FURTHER ANALYSES OF A LONGITUDINAL SURVEY OF CRIME AND DELINQUENCY

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Preface

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The views expressed in this report are those of the author and do not necessarily reflect the position or policies of the United States Department of Justice.

Contents

Contents (continued)

A. Longitudinal Research on Crime and Delinquency

A1. Introduction

The aim of this project was to carry out further analyses of data collected in an English longitudinal survey of crime and delinquency, the Cambridge Study in Delinquent Development. Longitudinal research on criminal behavior is becoming more popular in the United States, and its advantages are becoming more widely appreciated. However, no American survey has yet collected such extensive data, involving repeated interviews, questionnaires, and searches of records over a period of nearly 20 years, as the Cambridge Study. Therefore, it is hoped that the methods used and results obtained in this project will be helpful to American researchers who have started or are planning to embark on longitudinal surveys.

Most of the empirical results reported here are to be published in six papers: "Offending from 10 to 25 years of age" (Farrington, 1983c), "Stepping stones to adult criminal careers" (Farrington, 1983f), "Measuring the natural history of delinquency and crime" (Farrington, 1983b), "Predicting self-reported and official delinquency" (Farrington, 1983d), "Two-track or one-track justice? Some evidence from an English longitudinal survey" (Langan and Farrington, 1983), and "Implications of biological findings for criminological research" (Farrington, 1983a).

A2. Uses of Longitudinal Surveys

Longitudinal research involves repeated measures of the same people, or of samples from the same population. Studies which are prospective, in collecting data contemporaneously with or soon after the events of interest (and usually before key outcomes such as adult criminal behavior), are especially useful and offer the most scope for testing hypotheses. Similarly, there are many advantages in studies which extend over a long period (five years or more), which have

relatively frequent data collection points, and which obtain information from a variety of sources (e.g. official records, interviews with the subjects, and interviews with other informants such as parents, peers, and teachers). Very few surveys which fulfill the criteria stated in this paragraph, and which are concerned with crime and delinquency, have ever been carried out (see e.g. Farrington, 1979b). The Cambridge Study in Delinquent Development is one such survey.

Longitudinal surveys are especially useful in providing information about criminal careers. They have been utilized to establish the prevalence of convictions, arrests, or contacts with the police. In conformity with medical usage, 'prevalence' here refers to the proportion of a population who are affected up to a given age (e.g. during a lifetime), while 'incidence' refers to the proportion of a population who are affected during a given time period (e.g. one year). Therefore, prevalence is essentially cumulative incidence. Less is known about the prevalence or incidence of different kinds of crimes than about the prevalence or incidence of official contacts with the police or courts. Longitudinal research can establish the proportion of a population who commit at least one burglary (for example) at any given age (e.g. at age 16) or up to any given age (e.g. before age 18).

In addition to prevalence and incidence, longitudinal surveys can provide information about the individual crime rate at each age (or during any given time period). This refers to the number of crimes committed by people who commit at least one crime, and can be established for crimes in general or for specific types of crimes (see Blumstein and Cohen, 1979). Another quantity which can be established is the number of different types of crime committed at each age, which is a measure of versatility in offending. The number of crimes of each different type committed can be used to provide a measure of seriousness of offending at each age. As part of the process of cumulating crimes committed at different ages, longitudinal research can also establish the distribution of total criminal

activity over a population, and hence the extent to which a small minority of 'chronic' offenders commits a large proportion of all crimes.

Other features of criminal careers which can be studied are the ages at which they start and finish (e.g. for any given type of crime) and hence the distribution of career lengths or of residual career lengths at any given age or stage. In addition, continuities or discontinuities in careers, or transition probabilities between states (e.g. crime types) or ages, can be investigated. For example, an important question is the relationship between juvenile delinquency and adult crime. Longitudinal research can establish how often juvenile delinquency is followed by adult crime, and conversely how often adult crime is preceded by juvenile delinquency. Other questions center on the extent to which one type of crime leads to another, or the extent to which one type of (non-criminal) deviant or antisocial behavior leads to crime (or vice versa). These questions are relevant to the issue of versatility versus specialization in offending or antisocial behavior, and also to the 'natural history' of the development of criminal behavior.

Longitudinal research is also useful in establishing the interrelationships between different features of criminal careers, and how these features vary with other factors such as sex and race. Examples of questions which might be asked are the following: What is the probability of being arrested for any given type of crime at any given age for any given length of previous criminal career and number of previous crimes committed (of any type)? How does the residual length of a criminal career vary with the age at onset, the total number of crimes committed up to the current age, the current age, and the current rate of commission of different types of crimes (reflecting frequency and seriousness)?

It is easier to formulate these questions than to answer them, but it is a measure of our progress (and indeed of the past contributions of longitudinal research) that these kinds of questions were not even being asked 15 years ago.

A great deal of our knowledge in the past was at an aggregate level, conveying little detailed information about criminal careers. For example, cross-sectional data indicated that aggregate crime rates declined markedly with age after age 20, leading Boland and Wilson (1978) to highlight the inefficiency of incarcerating people most commonly when their criminal activity was low and declining. However, a declining crime rate could reflect a decreasing incidence of offenders, a decreasing number of different types of crime committed by offenders, or a decreasing number of crimes (of any given type) committed by offenders. It is conceivable that a decrease in the incidence of offenders in the population could coincide with (and outweigh) an increase in the individual crime rate of those offenders remaining, or that the residual length of criminal careers could reach its peak when offenders are about age 30 (Blumstein, Cohen and Hsieh, 1982). Either case might possibly justify a peak age of incarceration (probability of occurrence and average length) around age 30.

Related to the question of how key features of a criminal career vary with factors such as sex and race is the attempt to predict or explain these key features. Longitudinal research is useful in attempting to predict or explain the onset of criminal careers, their persistence, and their ending. It is often informative to study exceptions to the usual pattern, for example people from typical delinquency-producing backgrounds who rarely commit offenses or those from more favored backgrounds who become frequent or serious offenders. Most past research has been concerned to predict or explain the onset of crime or the recidivism of officially processed offenders rather than more specific parameters such as the number of different crimes committed or the individual crime rate. For example, it is not clear whether black-white differences in aggregate crime rates reflect different incidences, different types of crime committed, or different individual crime rates.

Longitudinal research is also useful in investigating the effects of different variables on a criminal career at different ages or stages of the career. Of particular interest are the effects of different kinds of criminal justice system

processing or penal treatments. These can be demonstrated most convincingly when a longitudinal survey is combined with a randomized experiment (see Farrington, 1983e). When experimental manipulations are impossible, quasi-experimental analyses of longitudinal data, systematically testing alternative hypotheses about the causes of observed effects (see Cook and Campbell, 1979), can also be convincing. Longitudinal research can additionally be used to study the effects of many other events which are thought to influence the course of development of criminal careers, such as leaving school, getting a job, getting married, and becoming unemployed. There is little conclusive data about the effects of these variables on tho key parameters identified above.

Another general use for longitudinal surveys is to study the transmission of criminal (and other) behavior from one generation to the next. It is well known that convicted parents tend to have convicted children, but little is known about offending (as opposed to convictions). Longitudinal research can establish whether the transmission is specific to particular offenses or more general, by comparing crimes committed by parents and children. Other features of criminal careers of parents and children (e.g. age of onset, length, individual crime rates) can also be compared. In addition, reasons for the transmission can be investigated, ranging from genetic or biological factors to family environment and even excessive police surveillance of known criminal families. As with the prediction of individual criminal careers, it may be informative to study cases which deviate from the usual trend, for example children with criminal parents who are well behaved and successful in law-abiding activities.

A3. Advantages and Problems of Longitudinal Surveys

Many methods can profitably be employed in criminological research. For example, a combination of a longitudinal survey and an overlapping cross-sectional one can often be more informative than a longitudinal survey alone. All methods have advantages and problems. However, cross-sectional research alone leads to

many ambiguities in interpretation, especially in regard to the key question of causal order. No amount of sophisticated statistical analysis of cross-sectional (or essentially correlational) data can convincingly demonstrate causal relationships. This is why federal agencies such as NIJ and NIMH have chosen to support longitudinal research, and also why secondary analyses of existing longitudinal datasets are now quite common (e.g. Clarke, 1974; Wiatrowski, Griswold and Roberts, 1981).

The advantages of longitudinal research can be illustrated by discussing more typical cross-sectional designs. For example, consider the study by Johnson (1979). This was an attempt to investigate the relationship between juvenile delinquency and a number of theoretically derived factors, such as attachment to parents, school success, the father's occupation, delinquent associates, delinquent values, and the perceived risk of apprehension. Johnson arranged for over 700 Seattle high school students aged 15-16 to complete a questionnaire including self-reported delinquency items and questions designed to measure the above factors. All the information was collected within one school period of 50-60 minutes.

Perhaps the major problem with this kind of research, as stated above, concerns causal order. For example, if high self-reported delinquency is correlated with low perceived risk of apprehension, does this mean that thinking there is a low probability of being caught makes juveniles more likely to commit delinquent acts? Or does it mean that the more delinquent acts juveniles commit, the more they realize how low is the probability of being caught? Or does it mean that the kinds of juveniles who commit many delinquent acts also give low estimates of the probability of being caught, without there being any causal relationship between these two factors? These kinds of questions can be asked for many of the above factors.

A major advantage of longitudinal research is its ability to establish the relative timings of different events. For example, Farrington (1977) could demonstrate that convictions preceded an increase in self-reported delinquency,

and Farrington (1978) could show that newly emerging parental disharmony at age 14 preceded newly emerging aggressive behavior at age 16-18. The more frequently that measurements are taken, the more securely can relative timings be established. As pointed out in section A2 above, causal relationships can be demonstrated most effectively in longitudinal research which is combined with experimental or quasi-experimental designs.

A second problem of much research on crime and delinquency centers on its retrospective nature. The memories of respondents who are attempting to provide information about past events may be faulty or biased. For example, consider a mother or a 15-year-old convicted male who is attempting to answer questions about how she brought him up. The methods of child rearing she used before the conviction are likely to be of most relevance to the investigator who is interested in explaining delinquency, since those used afterwards may have been affected by the conviction. However, the problem is that the mother's memory of child rearing methods used before the conviction may be affected by it. Many people search for explanations of delinquency, and the mother may feel that her child rearing methods must have been unsatisfactory because her son became a convicted delinquent.

The best way of avoiding problems of retrospective bias is to carry out a prospective longitudinal survey and collect information contemporaneously, or as soon after events as possible, before outcomes of interest (such as convictions) are known. More research is needed to establish the precise nature and extent of retrospective bias in criminological investigations. This could be done within a longitudinal survey, by comparing retrospective answers given at a later time about events which occurred at an earlier time with contemporaneous answers given at the earlier time (see e.g. Finney, 1981). However, a prospective design is likely to be uneconomic if the phenomenon of interest is very rare. Retrospective bias may be especially a problem with more subjective, less factual information.

Another advantage of longitudinal research is its ability to establish reliability and validity. When subjects are being seen repeatedly, it is hard for them to present a false picture of themselves to researchers without being detected...

Also, there are advantages in repeated searches of records. In the Cambridge Study in Delinquent Development, it was common to locate a criminal record at one time but not at another. This was caused partly by a deliberate agency policy to destroy certain kinds of records after certain periods of time, but it also reflected inconsistent information given by the subjects (e.g. the use of aliases), inconsistency in reporting by police and courts, the concurrent use of records by other agencies, and human errors and inefficiency in record keeping and searching. Estimates of the prevalence of convictions based on only one search of records are likely to be too low.

Changes with age or with time can be investigated in cross-sectional or longitudinal research. A problem with the cross-sectional study is to control for selection effects or differential mortality. Persons aged 45 may differ in many ways other than age from those aged 25, and those who have served 10 years in prison may differ in many factors other than time served from those who have served one year. The problem of selection effects can be avoided in a longitudinal survey, essentially because each person acts as his or her own control. Similarly, the problem of differential mortality can be avoided in longitudinal research by restricting analyses to the group tested at all ages or times. The extent to which this group is representative of the original sample can be investigated, and it should be possible to adjust any results to make them applicable to the original sample.

One problem which arises in longitudinal but not in cross-sectional research is the testing effect, or the effect of being interviewed once on responses given in a second test. It is possible to estimate the magnitude of this effect by testing only a subsample of the original sample on each occasion, or by comparing a subsample seen frequently with one seen rarely or not at all. When this has been done (Douglas, 1970; Bachman, O'Malley and Johnston, 1978), observed testing effects have been very small. Also, of course, major efforts to affect people's behavior by frequent contacts have often had a minimal impact (e.g. McCord, 1978).

Another effect which may cause difficulties in longitudinal research is statistical regression to the mean. In general, extreme scores at one age or time will become less extreme at a later age or time, and it is important to distinguish this effect (due to the random error component of scores) from real changes. This can often be achieved by having measurements at several different times. Problems of changes in measuring instruments over time, of developments in methods and theories, and of the applicability of the same questions at different ages and times, also have to be considered in longitudinal research.

A problem of cross-sectional and longitudinal research is to separate aging, period and cohort effects. Cohort effects are those specific to a particular cohort, for example following from the fact that a birth cohort is large or small. In general, all three effects cannot be estimated separately, unless certain simplifying assumptions are made. However, it is possible to distinguish two of the effects, for example the effects of aging from the effects of the particular time period. This can be achieved either with two or more longitudinal surveys or with a combination of longitudinal and cross-sectional research.

In most previous criminological projects, the major method of measuring crime and delinquency has been to use official records collected by the police and other criminal justice agencies. These records have many well known defects. For example, acts appearing in official records form a biased and underrepresentative sample of all delinquent or criminal acts committed, records are kept for the benefit of agency personnel rather than researchers, they are often kept inefficiently and unsystematically, and legal categories may distort the real behavior which occurred. There are many reasons why delinquent acts fail to appear in an official record, such as failure to define the act as delinquent, failure to report the act to the police, failure to record the act by the police, and failure to apprehend any offender. The major problem is that official records of crime reflect the behavior both of offenders and of official agencies, and it is difficult to disentangle them.

On the other hand, official records have advantages. They may be immediately and relatively cheaply available. They can cover a lengthy period, and the information is often recorded contemporaneously with events, before later outcomes of interest are known. This minimizes the problem of retrospective bias, although such bias may operate when the coding or extraction of data from records is done after outcomes are known. The information in records may be fuller than can be obtained in a typical social survey interview lasting one hour, but voluminous information can create problems for the researcher, in deciding what details to extract and in the time which it can take to read through a lengthy case history to discover the answers to a small number of questions.

Criticisms of official records have stimulated the increasing use of self-report measures of offending, and Johnson (1979) used this method. However, problems of response bias arise in research such as his, in which measures are derived from a single source on a single occasion. If self-reports of high offending are related to self-reports of low attachment to parents, is this because of a social desirability response bias? In other words, these results could be produced artefactually according to each person's willingness to admit unfavorable things about himself or herself on that particular occasion. Assuming that each measured variable reflects both a theoretical variable and bias due to the method of measurement, the best way of establishing a relationship between two theoretical variables is to measure them in different ways. For example, if self-reports of offending are related to parent reports of attachment and teacher reports of school success, it might be concluded that offending is related to attachment to parents and school success. If self-reports of the three variables are related, it could always be argued that the relationships were produced artefactually by common self-report biases. Also, there may be advantages in deriving composite variables by combining measures from different sources or at different ages. Such variables may contain less bias or error than the constituent measures, because errors may tend to be in opposite directions and hence may cancel out to some extent.

It is desirable to have both official record and self-report measures of offending. Self-report measures, like official records, have problems. Some members of the sample will not be interviewed, and some of those who are interviewed will conceal, exaggerate, or forget their offenses. Many self-report questionnaires are overweighted by relatively trivial items which, although technically crimes, would rarely lead to official processing. The validity of self-reports has usually been investigated by comparing them with official records (e.g. Farrington, 1973; Hindelang, Hirschi and Weis, 1981), but when the two measures are discrepant it is difficult to know which is at fault. The best strategy is probably to collect both measures and to study if results obtained with one hold with the other. If the two sets of results are concordant, this should increase our confidence in their correctness.

In general, much research on crime and delinquency involves too limited a number of measured variables. In attempting to demonstrate that a certain factor has an influence on delinquent behavior, it is desirable to hold constant all other factors. This can be achieved statistically in non-experimental research, for example by using some kind of partial correlation or multiple regression analysis, but only if all other relevant factors are measured. In doubtful cases, researchers should err on the side of inclusion rather than exclusion. Theoretically guided research can be undesirable if it leads the investigator to exclude important factors. The unwillingness of many American sociologists to believe in the importance of individual differences has led them to exclude possibly important factors, such as IQ, from their studies (see Hirschi and Hindelang, 1977).

Another problem, especially with older research on crime and delinquency (e.g. Glueck and Glueck, 1950), is the use of extreme groups of incarcerated delinquents and non-incarcerated non-delinquents. Because of the use of extreme groups, this design is likely to overestimate differences between convicted and unconvicted people. Also, of course, any differences between such groups may relate to or be caused by incarceration rather than reflect offending. The measurement of offending as a dichotomous variable confuses types of behavior with types of

people and fosters a false view of offending as a dichotomous phenomenon, that 'the offenders' can be contrasted with 'the vast majority of law-abiding people'. Self-report research and common sense suggests that offending is a continuous variable, and that people vary in the frequency, seriousness, and types of offending rather than in whether or not they offend.

Prospective longitudinal surveys including interviews may have many methodological advantages, but they also present many practical difficulties. Such research often requires a heavy commitment of resources over a long period, and one of the greatest problems is to obtain a long-term guarantee of funding. Long-term planning is necessary to get the fullest possible benefits from longitudinal research, but it is difficult to arrange in practice . Similarly, researchers may be understandably reluctant to devote a substantial part of their working life to one project.

