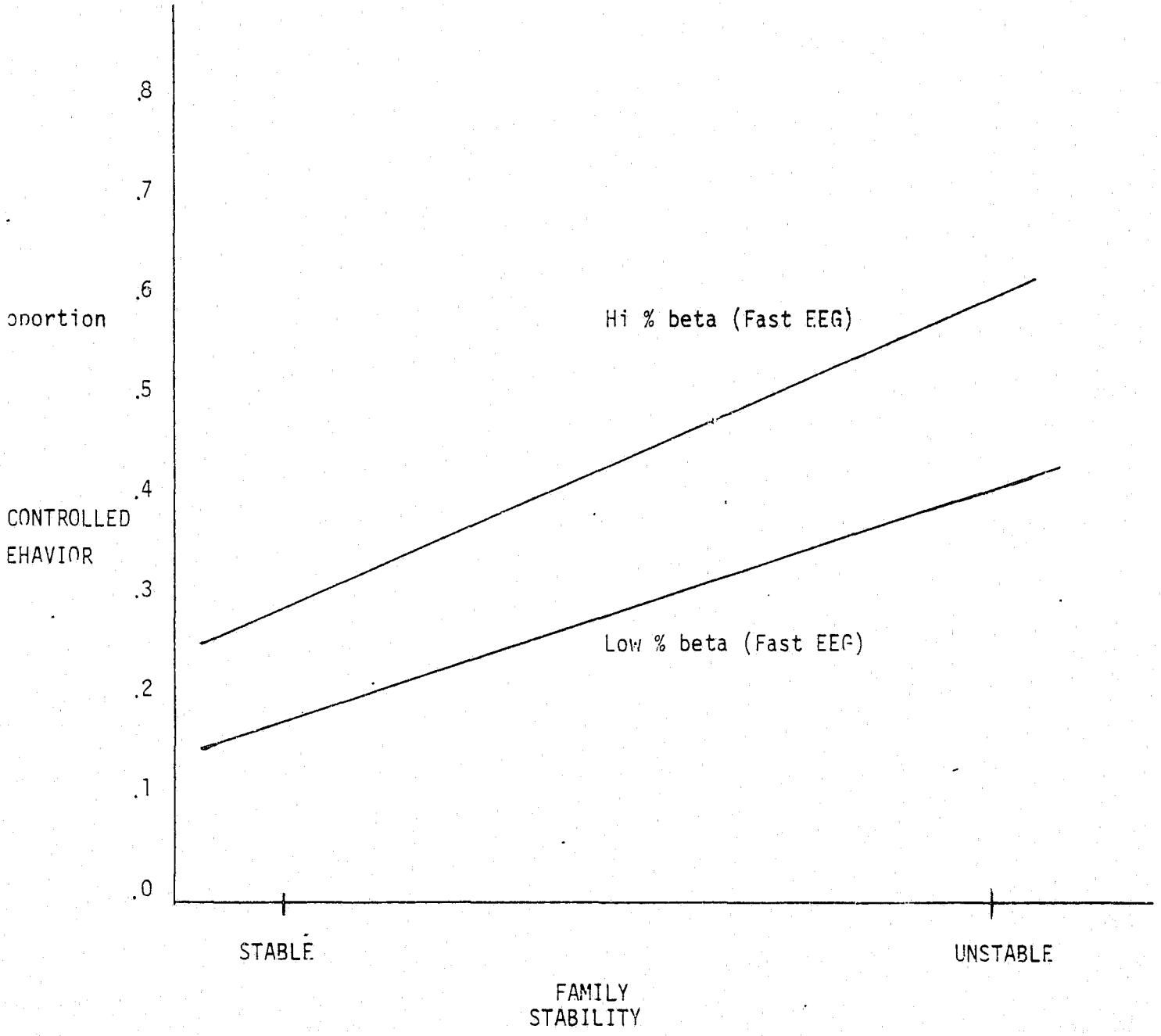
Last, in Figure 11 we see the large additive effect of verbal IQ and family stability on number of arrests. Those reared in unstable families who have low IQs achieve the highest number of arrests.

COMMENT

An application of these results.