Another major practical problem faced in a longitudinal survey is attrition, or the loss of subjects for a variety of reasons, including death, emigration, unknown addresses, and refusals. Locating elusive subjects can consume a great deal of time. Attrition would not be such a problem if those lost were a random sample, but they often include some of the most deviant people (i.e. those most interesting to criminological researchers). An advantage of a longitudinal survey is that some characteristics of the missing subjects are usually known, through earlier interviews, so that the maximum error resulting from attrition can often be estimated.

Cross-sectional surveys, of course, have fewer practical problems, since they cost less, involve a more limited time commitment, and avoid the difficulties of following people up. Nevertheless, I hope that sections A2 and A3 indicate why I think that longitudinal surveys of crime and delinquency which are (i) prospective, (ii) extend over a long time period, (iii) have relatively frequent data collection, and (iv) include information from a variety of sources, including records and interviews, are desirable.

A4. American Longitudinal Surveys of Crime and Delinquency

Many, perhaps most, American longitudinal surveys of crime and delinquency are based entirely on official criminal records, and these surveys have contributed greatly to our knowledge. Many of the statements in section A2 about the uses of longitudinal surveys to study criminal careers are inspired by the work of Blumstein (e.g. Blumstein, Cohen and Hsieh, 1982) or Wolfgang (e.g. Wolfgang, Figlio and Sellin, 1972). The Wolfgang survey has inspired a number of replications (e.g. Bursik, 1980; Rojek and Erickson, 1982). Similarly, our knowledge about careers of criminal violence has been advanced considerably by the Ohio Dangerous Offenders project, again entirely based on official records (e.g. Hamparian, Schuster, Dinitz, and Conrad, 1978; Van Dine, Conrad, and Dinitz, 1979).

Studies which combine a (usually retrospective) search of records with at least one interview have more scope than those based on records alone. For example, the information extracted from records depends to a large extent on what is stored, whereas the information collected in an interview can be decided by the researcher on theoretical grounds. Later work on the Wolfgang survey of boys born in 1945 (Wolfgang, 1980) included an attempted interview at age 26, and Shannon (1981) attempted to interview some members of the first two of his cohorts at ages 34 and 27 respectively. The two long-term surveys by Robins (Robins, 1966; Robins, West, and Herjanic, 1975) also included one interview when the subjects were aged at least 30. In some surveys, one interview has been followed by searches of records (e.g. Feldhusen, Aversano, and Thurston, 1976).

Very few long-term longitudinal surveys of crime and delinquency involving two or more interviews with the subjects have been carried out in the United States. One recently published study which I have had to discount was the long-term follow-up by Hartl, Monnelly, and Elderkin (1982) of the 200 men originally investigated in 1939 by Sheldon, Hartl, and McDermott (1949). These men were interviewed in 1958 and 1963 and contacted by letter (and in some cases by telephone) four more times up to 1979. Unfortunately, while complete case histories are given, the

way in which the results are presented (using psychiatric categories) makes it virtually impossible to draw any conclusions about criminal behavior, and this is true of a number of other psychiatric investigations.

In several long-term American surveys, the subjects have been followed up using telephone interviews or postal questionnaires rather than by means of face to face personal interviews. The longest lasting of these surveys is the Cambridge-Somerville Youth Study begun by Powers and Witmer (1951) and continued by McCord, McCord, and Zola (1959) and McCord (1978, 1979). Initially, in 1937-39 in Massachusetts, 650 boys (average age 10) were nominated by schools as difficult or average and enrolled in the study. Half, chosen at random, were given rather heterogeneous social work treatment (or 'friendly visiting': see Vosburgh and Alexander, 1980) for an average of five years. On the basis of the records made by the visiting counselors during this period, the boys' parents were rated on such factors as cruel, passive, or neglecting attitudes, lax or erratic discipline, and quarrelsomeness. Thirty years after the end of the treatment, McCord attempted to follow up 506 of the men by means of postal questionnaires.

Two other surveys involving postal questionnaires were carried out by Polk (1975) and Havighurst, Bowman, Liddle, Matthews, and Pierce (1962). Polk followed up 1,227 high school boys who completed a questionnaire in 1964, attempting to interview a subsample in 1968 and following up subsequently using postal questionnaires. Havighurst et al. initially contacted 487 children in a midwest city at age 11-14 in 1951-54, obtaining teacher and peer ratings. These children were followed up to 1960 by mail and by telephone.

Another postal follow-up study worth mentioning was carried out by Bachman, O'Malley, and Johnston (1978). They followed up a nationally representative sample of 2,277 boys aged about 15 in 1966. These boys were interviewed in 1966 and 1968, given group-administered questionnaires in 1969 and 1970, and followed up in 1974 by means of a postal questionnaire. Offending was measured entirely by self-report.

It seems likely that telephone interviews and postal questionnaires, while relatively easy to carry out, might be less reliable and valid than personal face-to-face interviews. In a face to face interview, it may be possible to collect more extensive and more sensitive information, and it might be harder for the subject to present a false picture (e.g. about home conditions, which might be obvious to the interviewer during home interviews). Therefore, face to face interviews are to be preferred. To my knowledge, there are only nine American longitudinal surveys combining the following key features: (i) two or more interviews with the subjects, (ii) the first and last interview separated by at least five years, (iii) a reasonable sized sample (in the hundreds at least), and (iv) providing information about criminal or delinquent behavior. These nine surveys are about to be joined by a tenth (by Elliott, discussed below).

Three of the existing nine surveys were carried out by the Gluecks (1930, 1934, 1937, 1940, 1943, 1950, 1968). The first followed up 510 men (average age 25) whose sentences in Massachusetts reformatory expired in 1921-22, and attempted to interview them or their relatives 5, 10, and 15 years later. The second followed up 1,000 juvenile delinquents (average age 14) examined by the Judge Baker Clinic in 1917-22, and attempted to interview them or their relatives 5 and 15 years later. The third survey followed up 500 delinquents in Massachusetts correctional schools in 1939-44 and 500 matched non-delinquents. These boys were contacted initially at an average age of 14, and later at average ages of 25 and 31.

Two other surveys were carried out by Hathaway and Monachesi (1957, 1963; see also Wirt and Briggs, 1959; Hathaway, Monachesi, and Young, 1960; Hathaway, Reynolds, and Monachesi, 1969). Both initially involved boys and girls, but only the boys were included in the long-term delinquency follow-ups. The first survey involved 1,958 boys (average age 15) tested in Minneapolis in 1947-48. Selected samples were contacted 4 and 8 years later. The second survey involved 5,701 boys (average age 15) tested in Minnesota schools in 1953-54, contacting selected samples at ages 19 and 28.

The longest lasting of the existing nine surveys was carried out by Lefkowitz, Eron, Walder, and Huesmann (1977). Their research is interesting because of its combination of interview and record data with peer ratings and parent reports. They initially interviewed 875 children aged 8-9 in 1959-60 in New York State and followed them up at ages 18-19 and 30. Langner, Gersten, and Eisenberg (1977) surveyed two samples of about 1,000 children initially aged 6-18 and their mothers in New York City. One sample of children was randomly selected and the other consisted of those in households receiving aid to dependent children. The mothers and subsamples of the children were interviewed in 1967-68 and again about five years later.

Another long lasting survey was carried out by Werner and Smith (1982) in Hawaii. They followed up 698 children from birth in 1955 to age 18. The mothers were interviewed before and just after the children were born, and the subjects themselves were interviewed at age 10 and (subsamples only) at age 18. In a Chicago study, Kellam, Branch, Brown, and Russell (1981) also interviewed parents and children. Their sample consisted of 1,242 families with first grade children in 1966-67. The children were interviewed at about ages 6, 8, and 16, and the final interview included a self-reported delinquency questionnaire.

As indicated above, a tenth survey of the kind described above is currently in progress. Elliott and Huizinga (1982) and Ageton (1982) have followed up 1,725 adolescents (out of a nationally representative target sample of 2,375) aged 11-17 in 1976, interviewing them every year up to 1980. A sixth round of interviews is due to be completed in 1984. When these have been done, this survey will be the first American longitudinal study of crime and delinquency involving a reasonable sized sample and more than three interviews covering at least five years. An additional advantage of the project is that both official records and self-reports of offending have been collected.

While the Elliott study will be the most interesting American project in many respects, it does not include information from any source other than official records and the subjects themselves. Several of the other surveys quoted here include

information from parents, peers, or teachers, and it has been argued above (section A3) that it is desirable to obtain data from multiple sources. This is difficult, of course, in a national investigation.

All the American longitudinal surveys mentioned in this section have interesting aspects, but one of the most significant is the Cambridge-Somerville study of McCord. This is the only one which combines a long-term longitudinal design with a randomized experiment. Also, the follow-up period of 35 years between the initial and final contact with the subjects is the longest of all. Also, information was obtained from multiple sources.

Attrition has proved to be a considerable problem in many of the American studies. In his follow-up at age 26, Wolfgang (1980) could only interview 567 out of the target sample of 975 (58%), largely because of difficulties in locating people. In his national survey, Elliott initially could only interview 1,725 out of 2,375 eligible youths (73%) because of refusals, and by the fifth round of interviews the sample had declined to 1,521 (64% of the original sample). In the Lefkowitz et al. 10 year follow-up, the initial sample of 875 children tested decreased to 735 who could be located, 460 who agreed to be interviewed, and 427 (49% of the original sample) who actually were interviewed. In their 22 year follow-up at age 30, the number interviewed decreased to 303 (35%). In McCord's 35 year follow-up, she was able to locate 480 of her target 506 people, of whom 48 had died. She posted questionnaires to 410 and received 235 replies (46% of her original sample).

In section B2 below, some of the unique features of the Cambridge Study in Delinquent Development will be described. For the moment, it can be noted that, unlike any existing American longitudinal survey of crime and delinquency, the Cambridge Study combines (a) more than three interviews with the subjects - actually seven, (b) covering a period of at least five years - actually 16, (c) a reasonable sized sample - 411, and (d) information from multiple sources - the subjects, records, parents, peers, and teachers. In addition, it is planned

to reinterview the sample in 1984 at age 31, therefore extending the follow-up period to 23 years. Also, attrition has been relatively low in the Cambridge Study. At age 18, 95% of the original sample at age 8 were re-interviewed, while 75% of the target sample were interviewed at age 24.

A5. Some Conclusions of American Longitudinal Surveys

One of the findings in the famous survey by Wolfgang, Figlio, and Sellin (1972) which surprised many people was that the prevalence of juvenile arrests for Philadelphia males was 35%. Later work on this survey (Wolfgang, 1980) showed that this prevalence up to age 30 was 47%. However, this was not really a new finding. Fifteen years earlier, the longitudinal survey of Hathaway and Monachesi (1957) had reported that 41% of Minneapolis boys had their names in police records for some kind of crime by age 19.

As the detailed review by Gordon (1976) shows, the prevalence of crime varies a great deal with different definitions. This is brought out very clearly in the work of Shannon (1981). He studied three birth cohorts, born in 1942, 1949, and 1955, followed up in records to ages 33, 26, and 21 respectively. Of the males in the three cohorts, 84%, 82%, and 72% respectively had a recorded police contact. The corresponding figures for the females were 48%, 52%, and 45%. However, the proportions with contacts for relatively serious offenses (felonies and major misdemeanors, which might be considered 'real crimes') were 22%, 23%, and 23% for the males and 2%, 5%, and 6% for the females.

Little is known about the prevalence of offenses which do not necessarily result in police contacts. More is known about incidence. The best figures for incidence are probably those obtained in the Elliott survey (Elliott, Knowles, and Canter, 1981; Elliott and Huizinga, 1982; Ageton, 1982). Rather confusingly, they use 'prevalence' to refer to the proportion of people who commit at least one offense in one year, and 'incidence' to refer to the average number of offenses committed per person (not per offender) in that year. Their figures show, for

example, that about two-thirds of young people commit at least one delinquent act in a year, but only about 6% commit an index offense in a year. The average number of delinquent acts committed per sample member was about 20 per year, but only one of these per year was an index offense.

When Elliott and his collaborators cumulate these figures over the years, more will be known about the prevalence of self-reported offenses. In addition, when it is published, his comparison between self-reported offending and official records will provide the best available American data on this. I understand that his comparison shows that about three-quarters of the most serious offenders according to self-reports have no official record. On the face of it, this seems a very surprising result, but it may refer to incidence (yearly data) rather than (cumulative) prevalence.

The best available data on variations in offending with age are probably those collected by Shannon (for official records) and Elliott (for self-reports). Both have multiple cohort designs which should allow some separation of aging and period effects. (Wolfgang has a similar design, with his 1945, 1958, and 1959-63 cohorts.) Shannon (1981) showed that the peak age for the average number of police contacts per cohort member was 16-17 for males and 17-19 for females. Whether these peaks primarily reflect the incidence of offenders, the number of different kinds of offences, or individual crime rates is not clear. Shannon did show that the average seriousness of contacts, for those who had at least one, decreased slightly with age for the first two cohorts and increased slightly with age for the third. In contrast, in Wolfgang's (1980) first cohort, the average seriousness of offenses stayed fairly constant during the juvenile years and then increased markedly during the adult years.

The Elliott survey showed interesting differences between results obtained with the proportion of offenders and those obtained with the average number of offenses. The proportion of offenders tended to peak at age 15-17 (Elliott, Knowles, and Canter, 1981), but the average crime rate over the whole sample did not vary greatly with age. This suggests that the individual crime rates (the

average crime rates of offenders) might even have reached a minimum at age 15-17. By comparing their data with the earlier figures of Gold and Reimer (1975), Elliott et al. were able to demonstrate increases in the incidence of self-reported delinquency of 13-16 year olds from 1967 to 1978.

The clearest distinctions between the different parameters characterizing criminal careers have been made by Blumstein. For example, Blumstein, Cohen, and Hsieh (1982), using official record data, showed that the number of different types of crime committed by offenders decreased after age 18 but that, controlling for crime type, offenders who remained criminally active continued to commit offenses at a constant rate. Blumstein and Graddy (1982) showed that racial differences in arrest rates primarily reflected differences in prevalence. For large American cities, the prevalence of an index arrest for males up to age 55 was 23%, but it was 14% for whites and 51% for non-whites. Whites and non-whites did not differ in the probability of recidivism or in the average time between arrests.

A useful contribution of prospective longitudinal research is in investigating the relationship between juvenile delinquency and adult crime. Because of the widespread failure to link up juvenile and adult records and the destruction of juvenile records, this is difficult to study retrospectively using official data (see Langan and Farrington, 1983). Little is known about the relationship between juvenile and adult self-reported crime. Some of the most extensive information about the relationship between juvenile and adult officially recorded crime was provided by Shannon (1981). The relationship was clearly significant in all three of his cohorts, and, perhaps because of the lower cutoff age, was greatest in the most recent cohort. In this cohort, of those who had committed a felony or major misdemeanor as juveniles, 34.9% committed one as adults (in comparison with 5.9% of the rest of the sample). Conversely, of those who had committed a felony or major misdemeanor as adults, 56.8% had committed one as juveniles (in comparison with 13.4% of the remainder).

Other longitudinal surveys have also provided useful information about the relationship between (officially recorded) juvenile delinquency and adult crime. In the longest follow-up by McCord (1979), beyond age 45, 21.4% of 201 males were convicted of serious crimes as juveniles, and 23.9% as adults. Nearly half of the juvenile offenders (46.5%) became adult offenders, in comparison with 17.7% of the remainder. Conversely, 41.7% of the adult offenders had been juvenile offenders, in comparison with 15.0% of the remainder. Whether these continuities reflect consistency in official biases or in offending behavior is not entirely clear.

The relationship between juvenile delinquency and adult crime leads on to a more general question about the probability of one offense being followed by another. The most famous (official record) information on this was published by Wolfgang, Figlio, and Sellin (1972). They reported that the probability of one arrest was .35, and then of a second following a first was .54. This probability gradually increased to around .80 for offense to offense transitions after the sixth. Wolfgang and Tracy (1982) repeated this analysis for the males in their second cohort, with similar results. The probability of a first arrest was .33, of a second following a first was .58, and this probability increased to around .80 for transitions after the fifth.

The high probabilities for the later transitions suggest that there is a group of unusually persistent offenders, and the Wolfgang et al. (1972) study is well known for popularizing the idea of the 'chronic' offenders with five or more arrests. In their first cohort, the 6.3% of the sample who were chronic offenders accounted for 52% of all juvenile arrests. In their second cohort, the 7.5% who were chronic offenders accounted for 61% of all juvenile arrests (Wolfgang and Tracy, 1982). Similar results have been obtained by other researchers. For example, Shannon (1981) reported that 5.8% of his third cohort were responsible for 51% of all the police contacts up to age 21. Of course, as Blumstein and Moitra (1980) pointed out, because every frequency distribution has to have a right-hand tail, the chronic offenders who comprise that tail will necessarily account for a disproportionately large number of arrests. The crucial question is whether

the chronic offenders can be identified prospectively as well as retrospectively. This issue is discussed in more detail in sections E3 and E4.

Another famous result first highlighted by the Wolfgang et al. survey was the relative lack of specialization in types of offenses by juveniles. When offenses were divided into five broad types, it was found that the probability of committing any given type did not depend on the type committed on the last occasion. This result is unusual. It is more usual to find a small amount of specialization superimposed on a high degree of generality. Wolfgang (1980) reported that there was more evidence of specialization in his adult data, and replications of his work by Bursik (1980) and Rojek and Erickson (1982) have also found some specialization. Self-reported offending also shows a high degree of generality (e.g. Peterson, Braiker, and Polich, 1980), although offense to offense transition matrices for it have not yet been published.

Rather than investigating transitions between types of offenses, Robins and Wish (1977) studied the more general topic of transitions between different types of deviant acts. Beginning with the fact that some people committed a great variety of deviant acts, they dismissed the 'tail of the distribution' argument on the grounds that the multiply deviant people could be reliably predicted. They then tried to distinguish general and specific predispositions towards deviance from general and specific developmental sequences. To a considerable extent, this distinction depends on somewhat subjective ideas about the underlying theoretical constructs and causal links.

For example, predicting that children of inadequate parents will be deviant involves the assumption that they have a genetically or environmentally produced predisposition. By some causal chain, the theoretical construct of inadequate parenting could cause the theoretical construct of delinquent behavior. On the other hand, predicting that children who disobeyed the teacher in first grade will be deviant assumes a natural progression from one type of deviance to another, or a developmental sequence. It is theoretically plausible to argue that the construct of disobedience at age 6 develops (matures?) into the construct of delinquency at

age 14, but less plausible to argue that disobedience at 6 causes delinquency at 14. These two kinds of relationships seem qualitatively different. In my opinion, the word 'cause' should be reserved for the non-developmental kind of relationship (predispositional in the terminology of Robins and Wish). The second kind of relationship should be referred to in some other way, for example as a developmental sequence.

Robins and Wish were especially concerned with developmental sequences, and with investigating whether they were primarily general (quantitative in their terms) or specific (qualitative). They defined a quantitative developmental process as one in which the likelihood of committing an untried deviant act depended principally on the number of other types of deviant acts already tried. A qualitative process was one in which certain specific acts tended to be stepping stones to others.

In testing these ideas, Robins and Wish studied 13 acts of childhood (before age 18) deviance, including elementary school failure and truancy, dropping out of high school before graduation, juvenile arrests, precocious sexual experience, drinking, and drug use, in their sample of 223 black males. Since the distribution of the number of different acts committed differed significantly from the Poisson or binomial distributions, they concluded that the variety of deviant acts was not the result of a random process. They found that all the acts tended to be interrelated. Of 78 2 x 2 tables, 73 showed a positive relationship, and 42 were positive and statistically significant. Interestingly, the acts which were the most closely related tended to be those which were closest in their ages of onset.

Robins and Wish then investigated whether one act led to another. Of 156 possible tables (13 acts, act 1 preceding act 2), 83 were testable. The other 73 either had too small numbers of the act 1 preceding or the act 2 following, or an act 2 which logically had to precede the act 1. Of the 83 tests, 38 were statistically significant (using a conservative criterion). Robins and Wish then tested for spurious relationships produced by third variables which were significantly related to both act 1 and act 2, using a matching method, and 12 of the relationships

did not hold independently of a third variable. In the case of the remaining 26, they then tested whether the relationships held independently of the number of different acts up to and including act 1, again by matching. Only eight relationships survived this test, suggesting that the developmental process was primarily quantitative (general) rather than qualitative (specific). The eight specific relationships made theoretical sense. For example, drinking led to marijuana and amphetamine use, truancy led to dropping out and, in the only reciprocal relationship, truancy led to school failure and school failure led to truancy.

I have described the results of Robins and Wish (1977) in detail because their approach is important and apparently not well known to criminological researchers (unlike the famous research of Wolfgang et al., for example). The later study by Robins and Ratcliff (1980) is also worth mentioning. They investigated the relationship between nine types of childhood deviant acts and five types of adult arrests. In general, the probability of an adult arrest increased with the number of different types of childhood deviance. However, controlling for the number of adult arrests, the probability of any given type of adult arrest did not increase with the variety of childhood deviance. Therefore, they concluded that the variety of childhood deviance predicted the extent of adult offending rather that any specific type.

Robins and Ratcliff went on to investigate whether specific types of childhood deviant acts predicted specific types of adult arrests, controlling both for the variety of childhood deviant acts and for the number of adult arrests. They found significant continuity only in drug use. For sex, the relationship was opposite to the expected one, since those with early sex experience were less likely to rape than the remainder. Robins has consistently argued that, since the major relationships in her research are general rather than specific (the overall level of childhood deviance predicting the overall level of adult deviance), there is a single syndrome made up of a broad variety of antisocial acts arising in childhood and continuing into adulthood.

The best predictors of criminal, antisocial, or deviant behavior at one age (e.g. in adulthood) may be criminal, antisocial, or deviant behavior at an earlier age (e.g. in childhood), either because of developmental sequences or because of continuity in the underlying theoretical constructs. However, longitudinal research has demonstrated that a number of non-behavioral factors predict the onset of criminal behavior, and these may be considered as possible causes. For example, in her long-term follow-up study, McCord (1979) concluded that (a) poor parental supervision and the mother's lack of self-confidence predicted convictions for property and personal crimes, (b) the mother's lack of affection and the father's deviance (alcoholism or a conviction for a serious crime) predicted property but not personal crimes, and (c) parental conflict and parental aggression (e.g. beating children) predicted personal but not property crimes.

Robins (1979) reviewed results obtained in her three longitudinal studies of white child guidance cases, black males, and Vietnam veterans. The first and second of these are the most relevant, with follow-up information at ages 43 and 33 on average, respectively. In both studies, adult antisocial behavior was predicted by: (a) an antisocial or alcoholic father; (b) an antisocial or alcoholic mother; (c) a broken home; (d) divorced or separated parents; (e) the guardian's occupation; (f) living in poverty; (g) parental supervision; (h) parental discipline; and (i) a large number of siblings. Whether these factors are important independently of each other is not clear, but the replicability of the results in the two different samples is impressive.

In general, criminal, antisocial, or deviant careers which begin at an early age tend to be the most serious. Loeber (1982) has reviewed some of the evidence on this, and identifies an age of onset of [illegible] as a particularly bad sign. An early age of onset is associated with more delinquent or criminal activity in total, more serious acts, and a higher rate of offending. The first arrest is usually preceded by high rates of antisocial behavior in school, in the family home, and in the neighborhood. Whether an early age of onset of delinquency is associated with a longer criminal career is not clear, and whether results obtained

with official records hold up with self-reported offending is also unclear.

In contrast to developments in predicting the onset of criminal careers, long-term longitudinal researchers have not paid much attention to predicting their ending since the early work of the Gluecks. For example, Glueck and Glueck (1940) followed up their 1,000 juvenile delinquents for 15 years after their court appearance, and found that the proportion arrested declined in each five-year follow-up period. The 'reformed' delinquents tended (a) to have higher IQs, (b) to be from higher economic status families, (c) to have parents with better conjugal relations, (d) to be older at the time of first arrest, (e) to be social rather than solitary offenders, (f) to be less often truants, and (g) to have experienced better parental discipline. Most recent efforts to predict recidivism have been parole prediction studies, and a few of these are mentioned in section E1. Whether different factors predict the ending of criminal careers at different ages or stages is unknown.

Apart from studies of the effect of penal treatments or of attempts to prevent delinquency, there has been surprisingly little effort by American longitudinal researchers to investigate the effects of specific events on the course of development of criminal careers. The most famous longitudinal research on prevention or treatment is the Cambridge-Somerville study mentioned earlier (McCord, 1978). The half of the sample who were given five years of treatment were no better subsequently in their criminal careers. In fact, if anything their outcomes were worse in the 30-year follow-up period. More of the treated group committed two or more offenses, showed signs of alcoholism, severe mental illness, or stress-related diseases, died relatively young, or had low prestige occupations. McCord speculated that the treated men may have become dependent on the treatment and resentful when it was withdrawn, or that the treatment may have encouraged such high expectations that they later felt deprived.

There are also very few American longitudinal studies of the intergenerational transmission of criminal activity. Two exceptions are the projects of Robins, West, and Herjanic (1975) and McCord (1977). Robins et al. compared male and

female children with their mothers and fathers, the fathers being the black men referred to earlier. In general, arrested parents tended to have arrested children, and the juvenile records of the parents and children showed similar rates and types of offenses. McCord found that convicted sons (her subjects) tended to have convicted fathers. Whether there is a specific relationship between types of convictions of parents and children, or between any other parameters of criminal careers (e.g. age of onset or length) is unclear. McCord reported that 28.6% of fathers convicted for violence had sons convicted for violence, but this may reflect the general tendency for convicted fathers to have convicted sons rather than any specific tendency for violent fathers to have violent sons.

This concludes my relatively brief review of American longitudinal surveys of crime and delinquency. I have, of course, concentrated on surveys lasting for a relatively long time and including at least one personal contact with the subjects. Surveys based entirely on records have been comparatively neglected, although many of them have produced interesting results. I hope that the reviews in section A will help the reader to appreciate the results described in the rest of this report.

B. The Cambridge Study in Delinquent Development

B1. Description of the Survey

The Cambridge Study in Delinquent Development is a prospective longitudinal survey of 411 males. Data collection began in 1961-62 when most of the boys were aged 8, and ended in 1980 when the youngest person was aged 25 years 6 months. The major results of the survey can be found in four books (West, 1969, 1982; West and Farrington, 1973, 1977), and a concise summary is also available (Farrington and West, 1981). As mentioned earlier, I am planning to reinterview as many as possible of the original sample of 411 at age 31, beginning in 1984.

At the time they were first contacted in 1961-62, the boys were all living in a working class area of London, England. The vast majority of the sample was chosen

by taking all the boys aged 8-9 who were on the registers of six state primary schools which were within a one-mile radius of a research office which had been established. There were other schools in this area, including a Roman Catholic school, but these were the ones which were approached and which agreed to cooperate. In addition to 399 boys from these six schools, 12 boys from a local school for the educationally subnormal were included in the sample, in an attempt to make it more representative of the population of boys living in the area.

The sample was limited to males from a working class urban area because of the prior expectation of a high prevalence of convictions (about a quarter) among them. The sample size was set at about 400 because this was considered large enough for statistical comparisons between convicted and unconvicted boys but small enough to interview each boy and his family and build up intensive case histories. Nationally representative samples of many thousands (e.g. Wadsworth, 1979) provide excellent bases for generalizations and statistical analyses, but with such numbers it is difficult to collect anything other than easily available objective information.

The boys were almost all white caucasian in appearance. Only 12, most of whom had at least one parent of West Indian origin, were black. The vast majority (371) were being brought up by parents who had themselves been reared in the United Kingdom or Eire. On the basis of their fathers' occupations, 93.7% could be described as working class (categories III, IV, or V on the Registrar-General's scale of occupational prestige), in comparison with the national figure of 78.3% at that time. This was, therefore, overwhelmingly a white, urban, working class sample of British origin.

The boys were interviewed and tested in their schools when they were aged about 8, 10, and 14, by male or female psychologists. They were interviewed in the research office at about 16, 18, 21, and 24, by young male social science graduates. Up to and including age 18, the aim was to interview the whole sample on each occasion, and it was always possible to trace and interview a high proportion. For example, at age 18, 389 of the original 411 (94.6%) were interviewed. Of the 22 youths missing at this age, one had died, one could not be traced, 6 were abroad, 10 refused to be interviewed, and in the other 4 cases the parent refused on behalf of the youth.

At age 21, the aim was to interview only the convicted delinquents and a similarly sized, randomly chosen sample of unconvicted youths. At this age, 218 of the target group of 241 were interviewed (90.5%). At age 24, the aim was to interview four subgroups of youths: persisting recidivists (those with two or more convictions up to age 19 and at least one more in the next 5 years), temporary recidivists (those with two or more convictions up to age 19 and no more in the next 5 years), unconvicted youths from seriously deprived backgrounds (from large families, in poor housing, with convicted parents, and with families supported by state welfare), and a random sample of unconvicted youths. At this age, only 85 of the target group of 113 (75.2%) were successfully interviewed, primarily because so many of these youths had left home and were difficult to trace.

At most ages, most boys were interviewed between 5 and 11 months after their birthdays. For example, for the interview at 14, 211 of the 406 seen were aged between 14 years 7 months and 14 years 11 months, while 97 were younger and 98 older. The median age at interview was 14 years 9 months. For the interview at 18, the median age was 18 years 7 months, and for the interview at 21 it was 21 years 5 months. There was most variability in age for the interview at 24, where the median age was 24 years 11 months. Of the 85 youths interviewed, 11 were aged 23, 34 aged 24, 23 aged 25, and 17 aged 26.

In addition to interviews and tests with the boys, interviews with their parents were carried out by female social workers who visited their homes. These took place about once a year from when the boy was about 8 until when he was aged 14-15 and was in his last year of compulsory schooling. The primary informant was the mother, although the father was also seen in the majority of cases. Most of the parents were cooperative. At the time of the final interview, when the boy was 14-15, information was obtained from the parents of 399 boys (97.1%). The boys' teachers also filled in questionnaires about their behavior in school, when the boys were aged about 8, 10, 12, and 14. Again, the teachers were very cooperative, and at least 94% of questionnaires were completed at each age.

It was also possible to make repeated searches in the central Criminal Record Office in London to try to locate findings of guilt sustained by the boys, by their parents, by their brothers and sisters, and (in recent years) by their wives. In order to obtain identifying particulars which would enable these searches to be carried out, the full name and date of birth of each family member, including the mother's maiden name, was sought during interviews. These data were checked against, and frequently supplemented by, information from medical and social service records and from birth certificates and marriage certificates obtained from the General Register Office in London. Repeated searches were necessary, because convictions were sometimes located in one search but not in another. When offenders are known to have died, their names are deleted from the Criminal Record Office, and there is also a tendency to 'weed out' records of minor offenses after a number of years. The searches continued until March 1980, when the youngest sample member was aged 25 years 6 months. The criminal records of the boys who have not died or emigrated are believed to be complete from the tenth birthday (the minimum age of criminal responsibility in England and Wales) to the twenty-fifth birthday.

Convictions were only counted if they were for offenses normally recorded in the Criminal Record Office, which are more or less synonymous with 'serious' or 'criminal' offenses. For example, no convictions for traffic offenses were included, nor convictions for offenses regarded as minor (e.g. public drunkenness or common assault). The most common offenses included were thefts, burglaries, and unauthorized takings of motor vehicles. In a few cases where information from the boy or elsewhere did not agree with that in the Criminal Record Office, the discrepancies were resolved by reference to local police or court records. Since the information in the records was supplemented by extensive interviews and other enquiries, it is unlikely that any convicted boy in the sample escaped identification.

Most information in this research was derived from interviews. The boys' parents provided details about such things as family income, family size (also checked against school records), the social class of the family breadwinner, their

degree of supervision of the boy, and their child rearing behavior (which was a composite variable reflecting attitude, discipline, and parental agreement). The boys provided details about their job histories and leisure habits, such as spending time hanging about, drinking, and sexual activity. The interviews with the boys at age 18 and later ages were fully tape-recorded and transcribed, making verbatim quotations possible.

Ratings were obtained from the boys' teachers about their troublesome and agressive behavior in school, about their truancy, and about their school attainments. Ratings were also obtained from the boys' peers when they were in their primary schools, about such things as their troublesomeness, daring, honesty, and popularity.

Many psychological tests and self-report questionnaires were given, not only to the boys but also to their parents. These have the dual advantages of comparatively objective scoring and ease of administration. Non-verbal IQ was measured using the Progressive Matrices test, vocabulary using Mill Hill synonyms, and personality by the New Junior Maudsley Inventory (at 10 and 14) and the Eysenck Personality Inventory (at 16). Psychomotor clumsiness was measured using three tests, the Porteus Mazes, the Spiral Maze, and the Tapping test. Self-report questionnaires were used not only to measure the commission of delinquent and violent acts, but also to measure attitudes (e.g. to the police) and the delinquent behavior of a boy's friends. The questionnaires filled in by the parents provided information about their health and about their child rearing attitudes.

The major physical measures were of the boys' heights and weights at different ages, although other measures were also taken (e.g. of grip strength, using a dynamometer, at age 10, and of pulse rate, using a pulsimeter, at age 18). Ratings of physical appearance were made by the interviewers, regarding such things as racial characteristics, wearing glasses, tattoos, nail biting, and hair length. Finally, a small number of behavioral measures were taken, by systematically giving the youths opportunities to smoke and to gamble part of their interview fee.

A great deal of effort was expended in investigating and maximizing the reliability and validity of the various measures. Problems arose especially with the ratings derived from the earliest interviews conducted with the families by the psychiatric social workers. In order that the psychiatric social workers might work in the way they were accustomed, and elicit the maximum cooperation, they were given a list of topics to be covered, but were allowed to conduct unstructured interviews. They took a few written notes during the interviews, but mainly relied on dictating into a tape recorder afterwards. A good deal of this information proved to be too subjective and too much influenced by halo effects to be of use for research purposes. West (1969, pp.124-134) has described some difficulties in deriving relatively objective measures from it.

The later interviews were more structured. For example, the interview with the youths at age 18 was entirely structured, with the exception of the questions about delinquency, violence, and sexual experiences. It was thought that these sensitive topics should be approached in an unstructured fashion. Also, as already mentioned, the whole interview was tape-recorded, and this facilitated consistent and relatively objective coding decisions. The major test of validity involved a comparison between what the youths said about their convictions and information available in official records. Only 6% of convicted youths denied being convicted, and only 2% of unconvicted youths claimed to have been convicted. Reliability was studied in a number of ways, including comparing different accounts of the same incident by different youths, responses given at 18 with those given by the same youth at 16, and responses in one part of the interview with those in another. Differences between interviewers were also investigated. None of these checks suggested that the interview information was unreliable or invalid.

The low attrition rates in this study were achieved at the cost of a great deal of interviewer effort and time. The interviewers would go to great lengths to track down a youth's address, using a variety of methods. Some were traced through the local housing department, some were located by probation officers, some were provided by neighbors, relatives, or present occupants of old addresses,

some were derived from criminal records, marriage certificates, or telephone directories, and letters were forwarded to some youths by the Department of Health and Social Security, the Post Office, or by employers. The interviewers would make repeated calls at an address in an attempt to find someone in, and would go back to try to secure an interview even if a youth refused on the first occasion. The higher attrition rate at age 24 may be partly a function of the reduced level of funding at that time, which meant that less time could be spent trying to trace missing youths.