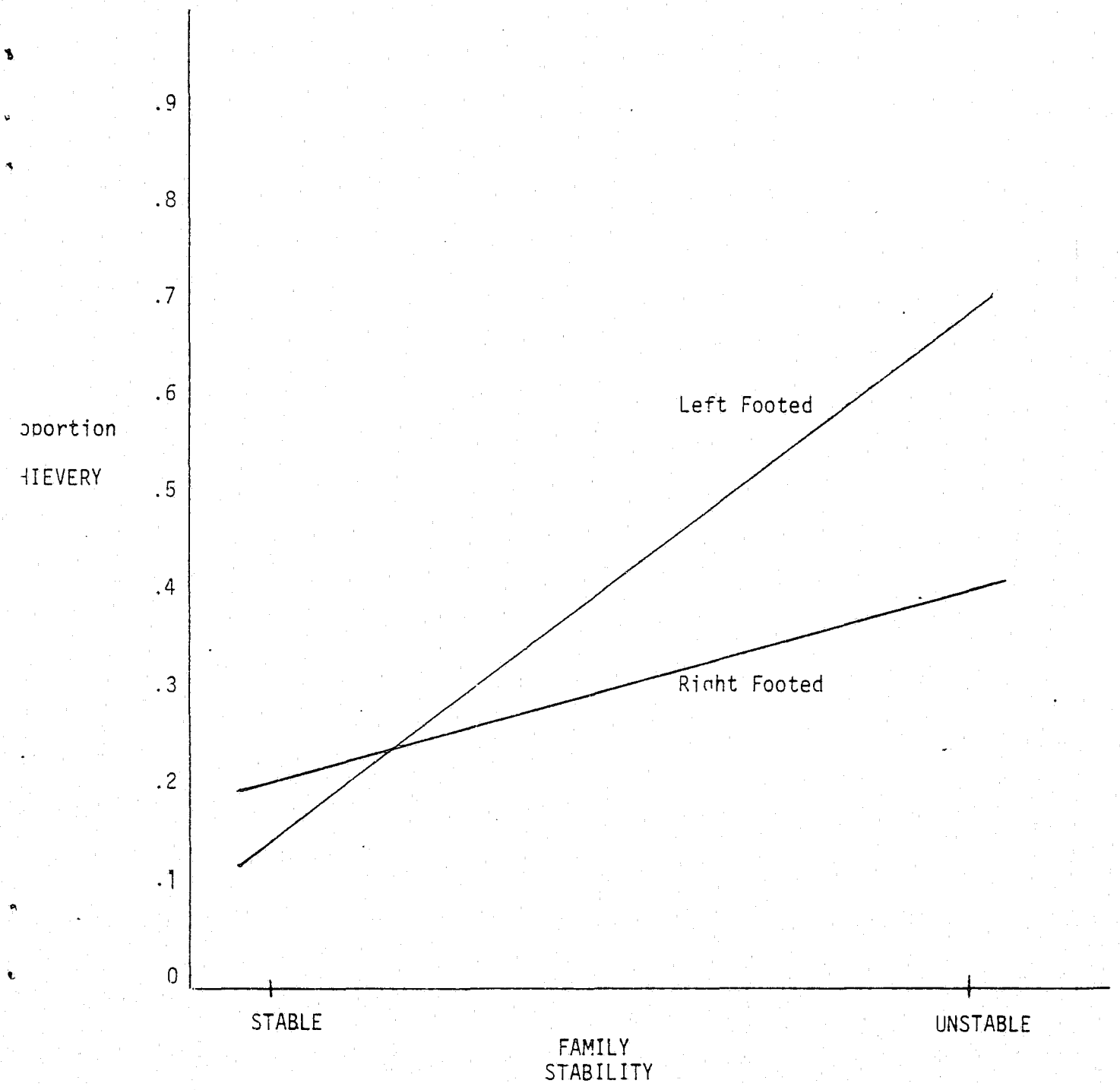
The figures tell an interesting story. First we should note that the psycho-biological and family factors relate additively and independently to expressions of criminal behavior. That is, they are not explaining the same variance. This fact has some implications for application of these findings. Society's most

FIGURE 4



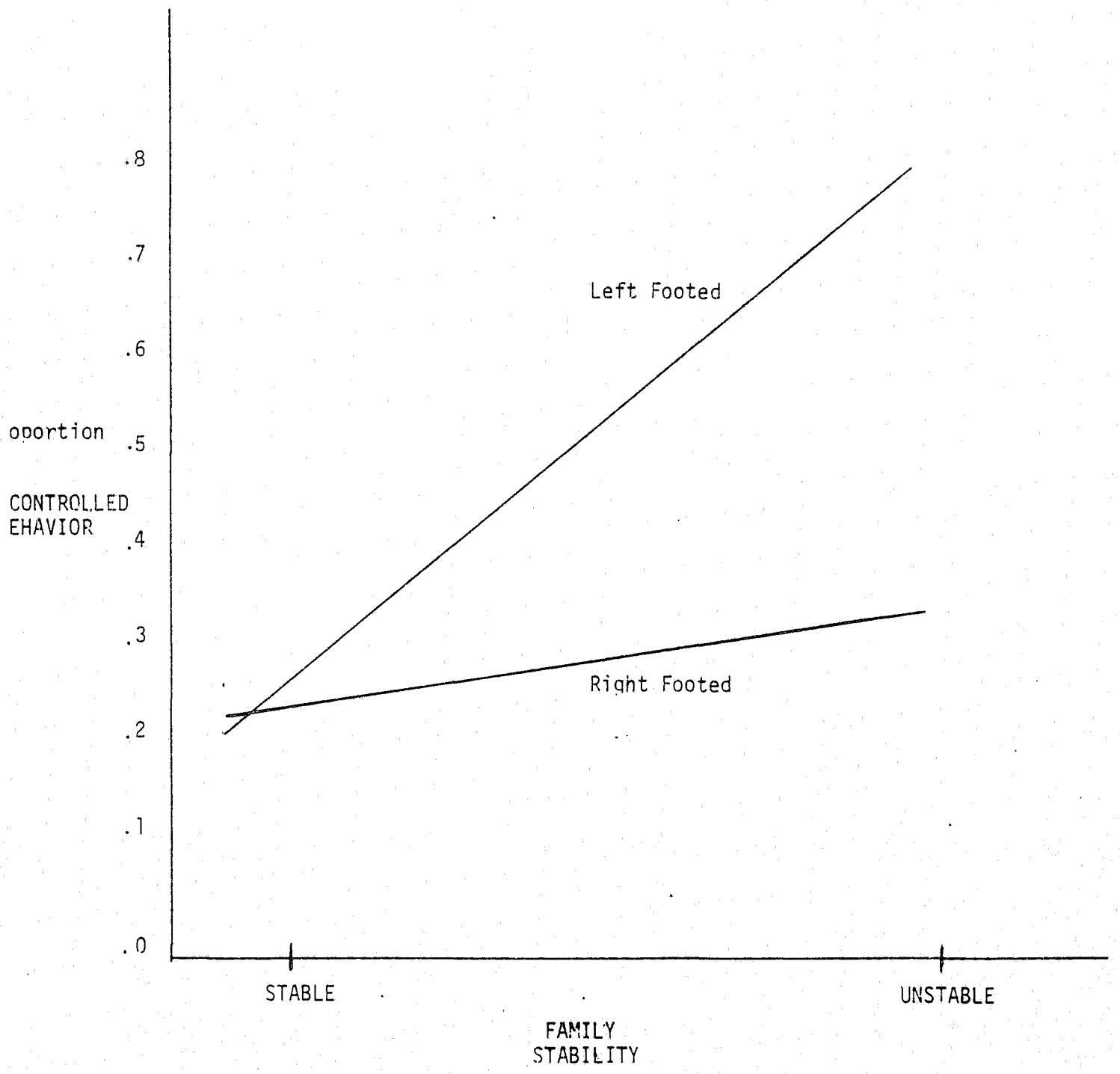
Proportion with uncontrolled behavior offenses by family stability and fast EEG activity