It is not possible to establish the effects on the boys or their families of being followed up over a long period. In retrospect, a control group of other (older and younger) boys from the original six schools should have been selected and followed up in records but never contacted personally. However, this was not done. The occasional intrusions of the researchers into their lives probably had little effect on the boys and their families. In general, the researchers did not do anything to change the lives of the families, although on occasions the social workers could not refrain from advising troubled parents where to go for help with their financial, housing, or health problems.

B2. Unique Features of the Survey

In section A4 above, it was noted that no American longitudinal survey of crime and delinquency combines more than three interviews with the subjects covering a period of at least five years, a reasonable sized sample, and information from multiple sources - the subjects, records, parents, peers, and teachers. The Cambridge Study in Delinquent Development has a unique combination of features:

(a) it is a prospective longitudinal survey over a period of nearly 20 years;

(b) the focus of interest is crime and delinquency;

(c) many variables were measured before any of the youths were officially convicted, to avoid the problem of retrospective bias;

(d) the study involved frequent personal contacts with a group of boys and their parents, so records were supplemented by interview, test, and questionnaire data;

(e) a fairly representative sample of urban working class youths was followed up, rather than extreme groups of (predicted or identified) delinquents and non-delinquents, so that all degrees of delinquency were present;

(f) the officially delinquent minority became gradually differentiated from their non-delinquent peers, avoiding the problem of selection of control groups;

(g) both official and self-report measures of delinquency were used;

(h) at least up to age 21, there was a very low attrition rate;

(i) many variables from different sources were measured, making it possible to test many hypotheses about delinquency, to investigate the relative importance of variables, and to study the importance of some variables while controlling for others. As mentioned earlier, other advantages in measuring variables from different sources are that it helps to determine whether observed relationships reflect real associations between theoretical constructs or measurement biases, it helps to establish validity and reliability, and it may be possible to reduce measurement errors by combining variables from different sources.

B3. Aims of this Project

The second report of the Cambridge Study in Delinquent Development (West and Farrington, 1973) was largely concerned with the natural history, explanation, and prediction of juvenile offending (i.e. between the tenth and seventeenth birthdays). The third report (West and Farrington, 1977) extended these analyses into the young adult years, up to the twenty-first birthday. I worked virtually full-time on this project from the summer of 1969 to the summer of 1975, funded by the British Home Office, and carried out all the computer analyses on which these two books were based.

Between the summer of 1975 and the summer of 1981, when I began my NIJ-funded Visiting Fellowship project, I became increasingly involved in other research, administrative, and teaching activities, and so had little time to work on the Cambridge Study. I did carry out a number of analyses of the data during this period - about one a year - on such topics as the effects of getting convicted (Farrington, Osborn, and West, 1978), the family backgrounds of aggressive youths (Farrington, 1978), a comparison of official and self-reported offending (Farrington, 1979a), truancy, schools, and delinquency (Farrington, 1980), a comparison of individual and group fights (Farrington, Berkowitz, and West, 1982), and a study of personality and offending (Farrington, Biron, and LeBlanc, 1982). These analyses enabled me to retain my familiarity with this complex and extensive dataset.

The funding for the Cambridge Study (in the final years from the British Social Science Research Council and Department of Health and Social Security) continued until the summer of 1979, and Professor Donald West continued to carry out interviews and collect official record data until then. Indeed, as mentioned earlier, the final set of official criminal records was obtained in March 1980. Professor West and his collaborators published a number of interesting and important papers during this period, on such topics as the effects of getting married (Knight, Osborn, and West, 1977; Osborn and West, 1979b), predicting the ending of criminal careers (Osborn and West, 1978, 1980), the effects of leaving London (Osborn, 1980), and a comparison between convictions of fathers and sons (Osborn and West, 1979a). However, the reduced level of funding meant that they did not have the resources to carry out computer analyses of the data.

One of my major aims in applying for the NIJ Visiting Fellowship was to be able to work full-time on the Cambridge Study data once again. There were two major objectives of the work. One was to extend the analyses of the data up to the twenty-fifth birthday, and to study the natural history, explanation, and prediction of offending up to 25. The second was to repeat earlier analyses of data up to the twenty-first birthday, using more modern statistical techniques.

Most of the data collected in the Cambridge Study consists of categorical variables, measured on nominal or ordinal scales. For example, following the Cambridge-Somerville study, maternal attitude was classified as loving normal, loving anxious, overprotective, cruel, passive, or neglecting (West and Farrington, 1973, p.49). In the past, I have been reluctant to analyze these kinds of data using parametric techniques such as least-squares multiple regression. Almost invariably, criminological data violate the underlying statistical assumptions of these techniques, such as that variables are measured on interval scales and are normally distributed. It is sometimes argued (e.g. Johnson, 1979, p.98) that such violations do not invalidate the conclusions, since some statistical techniques give reliable results (e.g. reasonably accurate p values) with some violations. In general, however, researchers cannot be sure that their data, with their particular violations, will not produce misleading results with these techniques.

My solution in the early 1970s to the problem of the multivariate analysis of these kinds of categorical data was to use rather crude matching techniques to investigate if one variable was related to offending independently of another. This was before the days of statistical packages, and I had to write Fortran programs to carry out virtually all analyses. From the mid-1970s onwards (in England), statistical packages such as SPSS became increasingly available. Furthermore, by 1980, statistical methods for the multivariate analysis of categorical data - in particular, logistic regression and loglinear modeling techniques (see Fienberg, 1980) - had been developed, and statistical packages (e.g. GLIM) were available to carry them out. Therefore, it was clearly desirable to analyze and reanalyze our data using these modern, defensible statistical techniques. Since they have rarely been used in longitudinal studies of crime and delinquency, it was hoped that experience with them would provide useful information for American researchers. In addition, of course, it was hoped that the substantive conclusions from this project (reported in sections C - G) would advance our knowledge about crime and delinquency.

C. The Natural History of Crime and Delinquency from 10 to 25

C1. Convictions at Each Age

The aim of section C is to document the natural history of criminal and delinquent behavior. Table C1 shows the number of youths first convicted for offenses committed at each age, the number of different youths convicted at each age, and the number of convictions at each age. The ages shown in this table are those at which offenses were committed rather than at the times of the convictions. There was sometimes a substantial delay between commission and conviction, especially in the case of the more serious offenses, where a youth might spend a year or more awaiting trial at the Crown Court. For example, perhaps the most serious criminal in the sample was a youth who carried out two robberies using guns, stealing more than £32,000. Both of these were committed when he was under 24, but he was not convicted for them until more than a year later, when he had passed his twenty-fifth birthday.

In this sample, the peak age for the number of different youths convicted (47) and for the number of convictions (63) was 17. By age 22, these figures had fallen by half, to 24 youths convicted and 33 convictions. By age 24, the figures were only about a quarter of the peak values, at 13 youths and 18 convictions. The peak period of official delinquency for this sample was from 14 to 20, with over 40 convictions (10 per 100 youths) at each age.

The number of youths convicted for the first time declined dramatically after the twenty-first birthday. The period from the tenth to the twenty-fifth birthday spans four legal categories in England and Wales: children (tenth to just before fourteenth birthday), young persons (fourteenth to just before seventeenth birthday), young adults (seventeenth to just before twenty-first birthday), and older adults (twenty-first birthday onwards). Children and young persons together are legally juveniles. It can be seen that 35 boys were first convicted as children, 49 as young persons, 44 as young adults, and only eight as older adults.

Table C1

Prevalence and Incidence of Convictions at Each Age

Age	Number of First Convictions*	Number of Different Boys Convicted	Number of Convictions
10	6 (1.5)	6	7
11	6 (3.0)	8	10
12	8 (5.0)	12	14
13	15 (8.7)	21	27
14	19 (13.5)	34	44
15	17 (17.7)	33	43
16	13 (20.9)	32	47
17	19 (25.7)	47	63
18	8 (27.7)	41	50
19	8 (29.7)	38	47
20	9 (31.9)	29	41
21	2 (32.4)	18	20
22	2 (32.9)	24	33
23	2 (33.4)	11	11
24	2 (33.9)	13	18
Total	136		475

* Cumulative percentage prevalence in parentheses, based on N=401.

Table C1 also shows the cumulative percentage prevalence of convictions, which reached 33.9 per cent by the twenty-fifth birthday. In calculating this, 10 unconvicted youths who had emigrated before age 25 were eliminated, since they were not at risk of a known conviction for the whole period. Of the convicted youths, five died and one emigrated before age 25, and all 16 dead or emigrant youths are eliminated in some subsequent tables (e.g. concerning convictions between the twenty-first and twenty-fifth birthdays, since none was at risk of this for the whole period). The information about death and emigration is complete only

up to age 22. The information about juvenile convictions (i.e. those before age 17) is complete for all 411 youths, since inquiries were made abroad in regard to the six youths who had spent at least a year of their juvenile period outside England and Wales.

The prevalence figure of about one-third of the sample with criminal convictions up to the twenty-fifth birthday may seem high. However, using official records, Farrington (1981) calculated that, if 1977 conviction rates were maintained for a generation, about 26% of English males would be convicted for a criminal offense up to the twenty-fifth birthday. The corresponding figure based on 1965 conviction rates was about 20%. Since the most common year of birth of sample members was 1953, most convictions occurred between 1963 and 1978. Taking 23% as the best estimate of the prevalence of convictions of English youths born in 1953, the sample figure is about 50% higher than the national one, no doubt reflecting the urban working class nature of the sample.

The peak age for the incidence of criminal convictions in the sample is slightly lower than the peak age seen in current official records. In England and Wales in 1981 (Home Office, 1982) the peak age for convictions for criminal offenses for males was 18 (7.7 convictions per 100 males), closely followed by 17 (7.5 convictions per 100 males). However, the peak age for the sample coincides with the peak age for convictions of the 1953 cohort followed longitudinally through official records. This peak age was reached by 17-year-old males in 1970 (5.9 convictions per 100 English males), closely followed by 18-year-old males in 1971 (5.7 convictions per 100). The peak rate for convictions in the sample (about 15 per 100 at age 17) was more than twice the corresponding national figure.

C2. Juvenile Delinquency and Adult Crime

Table C2 shows that there was a close relationship between juvenile (age 10-16) and adult (age 17-24) convictions. Of the 78 youths convicted as juveniles, 55 (70.5%) were convicted as adults, in comparison with only 52 (16.4%) of 317 not-convicted as juveniles (corrected $\chi^2 = 90.07$, 1 d.f., $p < .001$; unless otherwise

stated, all values of χ^2 have 1 d.f.). Conversely, the majority of adults convicted up to the twenty-fifth birthday (55 out of 107, or 51.4%) had previous juvenile convictions.

Table C2

Juvenile Versus Adult Convictions

Number of Juvenile Convictions	Number of Adult Convictions				
	0	1	2-3	4+	Total
0	265 (83.6)	33 (10.4)	12 (3.8)	7 (2.2)	317 (100%)
1	16 (36.4)	10 (22.7)	12 (27.3)	6 (13.6)	44 (100%)
2-3	6 (28.6)	3 (14.3)	6 (28.6)	6 (28.6)	21 (100%)
4+	1 (7.7)	0 (0.0)	2 (15.4)	10 (76.9)	13 (100%)
Total	288 (72.9)	46 (11.6)	32 (8.1)	29 (7.3)	395 (100%)

Note: Excluding 16 youths dead or emigrated before age 25.

The more juvenile convictions a person had, the more adult convictions he was likely to have. Only 13 youths in this sample had four or more juvenile convictions, but 10 of these (76.9%) also had four or more adult convictions. In contrast, only seven (2.2%) of the 317 youths who were not convicted as juveniles had four or more adult convictions, only six (13.6%) of 44 with one juvenile conviction, and six (28.6%) of 21 with two or three juvenile convictions. Of 29 youths with four or more adult convictions, only seven (24.1%) were not convicted as juveniles.

Thirty-three of the 78 juveniles were convicted of a relatively serious offense of burglary or violence, in comparison with 55 of the 107 adult offenders. Of the 33 serious juvenile offenders, 19 (57.6%) became serious adult offenders, eight (24.2%) became less serious adult offenders, and only six (18.2%) were not convicted as adults. Conversely, 19 (34.5%) of the 55 serious adult offenders were serious juvenile offenders, 14 (25.5%) were less serious juvenile offenders, and 22 (40%) were not convicted as juveniles. It seems clear that persons convicted as

juveniles of serious offenses were likely to be convicted as adults of serious offenses.

To provide a little more detail about transitions between different ages, the whole age range was divided into the four legal categories described above: children, young persons, young adults, and older adults. Of 35 convicted as children, 71.4% were convicted as young persons, in comparison with 13.0% of the remaining 376. Of 72 convicted as young persons, 63.9% were convicted as young adults, in comparison with 14.8% of the remaining 330 at risk. Of 92 convicted as young adults, 33.7% were convicted as older adults, in comparison with 5.0% of the remaining 303 at risk.

It could be argued that the continuity between juvenile and adult convictions reflected continuity in police activity rather than in offending, since it is likely that police attention and suspicion are especially focussed on persons with previous criminal records. In order to investigate this, the self-reported delinquency measures obtained during the interviews at ages 14, 18, 21, and 24 were studied. Continuity in police activity could not explain continuity in self-reported offending, at least among unconvicted youths.

A combined self-reported delinquency score was obtained for each youth at each age, which reflected both frequency and variety of offending. For example, at age 14, the youths were given descriptions of 38 acts on cards, and asked to say whether they had never, once or twice, sometimes, or frequently committed each act (see Farrington, 1973). These four possible responses were given the weights 0, 1, 2, and 3 respectively, and the weights were added up over all the acts to produce a combined self-reported delinquency score. This score significantly predicted later convictions among previously unconvicted youths. At age 18, the youths were asked to admit the number of times they had committed each of 12 acts in the previous three years, while at 21 and 24 they were asked to admit the number of times they had committed each of 10 acts in the previous two years. Each response was scored 0, 1, 2, 3, or 4, according to the number of acts admitted. The acts enquired about at each age included thefts, taking vehicles, burglaries, damaging property, drug use, and violence.

In agreement with the idea of continuity in offending, the self-reported delinquency score at each age was significantly correlated with the score at every other age. As might have been expected, the lowest correlation was between the scores at the most widely separated ages (14 and 24, $r = .33$, $N = 84$, $p = .002$). The average of the six correlations was .44.

It might still be argued that self-reported delinquency scores at different ages are correlated because (a) there is continuity in police activity, and (b) convictions are associated with higher scores (either because convictions lead to an increase in offending or because convictions make people more willing to admit offending: see Farrington, 1977). In order to investigate this, the correlations were calculated separately for convicted youths (up to age 24) and for youths who were never convicted. In both cases, five of the six correlations were significant. The average correlation for unconvicted youths (.45) was very similar to that for the whole sample, while the average correlation for convicted youths (.32) was somewhat lower. Therefore, it can be concluded that youths who were relatively frequent offenders during their juvenile years tended to continue to be relatively frequent offenders during their early adult years.

C3. Age of Onset

Table C3 shows that there was a tendency for the average number of convictions to decrease with the increasing age of the first conviction. Similarly, the average length of criminal career tended to decrease with the increasing age of the first conviction. (The length of career for each person was the difference between the age on the final conviction and the age on the first conviction; hence, persons with only one conviction had a career length of 0.) In general, the 20 youths first convicted at the earliest ages (10 to 12) tended to become the most persistent offenders. They averaged more convictions during every age range than any other group. The only slight exception to this was that, between ages 21 and 24, they were convicted at the same rate (1.00 per youth) as those first convicted at 15.

Table C3

Number of Convictions per Youth at Different Ages, According to Age on First Conviction

Age on First Conviction (N)	Average Number of Convictions per Youth at Age: 10-13	14-16	17-20	21-24	10-24*	Average Length of Career (in years)
10-12 (20)	2.10	2.30	2.16	1.00	7.17	8.2
13 (15)	1.07	1.13	1.53	0.80	4.53	6.2
14 (19)	-	1.47	1.17	0.41	2.82	3.2
15 (17)	-	1.76	1.76	1.00	4.53	4.4
16 (13)	-	1.00	1.33	0.36	2.82	3.9
17 (19)	-	-	2.10	0.37	2.47	1.8
18-19 (16)	-	-	1.19	0.38	1.56	0.8
20-24 (17)	-	-	0.53	0.65	1.18	0.2

* The average number of convictions per youth at age 10-24 is not necessarily the sum of the averages in the first four columns, because each figure is based only on youths at risk of conviction for the whole time period.

One question which arises is to what extent these results are artefactually produced by the cut-off point of this analysis at the twenty-fifth birthday. Clearly, the two people first convicted at age 24 necessarily had a career length of 0. However, it seems unlikely that the general pattern of the results would be changed by continuing the analysis up to the thirtieth or fortieth birthdays. It seems likely that the majority of these offenders had completed their criminal careers by the twenty-fifth birthday. Of the 128 offenders first convicted by their twenty-first birthdays, only 16 were convicted at age 23 or 24.

In order to investigate the most persistent offenders, the youths were divided into those with 0, 1, 2, 3, 4-5, and 6 or more convictions. This analysis was based on 397 youths, excluding all those dead or emigrated except two dead convicted youths who had six or more convictions. The 23 'chronic offenders' with six or more convictions (5.8% of the sample, or 17.4% of all the convicted youths)

amassed a total of 230 convictions, an average of 10 each. They accounted for almost exactly half (49.1%) of the total number of 468 convictions of this sample. Fourteen of the chronic offenders were convicted between ages 10 and 13, all 23 between 14 and 16, 22 between 17 and 20, and 15 (out of 21 at risk) between 21 and 24. Eleven were first convicted at age 10-12, six at age 13-14, and six at age 15. The relatively large number of convictions of those first convicted at 15 (Table C3) probably reflects the fact that six of them were chronic offenders, in comparison with only three at 13 and three at 14. The chronic offenders will be studied in more detail in section E4.