FIGURE 5



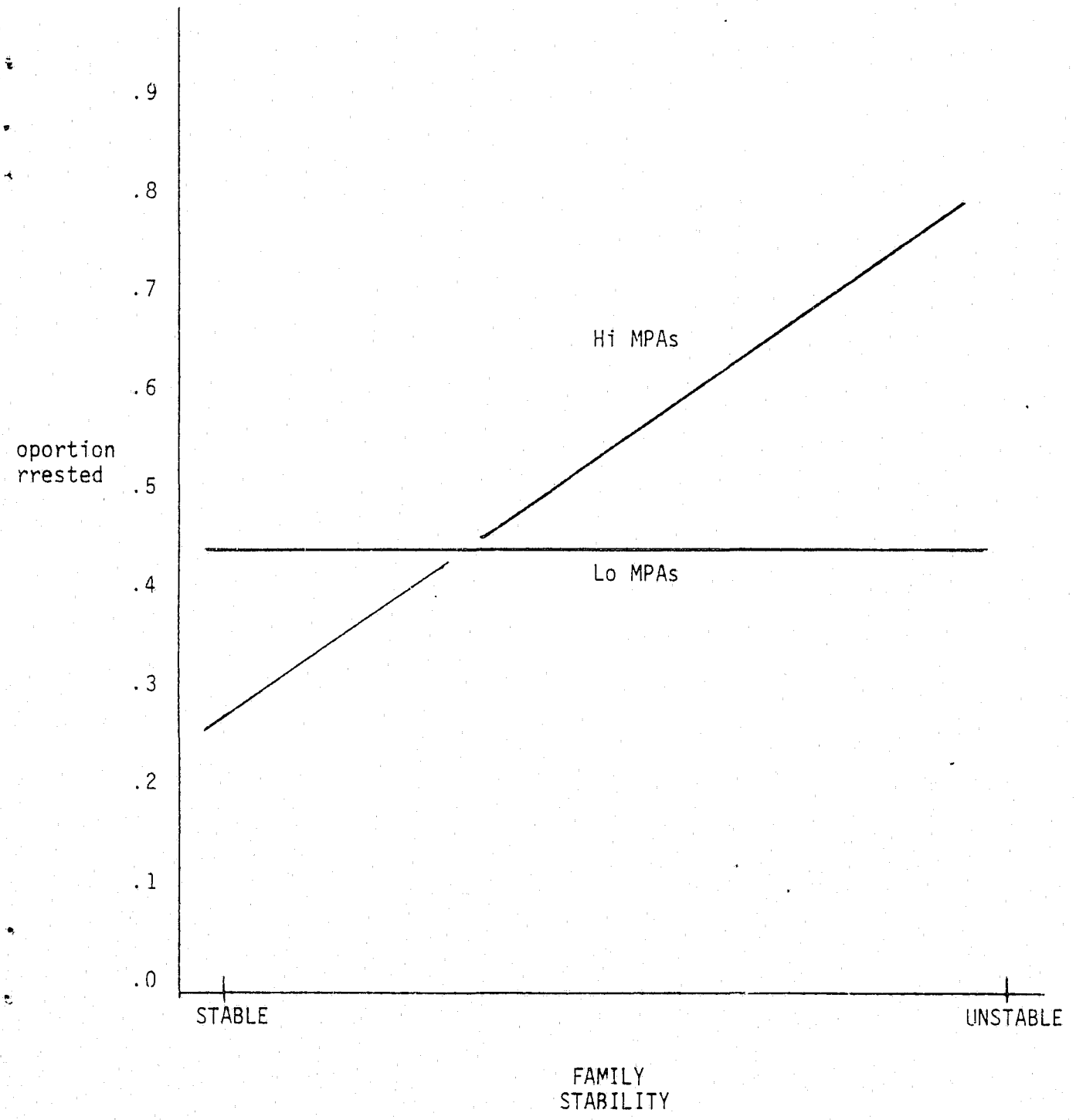
Proportion with thievery arrests by family stability and left foot preference