C4. Changes in Officially Recorded Offending with Age

Table C4 shows changes in the percentages of youths convicted of specified offenses at different ages, and also changes with age in the number of offenses leading to conviction. The ages are inclusive, and the age ranges are consecutive, so that (e.g.) age 10-13 means from the tenth until just before the fourteenth birthday. As before, only offenses normally recorded in the Criminal Record Office are included in this table. This means, for example, that assaults had to be quite serious (causing actual or grievous bodily harm) to be included, since common assault is not normally recorded. Only offenses leading to convictions are included in this table, not offenses 'taken into consideration'. Only 39 of the 475 convictions (8.2%) involved offenses taken into consideration, which were usually of the same kind as those leading to the conviction.

The youths were convicted of 683 offenses on their 475 occasions of conviction, showing that a youth was usually convicted of only one offense on each occasion. The types of offenses shown in Table C4 are chosen for comparability with those for which self-reports are available at different ages (q.v.). However, the seven types shown in the bottom half of the table account for the majority of offenses leading to conviction. There were 115 burglaries, 103 offenses of unauthorized taking of motor vehicles, 42 thefts from shops, 37 thefts from vehicles, 30 assaults, 28 offenses of damaging property, and 16 thefts from automatic machines such as telephone boxes, cigarette machines, and parking meters - a total of 371 offenses.

Table C4

Offenses Leading to Convictions at Different Ages

	Age			
	10-13 (N=411)	14-16 (N=411)	17-20 (N=402)	21-24 (N=395)
Percentage of Youths Convicted* of:				
Assault	0.5 (0.3)	0.5 (0.3)	3.7 (0.3)	2.5 (0.3)
Damage	0.5 (0.3)	1.2 (0.3)	3.7 (0.3)	1.0 (0.3)
Burglary	1.9 (0.4)	6.1 (0.6)	6.2 (0.5)	2.8 (0.3)
Taking Vehicles	1.0 (0.3)	7.1 (0.4)	7.5 (0.4)	2.3 (0.4)
Stealing from Vehicles	1.9 (0.3)	2.2 (0.4)	2.7 (0.3)	1.0 (0.3)
Shoplifting	1.5 (0.4)	2.7 (0.5)	1.5 (0.4)	1.3 (0.5)
Stealing from Machines	1.0 (0.3)	0.5 (1.0)	0.5 (0.6)	0.3 (0.3)
Drug Use	0.0 (0.0)	0.0 (0.0)	1.5 (0.6)	1.5 (0.3)
Any of Above	6.3 (0.4)	13.4 (0.7)	17.4 (0.6)	7.8 (0.5)
Any Offense	8.5 (0.5)	18.0 (0.8)	23.6 (0.8)	11.6 (0.7)
Number of Offenses per 100 Youths per Year of:				
Assault	0.1	0.2	1.0	0.6
Damage	0.1	0.4	1.0	0.3
Burglary	0.7	3.6	2.8	0.8
Taking Vehicles	0.3	2.8	3.0	0.9
Stealing from Vehicles	0.7	0.8	0.7	0.3
Shoplifting	0.5	1.2	0.6	0.6
Stealing from Machines	0.2	0.5	0.3	0.1
Any of Above	2.7	9.6	9.4	3.6
Any Offense	4.3	15.1	18.8	7.8

* Numbers in parentheses show the average number of offenses per year committed by each offender.

Of the remaining 312, 108 were miscellaneous thefts, and 56 were offenses of 'suspicious behavior' (e.g. going equipped to steal), which were often included as ancillary charges when a youth was convicted of burglary, taking vehicles, or stealing from vehicles. There were 36 offenses of handling or receiving stolen property, 32 of fraud or forgery, 22 of drug use, 21 of disorderly conduct (e.g. breach of the peace or threatening behavior), 20 of possessing an offensive weapon, 11 robberies, five sex offenses, and one arson. Self-report data is available about some of these other offenses, but only at one or two ages (e.g. receiving, theft from employers, defrauding the government, possessing an offensive weapon).

In the case of drug use, self-report data is available about the proportion of youths who have taken drugs but not about the number of occasions. It was thought more important to try to classify the youths as 'regular' or 'occasional' users than to try to obtain accurate estimates of drug consumption.

Table C4 shows that the peak incidence of most offenses leading to convictions was either at 14-16 or 17-20. For taking vehicles, 7.1% of the youths were convicted between 14 and 16, and 7.5% between 17 and 20. There were 2.8 offenses per 100 youths per year between 14 and 16, and 3.0 between 17 and 20. For burglary, 6.1% of the youths were convicted between 14 and 16, and 6.2% between 17 and 20. There were 3.6 offenses per 100 youths per year between 14 and 16, and 2.8 between 17 and 20.

Shoplifting, stealing from vehicles, and stealing from automatic machines were offenses which tended to be most frequent at relatively early ages. The peak incidence of stealing from machines was at 10-13 (1.0% of the youths convicted), and for shoplifting it was 14-16 (2.7%). The rate of stealing from vehicles was fairly constant from 10-20, at about 0.7 or 0.8 offenses per 100 youths per year. On the other hand, assault, damaging property, and drug use tended to peak at relatively later ages. The clear peak for assault and damage was at 17-20, with 3.7% of youths convicted and 1.0 offenses per 100 youths per year. Drug use was equally common at 17-20 and 21-24.

In most cases, the peak incidence of committing offenses not shown in Table C4 was at 17-20. For example, miscellaneous theft reached a peak of 3.0 offenses per 100 youths per year between 17 and 20, handling or receiving reached a peak of 1.0, possessing an offensive weapon 0.7, and robbery 0.4. An exception to this general trend was fraud or forgery. There were no offenses of this kind between 10 and 13, 0.4 per 100 youths per year at 14-16, 0.7 at 17-20, and 0.9 at 21-24. It may be that fraud or forgery has yet to reach its peak in this sample.

The individual crime rates (the average number of offenses committed per year per offender) had a much flatter distribution that the incidence figures, but still showed signs of peaking at 14-16 or 17-20. For all offenders and all offenses,

the individual crime rate was 0.5 from 10-13, 0.8 from 14-16, 0.8 from 17-20, and 0.7 from 21-24. The problem with individual crime rates for specific types of offenses is that most offenders only committed one of each type of offense during each age range. Since the age ranges were of three or four years, this produced the large number of individual crime rates of 0.3. However, it is clear that the peak in the number of offenses per 100 youths per year is primarily a peak in the incidence of offenders rather than in the rates of committing crime by offenders.

An attempt was also made to investigate changes in the 'quality' of officially recorded offenses with age. Burglaries and robberies were studied, as these were generally the most serious offenses committed. The 'quality' of these offenses was operationally defined in terms of the value of the stolen property, as estimated in police records. Of the 126 burglaries and robberies (including attempts) committed between ages 10 and 24 inclusive and leading to convictions, 60 either had no stolen property or the value not stated. (The items stolen were almost always described.) Of the remaining 66 offenses, three were duplicates, or instances where two youths in the sample were involved in the same burglary. This left 63 separate offenses, 55 burglaries and eight robberies. In order to allow for inflation, all values were converted into 1980 prices (the date of the last conviction), using the retail price index.

It seemed clear that the average amount stolen increased with age. At 1980 values, the average of 34 juvenile offenses was £196, of 22 young adult offenses was £487, and of seven adult offenses was £8,103. Four of the seven adult offenses netted more than £5,000, in comparison with none of the remainder. Only two of the 34 juvenile offenses, and only three of the 22 young adult offenses, involved more than £1,000. Therefore, it may be that, while offending in general peaks in late adolescence and early adulthood, the most serious offenses peak later in life and may coincide with the greatest use of incapacitation.

C5. Changes in Self-Reported Offending with Age

Table C5 shows changes in the percentages of youths admitting specified offenses at different ages, and also changes with age in the number of offenses

admitted. The age ranges shown in this table are not inclusive or consecutive.

Table C5

Self-Reported Offenses at Different Ages

	Ages (adjusted to N=387)			
	10-14	15-18	19-21	22-24
Percentage of Youths Admitting:				
Fighting	23.8 (-)	62.3 (4.4)	39.5 (1.8)	30.3 (1.4)
Damage	11.9 (-)	21.2 (2.5)	3.6 (3.6)	3.6 (3.6)
Burglary	13.2 (-)	10.9 (2.7)	4.5 (2.6)	2.6 (1.3)
Taking Vehicles	7.5 (-)	15.2 (2.4)	6.4 (7.4)	1.8 (0.7)
Stealing from Vehicles	9.3 (-)	13.4 (2.9)	4.1 (3.5)	2.4 (10.1)
Shoplifting	39.3 (-)	15.5 (7.3)	6.7 (9.8)	4.2 (6.2)
Stealing from Machines	14.7 (-)	19.1 (2.5)	2.4 (1.1)	2.4 (2.0)
Drug Use	0.3 (-)	31.5 (-)	20.4 (-)	18.2 (-)
Motoring Convictions	- (-)	16.3 (0.6)	17.0 (0.6)	12.4 (0.6)
Number of Offenses per 100 Youths per Year of:				
Fighting	-	272.5	71.2	42.5
Damage	-	53.7	12.8	12.8
Burglary	-	29.5	11.5	3.5
Taking Vehicles	-	36.3	47.5	1.2
Stealing from Vehicles	-	39.4	14.5	24.2
Shoplifting	-	113.2	65.4	26.2
Stealing from Machines	-	48.1	2.7	4.8
Any of above	-	592.6	225.6	115.1
Motoring Convictions	-	10.1	10.9	8.0

*Numbers in parentheses show the average number of offenses per year committed by each offender, - = Not available.

During the interview at age 14, the youths were asked to admit offenses which they had ever committed up to that time, and to say whether they had committed each once or twice, sometimes, or frequently (see Farrington, 1973). Therefore, precise information about frequency is not available at this age. It can be assumed that most acts admitted would have been committed after the tenth birthday. At age 18, the youths were asked to admit the number of offenses they had committed in the previous three years (see West and Farrington, 1977), while at ages 21 and 24 they

were asked to admit the number of offenses committed in the previous two years (see Knight, Osborn, and West, 1977; Osborn and West, 1980). On the basis of the median ages at interview (see section B1), the self-reported delinquency information is available for the period up to 14 years 9 months, from 15 years 7 months to 18 years 7 months, from 19 years 5 months to 21 years 5 months, and from 22 years 11 months to 24 years 11 months.

With one eception, the questions asked at ages 18, 21, and 24 were exactly the same. The exception was that the burglary question at ages 21 and 24 specified 'breaking an entering and then stealing money or things worth £5 or more', whereas at age 18 it merely specified 'breaking and entering and then stealing'. The questions asked at age 14 were less comparable. For example, the incidence of burglary is calculated from the responses to four questions, 'breaking into a big store, garage, warehouse, pavilion, etc.', 'breaking into a small shop (private tradesman) whether or not anything was stolen', 'planning well in advance to get into a house, flat, etc. and steal valuables (and carrying the plan through)', and 'getting into a house, flat, etc. and stealing things (don't count cases where stealing results from planning well in advance)'. A youth was counted as admitting burglary at age 14 if he admitted any of the above four acts.

Burglary is a rather extreme case, because there was no other instance where admissions at 14 were based on four questions. Admissions at 18, 21, and 24 were based on only one question. There was only one other case at age 14 where admissions were based on more than one question. The admissions for shoplifting at 14 were derived from 'stealing things from big stores, supermarkets, multiple shops (while shop open)' and 'stealing things from small shops or private tradesmen (shop open)'. The corresponding item at later ages specified 'shoplifting from shops, market stalls, stores, supermarkets, etc.'. Other items were more comparable at all ages. For example, 'stealing goods or money from slot machines, juke boxes, telephones, etc.' at 14 became 'stealing from slot machines, such as gas or electricity meters, parking meters, 'phone boxes, cigarette machines' at 18, 21, and 24. The procedure was the same at all four ages, since the acts were presented to the youths on cards as part of a face to face interview.

The admission rates shown in Table C5 are estimated for the sample of 387 youths (94.2% of the total) who were interviewed both at 14 and at 18. The admission rates for these 387 at 14 were very close to those for all 406 (98.8%) interviewed at 14, and it was concluded that working with a sample of 387 rather than 411 introduced a negligible error (less than 1%). Convicted youths (and self-reported delinquency admissions) were over-represented in the samples interviewed at 21 and 24, so it was necessary to adjust the admissions to what might have been expected from the whole sample. This was done very simply, and will be explained in the case of burglary, although the principles are the same in all cases.

Of the 387 youths interviewed at 14 and 18, 13.2% admitted burglary at 14 and 10.9% at 18. Only 217 youths were interviewed both at 18 and at 21. Of these, 16.6% admitted burglary at 18 and 6.9% at 21. The proportionate reduction in burglary between 18 and 21 for this sample was .584 (since 6.9 divided by 16.6 is .416). This reduction was then applied to the original figure of 10.9% of 387 to produce an estimated admission rate at 21 of 4.5% (10.9 x .416 = 4.5). Only 60 youths were interviewed both at 21 and 24. Of these, 11.7% admitted burglary at 21 and 6.7% at 24. The proportionate reduction in burglary for this sample, then, was .427. When this figure was applied to the previous estimate of 4.5% at age 21, it produced an estimate of 2.6% at age 24.

The estimated number of offenses per year was calculated in the same way. The 387 youths interviewed at 14 and 18 admitted a total of 342 burglaries (in the previous three years) at 18, or 29.5 per 100 youths per year. The 217 youths interviewed at 18 and 21 admitted 317 burglaries at 18 and 82 at 21, a proportionate reduction of .741. Applying this to the total of 342 burglaries for the whole sample of 387 produced an estimated number of burglaries at 21 of 89, or (in view of the two year admission period) 11.5 per 100 youths per year. The 60 youths interviewed at 21 and 24 admitted 49 burglaries at 21 and 15 at 24, a proportionate reduction of .794. Applying this to the previous estimate of 11.5 burglaries per 100 youths per year produced an estimate of 3.5 at age 24 (see Table C5).

This estimation method is simple and rough. The estimate at age 24 is likely to be the most inaccurate, since it is based on only 60 youths. On the other hand, the youths left in the sample at ages 21 and 24 tended to be those admitting the most acts. Therefore, the reduction estimate is likely to be adequate as a measure of the future law-violating behavior of the most delinquent youths at age 18. There will only be an inaccurate estimate for the whole sample if substantial numbers of the less delinquent youths at 18 were increasing their law-violating behavior at 21 or 24 or, at least, not decreasing it to the same extent as the more delinquent youths. This seems very unlikely. For example, considering the 217 youths interviewed at 18 and 21, 181 admitted no burglaries at 18. Of these, 173 (95.6%) also admitted no burglaries at 21, five (2.8%) admitted one burglary at 21, and only three (1.7%) admitted more than one burglary at 21. In general, there was a highly significant relationship between admissions at one age and admissions at the next.

Table C5 shows that the incidence of most offenses peaked between ages 15 and 18. During this period, 62.3% of the sample were involved in fights, 21.2% damaged property, 15.2% took vehicles, 13.4% stole from vehicles, 19.1% stole from machines, and 31.5% used drugs. However, burglary and shoplifting were more common before age 14 than between 15 and 18. The burglary result may be affected by the non-comparability of the measurements at ages 14 and 18 (see above). The four acts were admitted by between 4.0 and 4.6% of the youths, although 13.2% admitted at least one. Both shoplifting acts at 14 were admitted by a higher proportion of the youths than admitted the corresponding act at 18, so it is reasonable to conclude that the peak age for shoplifting was before 14. After age 18, the incidence of all acts declined.

It might be thought that the declining incidence between ages 18 and 21 shown in the top half of Table C5 is affected by the recall period (three years at 18 and two years at 21). However, when the analyses were repeated for youths admitting at least one offense per year (as opposed to at least one offense) the results were virtually unchanged. For the 217 youths interviewed at 18 and 21, the average

percentage admitting each of the first seven offenses listed in Table C5 was 30.0% at 18 and 12.4% at 21, a proportionate reduction of .587. The average percentage admitting these offenses at least once a year was 18.3% at 18 and 7.5% at 21, a very similar proportionate reduction of .601.

The number of offenses per 100 youths per year declined from 15-18 to 19-21 and again to 22-24. Table C5 shows that this decline was primarily in the incidence of offenders rather than in individual crime rates. With some offenses (fighting, burglary), incidence and individual crime rates both decreased. However, with other offenses (damage, stealing from vehicles), a decrease in incidence coincided with an increase in individual crime rates. In other cases (taking vehicles, shoplifting, stealing from machines), a decreasing incidence coincided with fluctuating individual crime rates.

Self-reports of motoring convictions are shown in Table C5 because these could not be obtained systematically from criminal records. It can be seen that there were no great changes with age in the number of offenses per 100 youths, the incidence, or individual crime rates.

C6. Comparing Official and Self-Reported Offending

The most startling difference between official and self-reported offending is in the overall rate of offending. The seven offenses specified in the bottom half of Tables C4 and C5 were committed at a rate of nearly 10 per 100 youths per year between ages 14 and 20, according to official records of convictions. According to self-reports, they were committed at a rate of nearly 600 per 100 youths per year from 15 to 18, and at 225 per 100 youths per year from 19 to 21. Similarly, individual crime rates were never greater than one offense per offender per year according to official records, but they ranged up to 10 offenses per offender per year according to self-reports.

There was less discrepancy between official records and self-reports in the incidence of offenders, especially for the more serious offenses. For example, burglary was admitted by 10.9% between 15 and 18 and by 4.5% between 19 and 21.