FIGURE 6



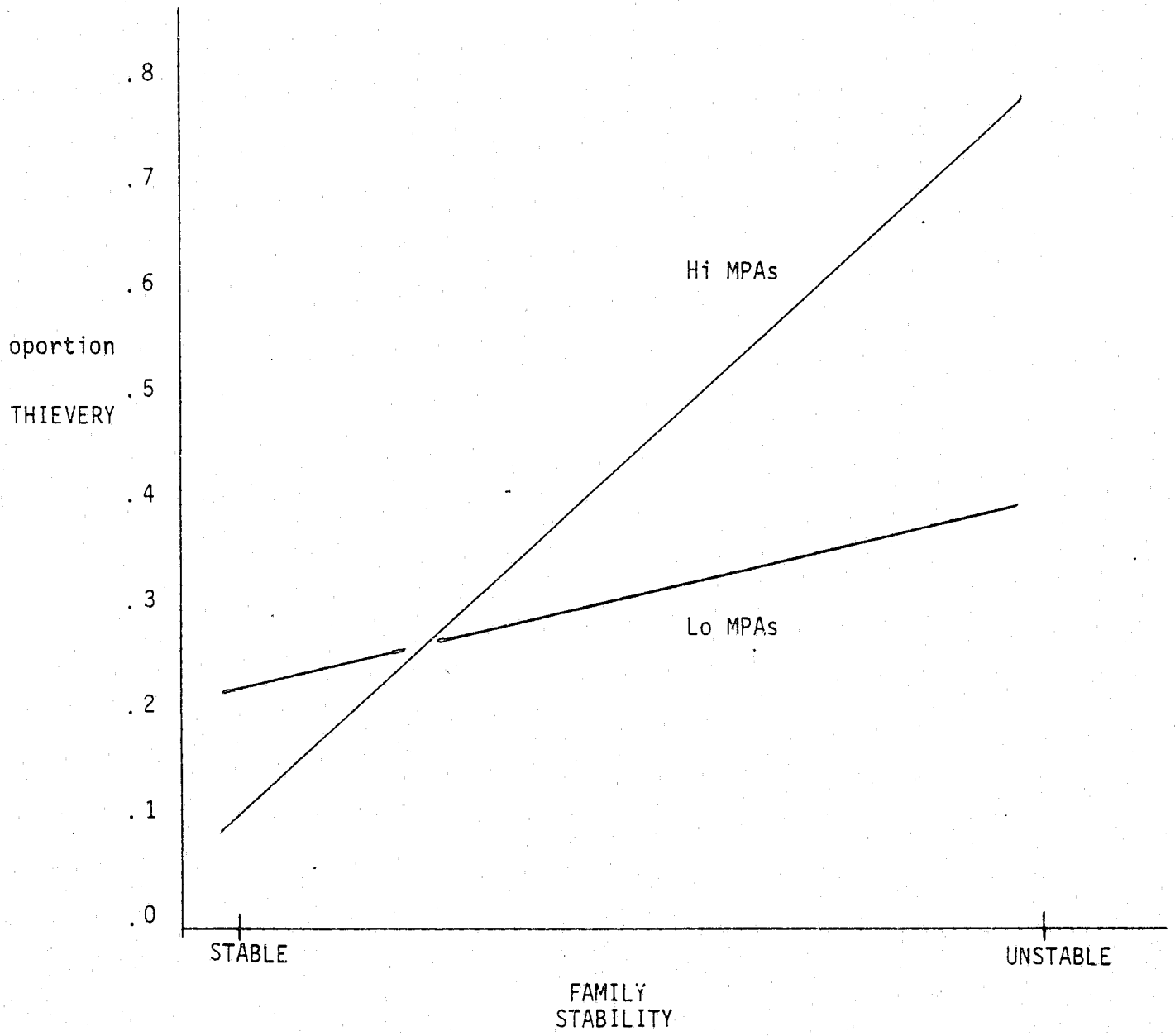
Proportion with uncontrolled behavior arrests by family stability and left foot preference

FIGURE 7



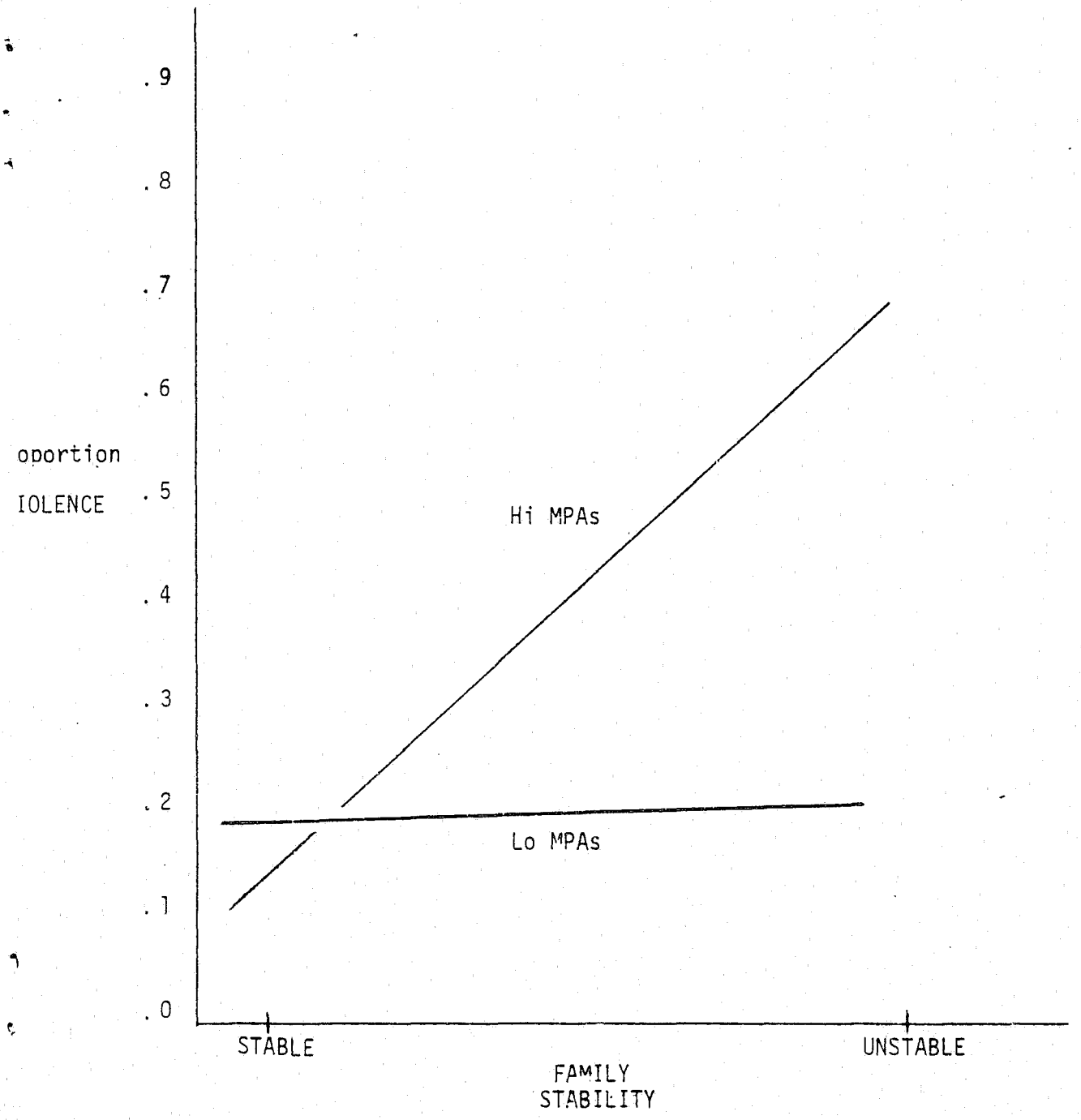
Proportion arrested by family stability and MPAs