These figures are not out of line with the 6.1% convicted of burglary between 14 and 16 and the 6.2% convicted between 17 and 20. Similarly, 7.1% were convicted of taking vehicles at 14-16 and 7.5% at 17-20. These figures are not out of line with the 15.2% who admitted taking vehicles at 15-18 and the 6.4% who admitted this at 19-21. It may be that the official records are tolerably accurate in identifying the offenders but very misleading in regard to the rates at which they commit crime.

Of course, there are problems of comparability between official and self-reported offending. The least comparable offense was assault. In the official records, it referred to relatively serious assaults, but the self-reports referred to fights, most commonly occurring in bars or streets. How many of these fights could have led to a charge of assault is uncertain. What is certain is that only a tiny fraction of assaultive behavior involving working class youths ever leads to a conviction for assault.

A detailed comparison of convictions and self-reports for the three-year period up to the date of the interview at age 18 was carried out. (This analysis updates that described by West and Farrington, 1977, p.28.) The number of youths admitting burglary during this period was 42 (10.8% of the 389 interviewed), whereas the number convicted of burglary during this period was 28 (7.2%). Of the 28 convicted of burglary, 20 admitted burglary (71.4%). The total number of offenses of burglary admitted was 342, whereas the total number leading to convictions was 35. These figures suggest that only about 10% of burglaries led to convictions. Despite this, the self-reports and official records agreed substantially in identifying the proportion of the sample who were committing burglary.

The same pattern held with the less serious offenses, although the agreement on incidence was less. For example, 60 youths (15.4% of 389) admitted taking vehicles, and 25 (6.4%) were convicted of it. Of the 25 convicted, 19 (76%) admitted it. The total number of offenses of taking vehicles admitted was 423, while the total number leading to convictions was 35. Once again, there was

much more agreement between official records and self-reports in identifying the offenders than in estimating the number of offenses committed.

Tables C4 and C5 agree in showing that, for most offenses, the peak age of incidence was within a year or two of the seventeenth birthday. This was true for taking vehicles, stealing from vehicles, damaging property, assault, and drug use, although assault and drug use did not decline with age as quickly as the other offenses. The peak age for shoplifting and for stealing from machines was earlier than 17. The peak age for burglary was less certain. According to official records, it was around 17, but according to self-reports it was earlier.

It was mentioned earlier that, according to official records, fraud was more common at 21-24 than at earlier ages. A question was asked at 21 and 24 about 'obtaining money from the government, such as unemployment or sickness benefit, by telling lies', and the proportion admitting this declined from 21 to 24 (from 15% to 10% of 60 interviewed at both ages). Therefore, it may be that this particular kind of fraud, one of the most common committed by these working class youths, has passed its peak by age 24.

D. Explaining the Development of Crime and Delinquency

D1. Measures of Crime and Deviance

The aim of section D is to investigate the determinants of criminal, delinquent, and deviant behavior at different ages from 8 to 25. As mentioned in section C, the period from the tenth to the twenty-fifth birthday spans four legal categories in England and Wales: children (age 10-13 inclusive), young persons (age 14-16), young adults (age 17-20), and older adults (age 21 onwards). In this sample, 35 boys (8.5%) were convicted as children, 74 (18.0%) as young persons, 95 (23.6%) as young adults, and 46 (11.6%) as older adults. For young adults and older adults, the percentages convicted refer to the populations at risk, that is the number of boys who had not died or emigrated (402 and 395 respectively at the different ages). The percentages for children and young persons refer to all 411 boys. As mentioned above, no boy died before age 17, and enquiries were made

abroad in regard to the six youths who spent at least a year of their juvenile period outside England and Wales. Over one-fifth of the boys (84) were convicted as juveniles (children or young persons), and over one-quarter (110) as adults.

In addition to the information about convictions, self-reports of offending were also obtained at different ages, of course. At age 14, the 108 boys (out of 405 interviewed) who admitted 13 or more different acts out of 38 enquired about were referred to as the 'self-reported delinquents'. At age 18, the scoring system reflected the frequency as well as the variety of offenses committed, and 97 youths out of 389 interviewed were categorized as self-reported delinquents, on the basis of their relatively high scores.

For the purposes of the present analysis, each variable was dichotomized into the 'worst' quarter and the remaining three-quarters, wherever possible. There were various reasons for this. First of all, in order to compare variables, it was desirable that each should be measured equally sensitively (or insensitively). Secondly, in order to carry out loglinear or logit analyses, it was desirable to have as few categories as possible for each variable, and for logistic regressions it was necessary to have dichotomous dependent variables. Thirdly, the one-quarter/three-quarters split had been used from the beginning of this study, because of the prior expectation that about one-quarter of the sample would be convicted, and the desirability of equating the proportion of those identified who were convicted and the proportion of those convicted who were identified. In addition, variables on which less than 350 boys were known (out of the 411) were eliminated. On most variables included, the number of missing cases was 5% or less, and there were no missing cases on many variables measured at age 8-10.

Two other measures of crime and deviance were used. One was the rating of the troublesomeness of the boys at age 8-10, made by their peers and teachers. This proved to be the best predictor of juvenile convictions. It might therefore be suggested that the understanding of why boys get convicted might be increased if it was understood why they behaved badly at an early age. The other measure was of 'antisocial tendency' at age 18. Generally, at this age, the convicted

youths were leading more deviant life styles than the remainder. The aim of the antisocial tendency index was to measure the extent of this deviant life style, excluding the kinds of deviance which usually led to convictions (i.e. property offenses such as thefts and burglaries). Therefore, antisociality reflects deviant behavior which is rarely, or in some cases never, dealt with by the police and courts. The antisocial tendency score was based on 11 factors which were inter-related (heavy gambling, heavy smoking, driving after drinking, use of prohibited drugs, sexual promiscuity, unstable job record, spending time hanging about, involvement in antisocial groups, most aggressive in behavior, anti-establishment attitudes, and tattoos). The 110 youths scoring 4 or more were identified as the most antisocial at age 18. Antisociality was the variable which was most closely related to convictions at any age (i.e. the best discriminator of the 136 convicted up to the twenty-fifth birthday from the remainder).

D2. Possible Explanatory Variables

The aim in this study was to measure as many factors as possible which were alleged to cause or contribute to delinquency. One of the major reasons for this was to investigate the inter-relationships between variables, and the extent to which one variable was related to delinquency independently of others. In any non-experimental study, as mentioned in Section A, it is desirable to achieve statistical control of as many variables as possible. However, in terms of statistically significant relationships, this study suffered from an embarrassment of riches. The majority of measured variables significantly differentiated between convicted and unconvicted youths. On any particular factor, it was almost invariably the category which, on common sense grounds, would be defined as the most adverse which included the highest percentage of convicted youths. For example, more delinquents were drawn from the poorest families, those with low IQs, and those whose parents exercised poor supervision over them. The problem was to reduce the very large number of measured variables (over 4,000 in the whole dataset) to a more manageable number.

Certain principles were adopted to guide the reduction procedure. In particular, the aim was to have each empirical variable measuring only one theoretical concept, as far as possible. This was achieved by identifying clusters of variables which were related empirically and theoretically, and then either choosing one variable as the best representative of this cluster or combining a number of the variables in the cluster into a single composite variable.

As an example, the psychiatric social workers' ratings of maternal attitude, maternal discipline, paternal attitude, paternal discipline, marital disharmony, and parental inconsistency, were all closely related. Parents tended to be seen as bad in many respects, or good in many respects, but rarely bad in some respects and good in others. It is probable that the psychiatric social workers had found difficulty in rating one aspect of parental behavior independently of another, and this is one manifestation of the halo effect mentioned above. In view of these relationships, it was decided to combine all the variables into one global rating called parental behavior. The rules of combination were very simple, both in this example and in others. Each boy was given, 1, 2, or 3 points on each variable, and his scores were simply added over all the variables. The features contributing to the rating of poor parental behavior were parents with cruel, passive, or neglecting attitudes, very strict, harsh, or erratic discipline, and parents who were in conflict with each other.

There were other reasons for combining variables. For example, the non-verbal IQ scores at ages 8 and 10 were combined (by averaging), on the grounds that the combined score would have less variability than either individual score. Measures of the same theoretical concept obtained from different sources were combined in the expectation that the biases present in the sources might cancel out to some extent. For example, the measures of troublesomeness obtained from teachers and peers were combined, as were the measures of daring obtained from parents and peers.

Another way in which the number of variables in the analysis was reduced was by eliminating those which were very subjective or not well defined. For example, the rating of mother's past health was eliminated because it depended on mothers' recollections and admissions of past events. The rating of present health of mothers, which in some cases was supplemented by hospital records, varied markedly with socioeconomic status, as expected, with the lower status mothers having poorer health. However, poor past health was not related to socioeconomic status, suggesting that the lower status families were underreporting. The rating of sibling disturbance was eliminated because there were marked differences between the psychiatric social workers in the proportion of boys said to have disturbed siblings, and these differences could only be explained by interviewer bias. The rating of unstable personality of mothers, which was intended to identify behavior-disordered individuals who did not necessarily have anxiety symptoms, was eliminated because it was not defined very explicitly. In choosing between variables, those which were more objectively measured were preferred.

The variables included in the present analyses are shown in Table D1, which also shows their relationship with convictions between 10 and 24 inclusive. There were 27 variables measured at age 8-10, 20 at age 12-16 (mostly at age 14), and 27 at age 18. The same variable was often measured at different ages, for example height, weight, IQ, vocabulary, neurotic extraversion, income, family size, social class, and poor housing.

D3. Relationships with Convictions at 10-13

Table D2 shows which of the possible explanatory variables were independently related to each dependent measure of crime or deviance. With the exception of the analysis of troublesomeness, only explanatory variables prior in time to each dependent measure were included in each analysis. Thus, family income at 8 was investigated as a predictor of self-reported delinquency at 14, but family income at 14 was not. Dependent measures at one time were included as possible explanatory variables in the analysis of a later dependent measure. Thus, convictions

Table D1

Summarizing all Relationships with Convictions at Age 10-24

Variable at age	'Worst' group Description	N (%C)	Remainder N(%C)	Corrected χ^2	p<
Family Income 8	Low	92(48.9)	309(29.4)	11.13	.001
Housing of Family 8-10	Poor	149(45.0)	252(27.4)	12.15	.001
Social Class of Family 8-10	Low	79(39.2)	322(32.6)	0.97	N.S.
Job Record of Father 8-10	Erratic	47(53.2)	323(30.3)	8.65	.005
Job of Mother 8-10	Full-time	110(28.2)	273(34.8)	1.27	N.S.
Family Size 10	Large	97(51.5)	304(28.3)	16.72	.001
Convicted Parent 10	Convicted	103(55.3)	298(26.5)	27.11	.001
Convicted Sibling 10	Convicted	45(57.8)	356(30.9)	11.71	.001
Parental Behavior 8	Poor	91(47.3)	295(28.5)	10.27	.005
Separation from Parent 10	Separated	90(51.1)	311(28.9)	14.34	.001
Parental Supervision 8	Poor	70(52.9)	303(28.4)	14.32	.001
Catholic Family 8	Catholic	71(50.7)	272(28.3)	11.79	.001
Nervous Mother 10	Nervous	122(41.8)	255(28.6)	5.91	.025
Nervous Father 10	Nervous	78(37.2)	281(32.4)	0.43	N.S.
Uncooperative Family 8	Uncooperative	43(51.2)	358(31.8)	5.56	.025
IQ 8-10	Low	102(48.0)	299(29.1)	11.35	.001
Psychomotor Clumsiness 8-10	High	102(44.1)	299(30.4)	5.76	.025
Vocabulary 10	Low	122(45.1)	271(28.4)	9.74	.005
Junior Attainment 10	Low	90(51.1)	287(28.2)	15.06	.001
Neurotic Extraversion 10	High	112(33.9)	275(33.1)	0.00	N.S.
Height 8-10	Low	71(43.7)	328(31.7)	3.21	N.S.
Weight 8-10	Low	73(38.4)	327(33.0)	0.54	N.S.
Troublesomeness 8-10	High	89(61.8)	312(26.0)	38.10	.001
Daring 8-10	High	120(53.3)	278(25.9)	26.84	.001
Dishonesty 10	High	87(49.4)	259(27.8)	12.77	.001
Popularity 8-10	Low	123(39.8)	263(30.0)	3.20	N.S.
Nervousness 8	High	91(24.2)	288(36.1)	3.92	.05
Family Income 14	Low	79(38.0)	265(30.9)	1.07	N.S.
Housing of Family 14	Poor	45(44.4)	351(31.6)	2.41	N.S.
Social Class of Family 14	Low	58(43.1)	311(32.5)	2.01	N.S.
Job of Mother 14	Full-time	100(32.0)	284(33.1)	0.01	N.S.
Family Size 14	Large	83(50.6)	313(29.1)	12.68	.001
Parental Attitude 14	Cruel, Passive, Neglecting	87(40.2)	290(30.7)	2.34	N.S.
Broken Home 15	Broken	48(54.2)	353(31.2)	8.98	.005
IQ 14	Low	117(47.0)	281(28.1)	12.37	.001
Vocabulary 14	Low	91(47.3)	308(29.5)	9.10	.005

[continued overleaf]

Table D1 (continued)

Variable at age	'Worst' group Description	N (%C)	Remainder N(%C)	Corrected χ^2	p<
Neurotic Extraversion 14	High	90(34.4)	309(33.3)	0.00	N.S.
Height 14	Low	97(37.1)	300(32.3)	0.55	N.S.
Weight 14	Low	97(33.0)	279(33.3)	0.00	N.S.
Aggressiveness 12-14	High	131(54.2)	270(24.1)	34.38	.001
Truancy 12-14	High	73(63.0)	328(27.4)	32.15	.001
Nervousness 14	High	106(37.7)	272(32.4)	0.76	N.S.
Hostile to Police 14	High	88(54.5)	310(27.7)	20.87	.001
Self-reported Delinquency 14	High	105(60.0)	293(24.2)	42.6	.001
Delinquent Friends 14	High	98(59.2)	300(25.3)	36.40	.001
School Leaving Age 15	Early	162(45.1)	239(26.4)	14.24	.001
Neurotic Extraversion 16	High	115(45.2)	276(29.7)	7.99	.005
Pulse Rate 18	Low	97(39.2)	285(32.3)	1.24	N.S.
Height 18	Low	108(36.1)	276(33.0)	0.22	N.S.
Weight 18	Low	91(30.8)	293(34.8)	0.34	N.S.
Gambling 18	Heavy	86(54.7)	297(27.9)	20.04	.001
Smoking 18	Heavy	103(48.5)	281(28.5)	12.68	.001
Drinking 18	Heavy	77(48.1)	307(30.3)	7.89	.005
Drug Use 18	Used	121(49.6)	263(26.6)	18.52	.001
Motoring Convictions 18	Convicted	62(58.1)	322(29.2)	18.09	.001
Driving after Drinking 18	Involved	83(53.0)	300(28.7)	16.12	.001
Fights after Drinking 18	Involved	124(50.0)	260(26.2)	20.27	.001
Sexually Active 18	High	163(51.5)	218(20.6)	38.38	.001
Antisocial Groups 18	Involved	80(57.5)	304(27.6)	23.92	.001
Job Record 18	Unstable	92(59.8)	291(25.4)	35.41	.001
Job Status 18	Low	54(64.8)	324(28.7)	25.36	.001
Relation with Parents 18	Poor	86(46.5)	298(30.2)	7.22	.01
Uncooperative 18	Uncooperative	64(45.3)	313(30.0)	4.97	.05
Money Saved 18	None	142(46.5)	234(25.6)	16.30	.001
Pro-Aggression Attitude 18	High	97(45.4)	287(30.0)	7.00	.01
Anti-Foreigners Attitude 18	High	78(42.3)	306(31.7)	2.67	N.S.
Pro-Drugs Attitude 18	High	117(41.9)	267(30.3)	4.34	.05
Anti-Establishment Attitude 18	High	96(51.0)	288(28.1)	15.88	.001
Tattooed 18	Tattooed	35(68.6)	349(30.4)	19.06	.001
Hospitalized for Injury 18	Hospitalized	137(42.3)	247(29.1)	6.27	.025
Spends Time Hanging About 18	Hangs About	61(57.4)	323(29.4)	16.69	.001
Anti-Social Tendency 18	High	109(71.6)	275(18.9)	94.29	.001
Self-Reported Violence 18	High	79(69.6)	305(24.6)	54.82	.001
Self-Reported Delinquency 18	High	97(66.0)	287(23.0)	57.91	.001

Notes to Table D1

%C = % Convicted between ages 10 and 24 inclusive
Not knowns excluded from each table
χ^2 corrected for continuity

at 10-13 were investigated as predictors of self-reported delinquency at 14. It was intended at a later stage to distinguish between causes and developmental sequences. The derivation and meaning of Table D2 will be explained in detail in this section for convictions at 10-13 as a dependent measure. The results obtained with other measures of crime and deviance will be summarized in section D4.

For each dependent measure, the aim of the analyses was to specify which explanatory variables were related to it independently of all other explanatory variables. As mentioned in section B3, since all variables were categorical, the most defensible methods statistically of doing this were logistic regression and loglinear analysis. However, both were difficult to use. Logistic regression was carried out using the GLIM program package, but this was a laborious process. After entering in the equation the explanatory variable which was most closely related to the dependent variable, it was then necessary to enter all the other explanatory variables one by one to establish which one produced the greatest decrease in G^2 (the likelihood ratio goodness-of-fit statistic). Having established the first two variables in the equation, it was then necessary to repeat the whole process to select the third, and so on. This took a great deal of time.

This stepwise selection process is done automatically in the SPSS multiple regression program. The dichotomous data involved here, like most social science data, do not conform to the underlying statistical assumptions of multiple regression. However, comparisons of multiple regression and logistic regression suggested that the two procedures produced very similar results with these dichotomous data. Therefore, it was decided to use multiple regression initially with all the variables to identify those which appeared to be independent predictors. The more defensible logistic regression was then carried out to investigate the independent contributions of the variables identified by the multiple regression. It was thought unlikely that any important relationships would be missed in this two-stage method.

Table D2

Relationships with Crime and Deviance at Different Ages

Dependent Measure	Explanatory Variables	Corrected χ^2	Partial Correlation	Multiple Regression	Loglinear/ Logit	Logistic Regression
Trouble-someness 8-10(92)	Psychomotor Clumsiness 8-10(104)	24.60	**	***	---	---
	Poor Super-vision 8 (74)	25.90	**	***	**	***
	Convicted Parent 10 (104)	17.16	*	*	**	**
	Low Vocabu-lary 10(124)	18.64	*	**	**	***
	Low Family Income 8 (93)	25.01	*	---	*	*
Convic-tions 10-13 (35)	Trouble-someness 8-10(92)	33.57	***	***	***	***
	Uncooperat-ive Family 8(43)	15.59	***	**	---	---
	Poor Hous-ing 8-10 (151)	12.49	**	**	**	*
	Poor Paren-tal Behavi-or 8(96)	13.29	*	*	*	---
	Low IQ 8-10 (103)	12.67	*	*	*	**
	Catholic Fa-mily 8(73)	7.19	*	---	*	*
Self-Reported Delin-quency 14(108)	Convictions 10-13(35)	29.63	***	***	***	***
	Daring 8-10 (121)	20.35	***	***	***	***
	Convicted Parent 10 (104)	13.70	**	**	**	**
Convict-ions 14-16 (74)	Convictions 10-13(35)	70.06	***	***	***	***
	Daring 8-10 (121)	36.76	***	***	***	***
	Convicted Parent 10 (104)	21.70	***	***	***	***
	Dishonest 10(88)	18.75	**	*	**	*
	Delinquent Sibling 10 (46)	14.09	*	*	---	---

Table D2 (continued)

Dependent Measure	Explanatory Variables	Corrected χ^2	Partial Correlation	Multiple Regression	Loglinear/ Logit	Logistic Regression
Convict-ions 17-20 (95)	Convictions 14-16(74)	76.07	***	***	***	***
	Delinquent Friends 14 (10)	38.79	***	***	**	***
	Low Social Class 14 (58)	8.18	**	**	**	**
	Truancy 12-14(73)	41.88	**	***	***	***
	Convicted Parent 10 (104)	28.53	**	*	*	*
	Teacher Rating Aggressive 12-14(134)	29.12	*	*	---	---
	Delinquent Sibling 10 (46)	22.92	*	*	*	---
	Neurotic Extraversion 16 (118)	6.30	---	*	---	---
Self-Reported Delinquency 18(97)	Convictions 14-16(74)	46.29	***	***	***	***
	Self-Reported Delinquency 14 (108)	28.34	**	**	*	**
	Teacher Rating Aggressive 12-14 (134)	19.86	*	*	*	*
	Neurotic Extraversion 16(118)	8.20	*	*	*	*
Anti-Social Tendency 18(110)	Convictions 14-16(74)	71.36	***	***	***	***
	Self-Reported Delinquency 14 (108)	60.37	***	***	***	***
	Teacher rating Aggressive 12-14 (134)	34.85	**	**	*	*
	Convicted Parent 10 (104)	31.09	**	**	**	*
	Truancy 12-14(73)	40.47	*	***	**	***
	Large Family size 10 (99)	20.62	*	*	**	**

Table D2 (continued)

Dependent Measure	Explanatory Variables	Corrected χ^2	Partial Correlation	Multiple Regression	Loglinear/ Logit	Logistic Regression
Convictions 21-24 (46)	Convictions 17-20(95)	53.91	***	***	***	***
	Convictions 14-16(74)	53.36	***	***	**	***
	Unstable Job Record 18(92)	26.57	**	*	*	*
	Low Family Income 14 (79)	7.64	*	*	*	*
	Anti-Establishment Attitude 18(98)	18.01	*	**	---	---
	Hostile Attitude to Police 14 (90)	23.38	*	---	*	**
	Convictions 10-13(35)	29.97	---	*	*	---

Notes

Number in parentheses = number in extreme category (e.g. 92 most troublesome).
Corrected χ^2 derived from 2 x 2 table relating each explanatory and dependent measure (3.84 significant at .05, 6.63 at .01, 10.83 at .001).
* $p < .05$, ** $p < .01$, *** $p < .001$, --- Not significant.

The results obtained with convictions at 10-13 are shown in Table D2. In the multiple regression, the variables entering the equation were as follows, with the significance of the change in F given in brackets: troublesomeness at 8-10 ($p < .001$), uncooperative family at 8 ($p = .001$), poor housing at 8-10 ($p = .006$), poor parental behavior at 8 ($p = .021$), low IQ at 8-10 ($p = .039$), and Catholic family at 8 ($p = .056$). Variables which were not quite significant at $p = .05$ in the multiple regression analysis were included in the logistic regression analysis. The following variables produced a significant decrease in G^2 when they entered the equation in the logistic regression analysis: troublesomeness at 8-10 ($p < .001$), low IQ at 8-10 ($p < .01$), poor housing at 8-10 ($p < .05$), and Catholic family at 8 ($p < .05$).

The differences between the multiple regression and logistic regression results may be a function of the way missing data were treated in the two analyses. Boys

who were not known on any one variable were eliminated completely in the logistic regression, but they were only eliminated from correlations involving that particular variable in the multiple regression. It is likely that an uncooperative family did not appear to be important in the logistic regression because boys whose parents were rated as uncooperative towards the social workers tended to be rated as not known on other variables and hence excluded from the analysis. For example, all 15 rated as not known on parental behavior were among the 43 rated as having uncooperative parents. Therefore, the importance of uncooperative parents could not be apparent in the logistic regression.

It was also difficult to carry out the loglinear analysis. Since this is based on a multidimensional contingency table, it cannot be used to investigate many variables at a time, given the present sample size. With all variables dichotomous and a sample size of about 400, the maximum number of variables which can safely be included in a loglinear analysis is six (five explanatory and one dependent), totalling 64 cells and an average cell size of about 6. It would not be safe to carry out a loglinear analysis with an average cell size of less than 5. If the variables had not all been dichotomized, the number which could have been included in a loglinear analysis would have been less.

Since each investigation of the prediction of crime or deviance had to include many more than five independent variables, it was decided to use partial correlations to identify a small number of variables which were independently important, and then to carry out a loglinear analysis with these. The partial correlation method is less defensible statistically, but it seemed unlikely that it would produce misleading results. Zero order (phi) correlations derived from 2 x 2 tables are simply related to χ^2 without the correction for continuity ($\chi^2 = phi^2/N$), and first order partial phi correlations produce results almost identical to those obtained in comparable loglinear analyses (Farrington, Biron, and LeBlanc, 1982).

Concentrating on convictions at 10-13, the first step was to investigate which of 27 variables measured at 8-10 (including troublesomeness) predicted these convictions significantly. The criterion used to select variables was whether the phi

correlation was .100 or greater, since this value of phi almost always corresponded to a significant χ^2 value (corrected for continuity). It should perhaps be pointed out that phi^2 should not be interpreted as the percentage of the variance explained. The maximum value of phi^2 depends on the marginal frequencies of the 2 x 2 table, and may be considerably less than 1. For example, in the table relating troublesomeness (marginals 92 and 319) to convictions at 10-13 (marginals 35 and 376), the maximum value of phi^2, if all convicted boys were troublesome, is .323 (319 x 35 divided by 376 x 92). The actual value of phi in this case was about half the maximum (.296 as opposed to .568).

Eighteen of the 27 variables investigated in the first stage of the analysis significantly predicted convictions at 10-13, that is all except convicted parents at 10, peer rating unpopular at 8-10, nervousness of the boy at 8, nervousness of his mother at 8-10, nervousness of his father at 8, neurotic extraversion of the boy at 10, social class of the family at 8-10, whether the mother had a job at 8-10, and the weight of the boy at 8-10. The best predictor was troublesomeness at 8-10. Twenty-two of the 92 troublesome boys were among the 35 convicted, in comparison with 13 of the remaining 319 ($\chi^2 = 33.57$, $p < .001$, phi = .296).

The next stage of the analysis was to investigate first order partials, to see if each variable predicted convictions at 10-13 independently of each other variable. The criterion for retention in the analysis at each stage was a partial phi of .100 or greater. In the case of convictions at 10-13, six variables were not related independently of troublesomeness: delinquent siblings at 10, daring at 8-10, dishonesty at 10, parental supervision at 8, separations from parents up to 10, and an unstable paternal job record at 8-10. The advantage of this successive partialing technique is that it is possible to explain why each variable with a high zero order correlation was dropped from the analysis.

Second order partials were then calculated for 12 variables, and four were not significantly related to convictions at 10-13 independently of troublesomeness and low family income taken together (the two variables with the highest zero order correlations): large family size at 10, psychomotor clumsiness at 8-10,

low vocabulary at 10, and poor junior school leaving results at 10. Third order partials were then calculated for the remaining eight variables, but all seemed to be related independently of the most obvious combinations of three other variables.

Fourth order partials were then calculated for these eight variables, and all partials were scrutinized systematically. Low family income fell below .100 on ten occasions, low height on seven occasions, and poor housing once. Since the lowest partial correlation was achieved by low family income, it was decided to drop this variable from the analysis. This eliminated the low partial for poor housing, since that occurred when controlling for troublesomeness, low family income, low IQ, and low height. It also eliminated six of the seven low partials for low height, but one was left (controlling for troublesomeness, low IQ, a Catholic family, and poor housing). Therefore, low height was eliminated from the analysis. Fifth order partials were then calculated for the remaining six variables (troublesomeness at 8-10, uncooperative family at 8, poor housing at 8-10, poor parental behavior at 8, low IQ at 8-10, and a Catholic family at 8), and each proved to be significantly related to convictions at 10-13 independently of the other five. These significant partials are shown in Table D2.

The final stage was to carry out a loglinear analysis. Actually, a logit analysis was used since, in investigating relationships with a clear dependent variable, this gives exactly the same results as a loglinear analysis. The great advantage of the logit analysis is that it takes far less computer time (about two seconds on the Cambridge IBM 370/165, as opposed to over 40 seconds for the comparable loglinear analysis). The point of each logit analysis was to investigate if each explanatory variable had a main effect on each dependent variable over and above the main effects of all other explanatory variables. Thus, the contributions of all other explanatory variables were investigated first, and then the additional contribution of the explanatory variable under investigation (measured by G^2, with 1 d.f., distributed as χ^2). It was always true that the model containing main effects only was not significantly different from the data, suggesting that it was not necessary to investigate interactions.

As mentioned above, a maximum of five explanatory variables can be investigated in these logit analyses. When more than five survived the partial correlation analyses (as in the case of convictions at 10-13), more than one logit analysis was carried out. The first logit analysis investigated the separate contributions of the five explanatory variables with the highest partial correlations. Each other logit analysis investigated the separate contribution of each other explanatory variable over and above the four with the highest partial correlations. In the case of convictions at 10-13, the first logit analysis investigated the separate contributions of the first five explanatory variables listed in Table D2. The second logit analysis investigated the contribution of a Catholic family over and above troublesomeness, an uncooperative family, poor housing, and poor parental behavior.

The results of the logit analyses confirmed the results of the partial correlation analyses in showing that troublesomeness, poor housing, poor parental behavior, low IQ, and a Catholic family were all independently predictive of convictions at 10-13. However, an uncooperative family, which was significantly related according to partial correlations, was not significantly related according to the logit analysis. This was almost certainly because the logit analysis, like the logistic regression, only included boys known on all variables (see above).

With categorical data commonly obtained in the social sciences, there is no ideal way of handling a large multivariate problem. However, there are considerable advantages in using a variety of methods. If both the partial correlation/multiple regression and logit/logistic methods indicate that a variable makes an independent contribution to a measure of crime or deviance, it is reasonable to accept this conclusion. When a variable is identified by only one method, its contribution is less certain. Only variables identified by both methods will be discussed below.

D4. Independent Predictors of Crime and Deviance

Table D2 shows that the boys who were rated troublesome at age 8-10 tended to be those from low income families, those having poorly supervising, convicted

parents, and those having a low vocabulary. Troublesomeness was the most significant determinant of whether a boy was convicted at 10-13. However, in addition to troublesomeness, these convictions were predicted by poor housing, poor parental behavior, low IQ, and coming from a Catholic family. The absence of any of the predictors of troublesomeness from this list suggests that they may have had their effect in producing troublesomeness at 8-10, and that they may not have any effect on convictions over and above their effect on troublesomeness.

Self-reported delinquency at 14 and convictions at 14-16 were predicted best by convictions at 10-13. However, being rated as daring, having convicted parents, and being rated as dishonest (for convictions at 14-16 only) all had additional independent effects. Convictions at 17-20, self-reported delinquency at 18, and being antisocial at 18 were all predicted best by convictions at 14-16. However, whereas self-reported delinquency at 14 added to the prediction in the cases of self-reported delinquency at 18 and antisociality, it was a boy's reported delinquency of his friends at 14 which added to the prediction of convictions at 17-20. (Self-reported delinquency and reported delinquency of friends were highly correlated, no doubt because most delinquent acts were committed with friends.) Teachers' ratings of aggressiveness, convicted parents, and truancy were other factors which appeared more than once in predicting these three measures. In contrast, low social class and having a delinquent sibling predicted only convictions at 17-20, neurotic extraversion predicted only self-reported delinquency at 18, and large family size predicted only antisociality.

Finally, adult criminal convictions at 21-24 were predicted best by convictions at 17-20 and by convictions at 14-16. However, if the boy himself had an unstable job record at 18, if he came from a low income family at 14, if he had a hostile attitude to the police at 14, and if he had been convicted at 10-13, all of these made additional contributions to his likelihood of sustaining adult criminal convictions. An anti-establishment attitude at 18 was highly correlated with a hostile attitude to the police at 14, and if one of these factors remained in an analysis the other did not, in general.

D5. Continuity in Behavior?

It seems clear that the causes of adult criminal convictions can be traced back to childhood. The best predictors of convictions at 21-24 were convictions at 17-20 and convictions at 14-16; the best predictors of convictions at 17-20 were convictions at 14-16; the best predictors of convictions at 14-16 were convictions at 10-13 and daring behavior at 8-10; and the best predictor of convictions at 10-13 was troublesome behavior at 8-10. The same is true of other measures of deviance. The best predictors of self-reported delinquency at 18 and antisocial tendency at 18 were convictions at 14-16 and self-reported delinquency at 14, and the best predictors of self-reported delinquency at 14 were convictions at 10-13 and daring behavior at 8-10. As with aggression (Olweus, 1979), the continuity of troublesome, delinquent, deviant, and criminal behavior from childhood to adulthood seems striking.

Alternatively, it could be argued that the continuity of behavior is illusory. Convictions at one age may predict convictions at a later age because of continuity in police and court bias, and self-reports at one age may predict self-reports at a later age because of continuity in the willingness to admit delinquent acts. However, it is interesting that the two self-reported delinquency measures (at 14 and 18) were best predicted by earlier convictions, and the same was true of antisocial tendency. It might be expected that convictions and self-reports would be subject to different biases, and that similar results obtained with the two measures might reflect offending behavior rather than bias. The continuity between convictions and self-reports supports the hypothesis that there is continuity in behavior rather than in biasing factors.

Against this, it could be argued that convictions predict self-reports because convicted youths are more likely to admit delinquent acts than unconvicted youths. Continuity in delinquent behavior is best demonstrated by the prediction of convictions by self-reports, which did happen but is not shown in Table D2. Nearly half of those high on self-reported delinquency at 14 (42.9%) were convicted at 17-20, in comparison with only 16.7% of the remainder ($\chi^2 = 28.03$, $p < .001$, phi =

.271). However, self-reported delinquency at 14 was dropped from the partial correlation analysis of convictions at 17-20 because it did not predict independently of reported delinquency of friends at 14 and convictions at 14-16. Similarly, self-reported delinquency at 14 and 18 significantly predicted convictions at 21-24, but neither prediction held independently of antisociality and earlier convictions. In turn, antisociality at 18, which had been expected to be one of the most important predictors of convictions at 21-24, did not predice independently of earlier convictions and an unstable job record at 18.

Of course, if self-reported delinquency, convictions, and antisociality are all measures of the same underlying theoretical construct (deviant behavior?), it is not surprising that they do not predict independently. Perhaps the best evidence in favor of the argument that there is continuity in deviant behavior rather than in biasing factors is the earlier demonstration that self-reported delinquency predicts convictions among unconvicted youths (Farrington, 1973). Taking into account other evidence about the validity of self-reported delinquency measures (see e.g. Hindelang, Hirschi, and Weiss, 1981), the most plausible conclusion is that the continuity of troublesome, delinquent, deviant, and criminal behavior from childhood to adulthood is real rather than artefactual (see also section C2).

The above discussion should not be taken to assert that there were no differences between results obtained with convictions and those obtained by self-report. There were many similarities. In particular, at age 14-16 the best predictors of both were convictions at 10-13, daring at 8-10, and convicted parents at 10. However, there were some differences which may reflect bias. For example, low social class at 14 was one of the independent predictors of convictions at 17-20 but was unrelated to self-reported delinquency at 18. One possible explanation for this difference is that the police were biased against lower class youths (see also Farrington, 1979a).

D6. Influences on Crime and Delinquency

The independent predictors of crime and delinquency at different ages are

shown diagrammatically in Figure D1.. In this, low family income at 8 and poor housing at 8-10 are grouped under the heading of economic deprivation at 8-10; poor supervision at 8 and poor parental behavior at 8 are grouped as parental mishandling; convicted parents and delinquent siblings as family criminality; low vocabulary at 10 and low IQ at 8-10 as school failure at 8-10; and low family income at 14 and low social class at 14 as economic deprivation at 14. These groups could be justified on theoretical and empirical (correlational) grounds. Converting the results shown in Table D2 to Figure D1 was a subjective process to some extent, but it is believed that Figure D1 summarizes the major influences.