FIGURF 8



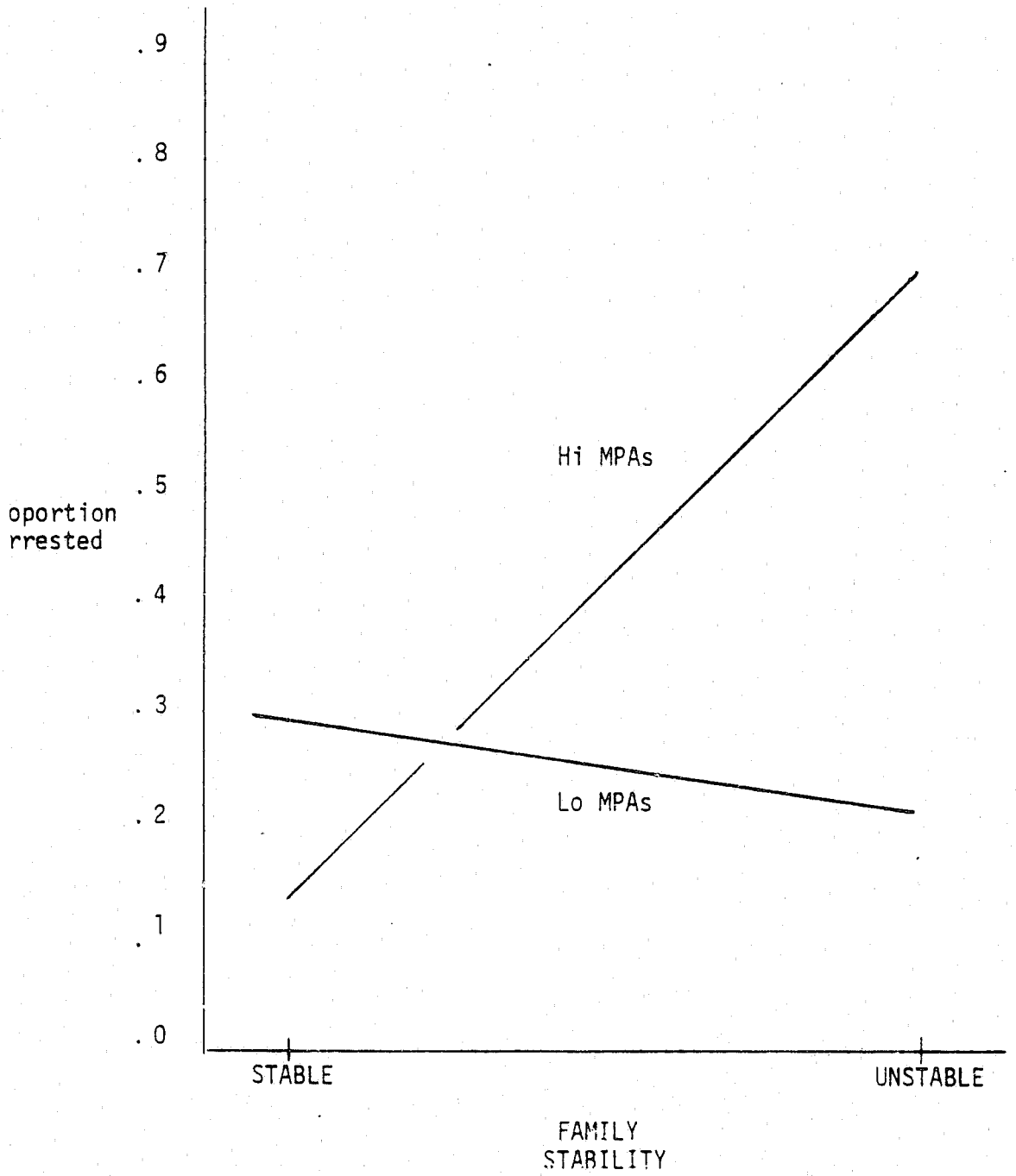
Proportion arrested by family stability and MPAs

FIGURE 9



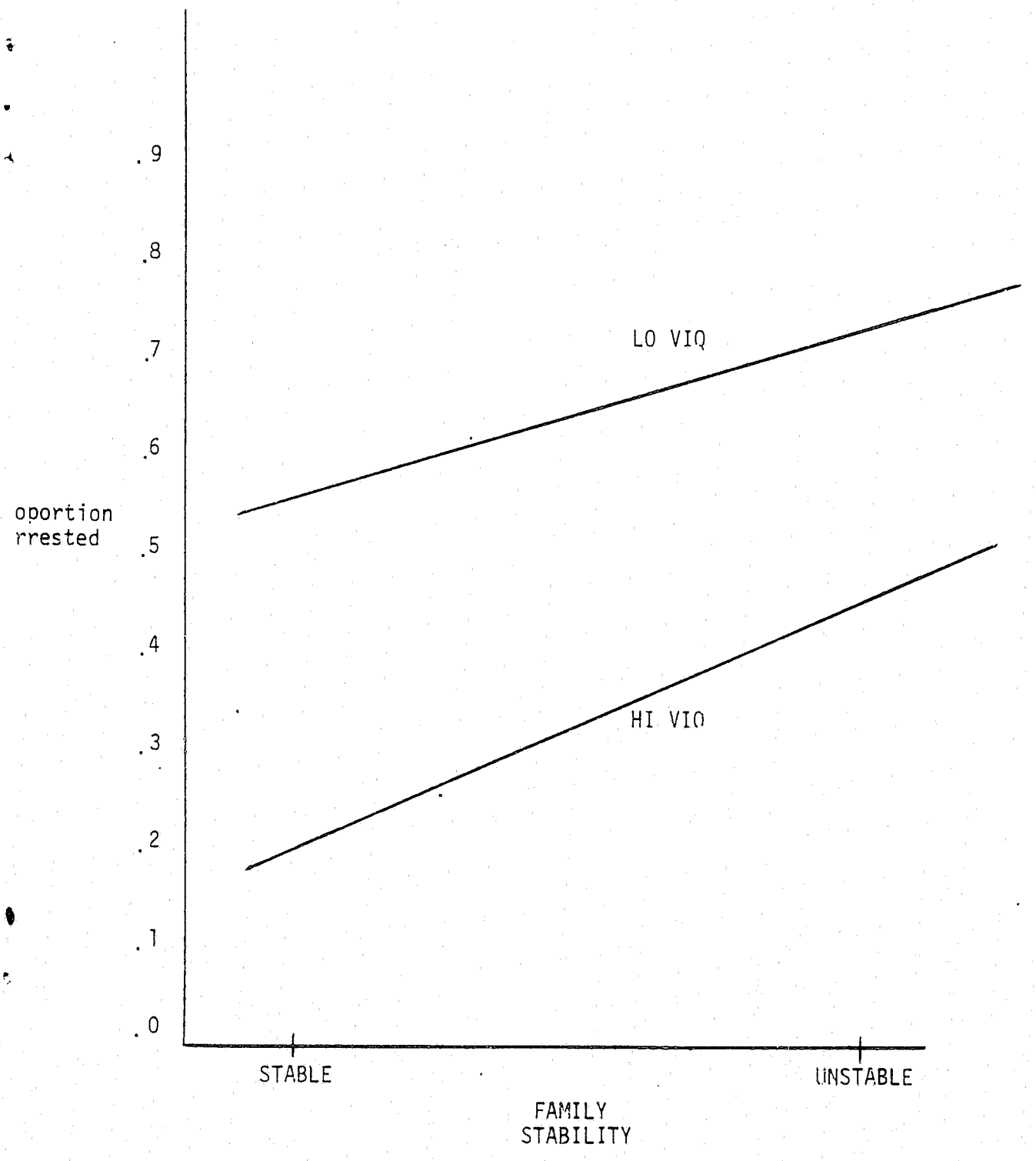
Proportion arrested for violence by family stability and MPAs

FIGURE 10



Proportion arrested by family stability and MPAs

FIGURE 11



Proportion arrested by family stability and verbal IQ

severe crime problems are tied to the highly active behavior of recidivists and chronic offenders. If such individuals could be identified early in their delinquent careers, effective preventive interventions might be developed which could treat these youths (e.g., by enabling them to control their criminogenic tendencies) or they might be counseled and trained for careers which could make productive use of their distinctive characteristics. But the first step in applying this model of preventive intervention is early identification of the future recidivist. Combinations of social-familal factors have been successful by themselves in explaining up to 27% of the variance in criminal behavior (Robins, 1966). We have predicted earlier that the addition of biological and psychological variables and biosocial interactions to the assessment procedures would improve prediction. A major goal of this project has been empirically to assess this hypothesis. It is clear from Figures 1-11 that predictions of recidivism can be improved by combining biological and sociofamilial measures. There are a number of implications of an applied nature to this improvement of prediction.

For example, we might profitably commence studies with large numbers of first time offenders, assessing them with a wide variety of measures including some variables from the IE assessment. We would then wait until some evidence recidivism and determine which combination of assessment measures distinguish the future recidivist and chronic offender. By application of modern techniques for assessment construction and some iterations there is reason to believe that we might, relatively quickly, produce a

practicable, reliable, valid, brief assessment battery which would identifiy our target population at the time of their first encounter with the criminal justice system.

The reliable early identification of the recidivist would make possible targetted intervention studies with a limited number of selected subjects and specific, measurable goals. Hypotheses for intervention techniques could be drawn from current criminological theory and from consideration of the critical anamnestic, biological, psychological and socio-familial variables which distinguish the recidivist.

It is beyond the purview of this report to suggest the types of interventions which might be studied. But before leaving this topic, we must recognize the existence of one problem with this intervention model. The ethical and legal implications of biological assessment of first-time arrested delinquents may cause some to pause. Others may hesitate to intervene with such youngsters even with their permission as well as their parents'. There will be objections to biological interventions; perhaps these objections will be muffled if it can be clearly demonstrated that the interventions are simply treatments for subtle medical problems such as minimal brain damage or biochemical imbalances. Aspects of this ethical discussion will relate to the nature of the interventions studied and the false positive rate.

Neurological Factors

Statistical interactions between the family variable and biological factors were significant for the neurological factors,

laterality and MPAs (see Figures 5-10). This interactive effect of family stability and biological factors is reminiscent of the early study by Drillien (1964). She found that premature infants tended to perform poorly in school. Further study revealed that this infirmity of the prematurely born did not predispose to school failure in cases in which the premature infant was raised in a stable family. In unstable families, premature infants suffered in intellectual ability and performance. In other words, in the Drillien study rearing factors made up for perinatal insult.

A number of similar interactive results have been reported for other perinatal -family factors (Mednick, Mura, Schulsinger and Mednick, 1971; Sameroff, 1975). We have already indicated that number of MPAs may be in part viewed as an index of disturbances during the individual's fetal development. In this sense, the observed interaction with family factors may be seen as consonant with the literature.

It is not immediately apparent how the laterality-family interactions relate to perinatal events. Raised incidence of left handedness has been observed in a variety of clinical conditions, especially mental retardation and epilepsy. (Brain, 1945; Bingley, 1958; Hecaen and Ajuriaguerra, 1964; Hicks and Banton, 1975). Left handedness in such clinical groups is approximately double that for the general population. An important explanation for this fact suggests that perinatal (or at least very early) damage to the left hemisphere interferes with development of functions in the right hands and feet (in natural right-handers).

Because of this left hemisphere damage, the infant acquires a preference for left side functioning becoming what is termed a pathological left hander (or PLH). (Bingley, 1958). Thus for some subgroup of left handers the basis of their sinistrality may be perinatal left hemisphere damage. Evidence from Penfield and Roberts (1959) and Satz, Yanowitz and Willmore (1982) strongly indicates that PLH individuals suffered left hemisphere brain lesions prior to age 2. Bakan (1971), Bakan et al., (1973) and Coran and Porac (1980) report evidence that left handers suffer abnormally high levels of perinatal stress. No methodology (which has been replicated) exists for the detection of the PLHs from a population of left handers. Such a determination would be useful. We would hypothesize that it is this perinatally-damaged subgroup of left handers who elevate frequencies of criminality among the sinistrally-inclined subjects in this study.

Thieves vs. Violent Offenders

A simple analysis was completed to determine which factors might differentiate thieves from violent offenders. Inasmuch as we have fewer subjects than the Family Study we included in the violent group (N=17) any subject who had been arrested for a violent offense no matter what other arrests are recorded for him. The thievery group (N=22) contained thieves who had not been arrested for a violent offense.

In Table 17 we report the means and T-test results for the thievery and violent groups. As can be seen the thieves are marked by having relatively young mothers at the time they were born (with a moderate standard deviation, 3.97 years). The vio-

lent offenders, on the other hand, have somewhat older mothers; what is interesting here is the large variability in their ages (standard deviation is 7.11 years). A suprisingly large number of the violent offenders have mothers over 30 years of age at the time of the birth of the subject. These findings in combination with the Family Study analysis suggest that thievery is preceded by the child being born into a low SES, unstable family with a relatively young mother. The violent offender is reared in an SES which is not different from that of the non-offender. The stability of his family is also quite comparable to that of non-offenders. His mother is not young at the time of his birth. The older age of the mother is not incompatible with the speculations we advanced earlier regarding possible neurological damage of perinatal origins in the violent offender group.

Inspection of Table 17 indicates that the violent offender is more left side lateralized and evidences more MPAs than the thieves. Neither of these findings quite reach statistical significance. In view of the earlier discussion of the laterality findings it would be of interest to divide the non-right side dominant individuals into PLH and natural left handers. Satz et al (1982) are developing some methods for this type of analysis which may be applicable to our data base in the near future. We would predict that the PLH subgroup of the left dominant subjects would contribute heavily to the violent offenses in this sample.

We conclude from these analyses that the thief is influenced by a combination of biological and family variables in his development of antisocial behavior. For the violent offender in these

two samples sociofamilial variables are less useful in helping us to understand the origins of violence. The findings encourage searching among perinatal and other biological factors for the origins of violence.

TABLE 16

TESTS OF BIOSOCIAL INTERACTION REFLECTION BY FIGURES 1-11

FIGURE	Dependent Variable	Independent Variables	F	df	P
1	Percent Arrested	Family Stability	5.46	1,85	.02
		Skin Conductance Latency	6.45	1,85	.01
		Interaction			n.s.
2	Percent Arrested	Family Stability	6.11	1,89	.01
		Number of Skin Conductance Orienting Responses	4.15	1,89	.04
		Interaction			n.s.
3	Percent Arrested	Family Stability	6.24	1,81	.01
		Skin Conductance Recovery Time	3.92	1,81	.06
		Interaction			n.s.
4	Percent With Uncontrolled Behavior	Family Stability	7.14	1,76	.009
		Percent EEG Fast Frequency	7.96	1,76	.006
		Interaction			n.s.
5	Percent Thieves	Family Stability	11.23	1,74	.001
		Foot Preferance	3.51	1,74	.06
		Interaction	4.59	1,74	.04
6	Percent With Uncontrolled Behavior	Family Stability	5.61	1,74	.02
		Foot Preference	1.70	1,74	n.s.
		Interaction	4.42	1,74	.04

TABLE 16
(continued)

FIGURE	Dependent Variable	Independent Variables	F	df	P
7	Percent Arrested	Family Stability	5.77	1,92	.02
		MPAs			n.s.
		Interaction	6.15	1,92	.015
8	Percent Thieves	Family Stability	12.44	1,73	.0007
		MPAs			n.s.
		Interaction	8.03	1,73	.006
9	Percent Violent	Family Stability	7.28	1,71	.009
		MPAs	3.94	1,71	.05
		Interaction	4.17	1,71	.04
10	Percent Uncontrolled Behavior	Family Stability	6.39	1,73	.01
		MPAs			n.s.
		Interaction	7.04	1,73	.009
11	Percent Arrested	Family Stability	5.86	1,95	.02
		Verbal IQ	7.77	1,95	.006
		Interaction			n.s.

TABLE 17

FAMILY FACTORS	Mean THIEVES	Mean VIOLENT OFFENDERS	T	df	p
Mother's age (in years)	20.9	25.4	2.29	37	.03
Family Stability (1)	1.64	1.59	.30	37	n.s.
SES	1.90	1.44	.94	35	n.s.
ANS FACTORS					
Half Recovery Time	9.89	8.96	.43	35	n.s.
Latency	.03	.15	.34	36	n.s.
INTELLIGENCE					
Verbal IQ	103	104	.16	37	n.s.
Performance IQ	111	111	.04	37	n.s.
NEUROLOGICAL					
Number of MPAs	3.90	4.63	1.59	35	.12
Footedness (2)	.59	1.20	1.63	35	.11

NOTES: 1. A higher score indicates more instability.

2. A higher score indicates more left lateralization.

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