The continuity, or developmental sequence, from troublesome behavior at 8-10 to criminal behavior at 21-24 is shown in the middle of Figure D1. The troublesome boys, and the juvenile delinquents, were those who had experienced economic deprivation, parental mishandling, family criminality, and school failure at an early age. Later measures of economic deprivation (at 14) and of school failure (truancy at 12-14) predicted delinquency at the young adult and adult ages. There were no later measures of family criminality, and so the measures up to age 10 continued to predict adult crime. There were later measures of parental mishandling, but they did not appear to be important in relation to later criminal behavior.

Parental mishandling, therefore, seemed important only in relation to troublesome and delinquent behavior at an early age. Economic deprivation, family criminality, and school failure, on the other hand, seemed to have continuing and longer lasting effects. In addition, adult criminal behavior seemed to be influenced by delinquent friends at 14, an unstable job record at 18, and anti-establishment attitudes at 18.

Of course, the explanatory variables tended to be inter-related, and Figure D2 shows the strongest of these relationships. The broken lines indicate relationships which were significant at $p = .001$ (phi greater than .160) and the solid lines indicate phi values greater than .220. The relationship between economic deprivation at 8-10 and economic deprivation at 14 probably reflects two measures of the same underlying theoretical construct, but some of the other relationships may be causal.

Figure D1

Influences on Delinquency

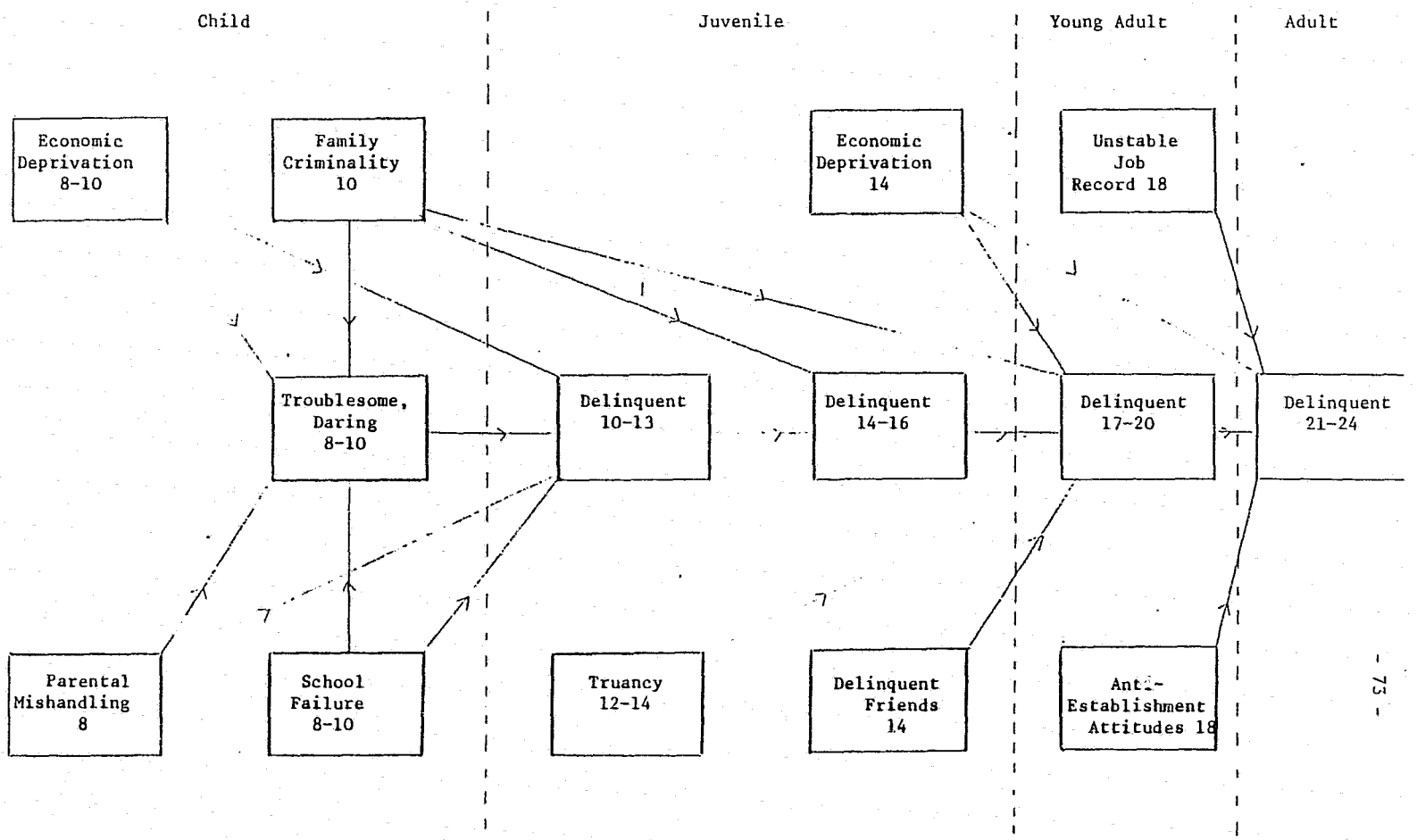
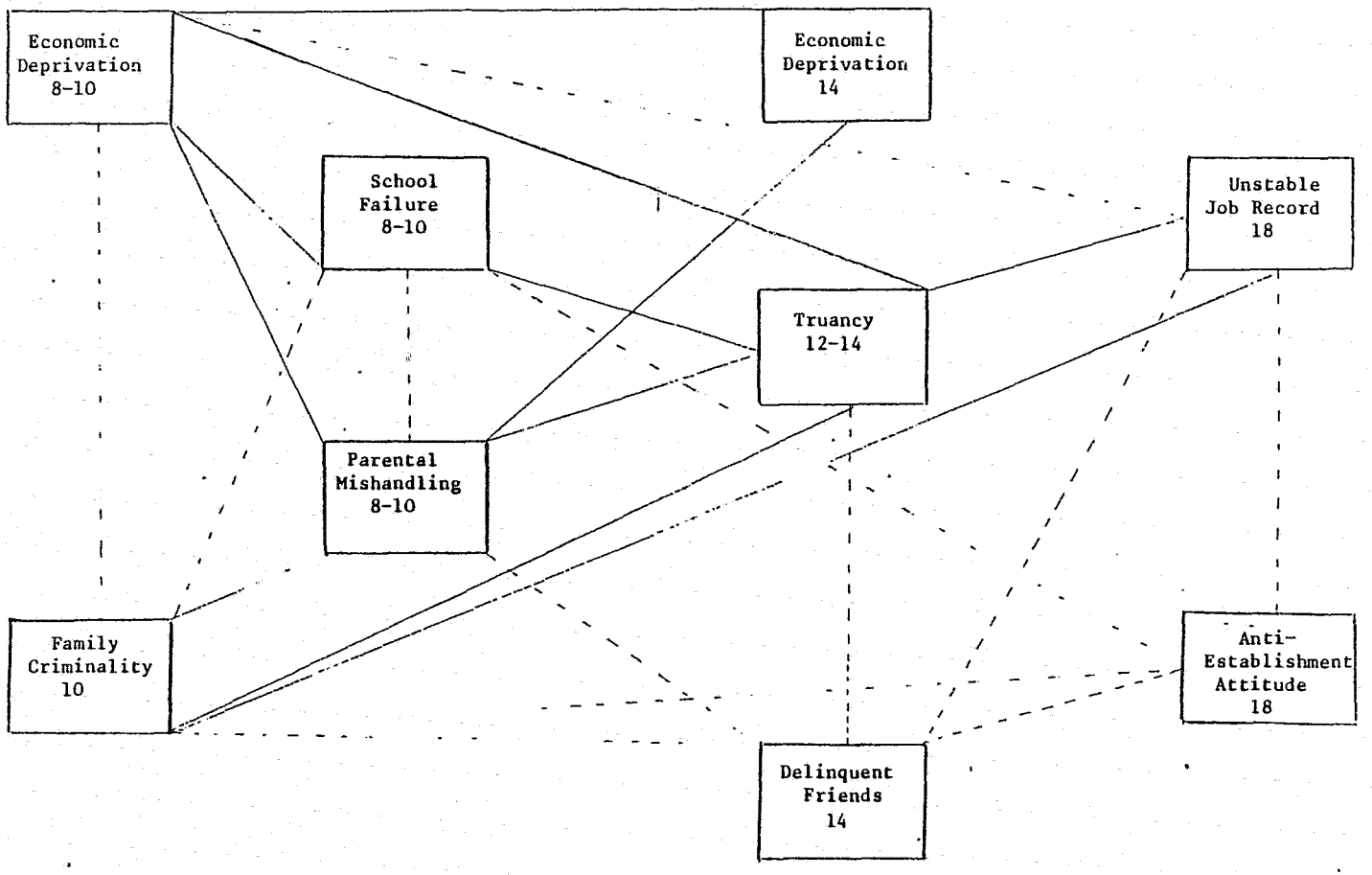


Figure D2

Relationships Among Explanatory Variables



Some of the more important speculative interpretations of Figure D2 are as follows:

(a) boys from poor families tend to fail in school at age 8-10;

(b) school failure at age 8-10 tends to be followed by truancy at 12-14 and in turn by an unstable job record at 18;

(c) parents who are poor and/or criminal tend to exercise poor supervision over their children and to bring them up harshly and erratically;

(d) poor parental supervision leads to truancy and in turn to an association with delinquent friends;

(e) boys from criminal families tend to have delinquent friends and anti-establishment attitudes; and

(f) anti-establishment attitudes lead to an unstable job record.

D7. A Speculative Theory

In trying to put forward one theory to explain the results of this research, a combination of suggestions made in four existing theories seems most plausible. These are Cohen's (1955) delinquent subculture theory, Trasler's (1962) social learning theory, Hirschi's (1969) control theory, and Sutherland and Cressey's (1974) differential association theory. Before outlining a speculative theory of my own, the four existing theories will be summarized briefly. The emphasis in the delinquent subculture and differential association theories was on explaining why people committed delinquent acts, while the emphasis in the social learning and control theories was on explaining why people did not commit delinquent acts.

Cohen (1955) suggested that boys committed delinquent acts because they were conforming to the standards of a 'delinquent subculture'. Working class boys competed with middle class boys in school according to middle class standards. Working class boys were handicapped in this competition, because their parents were less likely to have taught them reasoning, middle class manners, the avoidance of aggression, and the postponement of immediate gratification in favor of long term goals. Consequently, they were likely to antagonize their teachers and

perform badly in school. Faced with the problem that they could not achieve status according to the middle class standards of the school, these boys solved this problem by joining a delinquent subculture, with standards in opposition to those of the larger society, in which they could achieve status. Cohen's theory explains why there is an association between delinquency and a lower class environment, school failure, and certain methods of child rearing.

Trasler (1962) suggested that children were naturally selfish and hedonistic, trying to maximize their pleasure and minimize their pain. Delinquency arose naturally in the pursuit of hedonism, so the problem was to explain why people refrained from it. According to this social learning theory, people refrained because the hedonistic tendency to commit delinquent acts was blocked by the conscience. The crucial factor in building up the conscience was punishment imposed by the parents. After the child committed an act which the parent considered to be socially undesirable and for which the child was punished, the child had an anxiety reaction. After the behavior was followed by the punishment a number of times, the contemplation of the act by the child led to an involuntary resurgence of this anxiety, which tended to block the commission of the act. In this theory, the punishment did not have to be physical punishment, and in fact Trasler thought that 'love-oriented' discipline, characterized by withdrawal of love, warm consistent treatment, and reasoned explanations, was especially effective. It was argued that delinquency was more common among lower class children because lower class parents used less effective child rearing techniques.

Hirschi (1969) suggested that people did not commit delinquent acts if they had a strong bond to society. In discussing the elements of this bond, Hirschi emphasized four theoretical constructs. Attachment referred to the extent to which people cared about and internalized the wishes and expectations of others, such as parents. Commitment referred to the rational element in crime, suggesting that people weighed the benefits against the costs, and did not commit crimes if the costs outweighed the benefits. Involvement drew attention to the fact that many people were so busy doing conventional activities that they had little time

or opportunity for delinquency, and belief referred to the extent to which people believed in the rules of society. This theory is quite similar in many ways to Trasler's, for example in predicting that parental affection and close supervision should be negatively related to delinquency.

Finally, Sutherland and Cressey (1974) suggested that delinquent attitudes and techniques of committing crimes were learned during interaction with other people in small groups. Whether a person committed many or few delinquent acts depended on whether he came into contact more with delinquent than with law-abiding attitudes. This theory fits in well with the facts that criminal parents tend to have delinquent children and that the more delinquent boys tend to have delinquent friends.

Based on our research findings, and inspired by the above four theories, the speculative theory which I would put forward to explain the most common varieties of male delinquency (crimes of dishonesty such as thefts and burglaries) can be summarized as follows:

(a) Delinquent acts are the end product of a four stage process.

(b) In the first stage, motivation arises. It is suggested that the main desires which ultimately produce delinquent acts are desires for material goods, status among intimates, and excitement. (In our survey, when the youths were asked why they committed delinquent acts, the most common reasons stressed the desire for the material goods obtained and for excitement.) No attempt will be made to explain why these desires exist. They may be culturally induced in general, or a response to a specific situation (e.g. a desire for excitement arising from a feeling of boredom). How they vary with other factors is not clear. For example, it may be that the desire for excitement is greater among children from poorer families, because excitement is more highly valued by lower class people than by middle class people, because poorer children lead more boring lives, or because poorer children are less able to postpone immediate gratification in favor of long term goals (which may be linked to the emphasis in lower class culture on the concrete and present as opposed to the abstract and future).

(c) In the second stage, a legal or illegal method of satisfying the desire is chosen. It is suggested that some people (e.g. children from poorer families) are less able to satisfy their desires for material goods, excitement, and social status by legal or socially approved methods, and so they tend to choose illegal or socially disapproved methods. The relative inability of poorer children to achieve goals by legitimate methods may be partly because they tend to fail in school and hence tend to have erratic, low status employment histories. School failure in turn is often a consequence of the unstimulating intellectual environment which lower class parents tend to provide for their children, and the lack of emphasis on abstract concepts.

(d) In the third stage, a motivation to commit a delinquent act is magnified or opposed by internalized beliefs and attitudes about law-breaking which have been built up in a learning process as a result of a history of rewards and punishments. The belief that delinquency is wrong, or a 'strong conscience'. tends to be built up if parents are in favor of legal norms, if they exercise close supervision over their children, and if they punish socially disapproved behavior using love-oriented discipline. The belief that delinquency is legitimate, and anti-establishment attitudes generally, tend to be built up if children have been exposed to attitudes and behavior favoring delinquency, especially by members of their family and by their friends.

(e) The fourth stage is a decision process in a particular situation, and is affected by immediate situational factors. If any resulting motivation to commit a delinquent acts survives the third stage, whether the tendency becomes the actuality in any given situation depends on the costs, benefits, and probabilities of the possible outcomes (e.g. the material goods which can be stolen, peer approval, being caught by the police). In general, people are hedonistic, and make rational decisions.

This theory is very speculative, and it can only be sketched out roughly within the limitations of this section. Applying it more explicitly to the results of this project, children from poorer families are especially likely to commit delinquent

acts because they are unable to achieve their goals legally (partly because they tend to fail in school) and possibly because they value some goals (e.g. excitement) especially highly. Children who receive parental mishandling are especially likely to commit delinquent acts because they fail to build up internal controls over socially disapproved behavior, while children from criminal families and those with delinquent friends tend to build up anti-establishment attitudes and the belief that delinquency is justifiable. The whole process is self-perpetuating in that early school failure may lead to truancy and to a lack of educational qualifications, which in turn leads to low status jobs and periods of unemployment, all of which make it even harder to achieve goals legitimately. Similarly, delinquent acts themselves may have causal effects, since they may lead to official processing and hence to anti-establishment attitudes (Farrington, 1977), delinquent friends, and unstable job histories.

Delinquency may peak between ages 14 and 20 because boys (especially lower class school failures) have high desires for excitement, material goods, and status between these ages, little chance of achieving these desires legally, and little to lose (since legal penalties are lenient and their intimates - male peers - approve of delinquency). In contrast, after age 20, desires become attenuated or more realistic, there is more possibility of achieving these more limited goals legally, and the costs of delinquency are greater (since legal penalties are harsher and their intimates - wives or girlfriends - disapprove of delinquency).

The theory has obvious limitations. It is only intended to apply to property crimes by males. No hereditary or biological factors are included in it, because the research was not particularly designed to investigate these. Also, no individual difference factors are included in it (e.g. pre-existing differences in daring or aggressiveness). Ideally, the theoretical constructs in this theory, and their causal relationships, should be specified more explicitly. A mathematical model should be constructed, and attempts made to estimate the value of parameters so as to provide the best fit to the data (see section E3).

This theory has some similarities to the recent attempt by Elliott, Huizinga, and Ageton (1982) to integrate strain, control, and social learning theories. One of their key ideas was that delinquency resulted from differential bonding to conventional and deviant groups. There were three alternative paths to delinquency. The strain theory path occurred when conventional bonding (produced by effective early childhood socialization) was attenuated by poor school performance and limited opportunities for achieving goals. Crime acted as an alternative method of achieving material success. The control theory path occurred when childhood socialization was ineffective, producing weak internal and external controls over delinquency. The social learning theory path occurred when delinquency was reinforced by an individual's interpersonal network. Delinquency was likely to be most serious when strain, weak conventional bonding, and strong bonding to deviant groups occurred together.

Elliott et al. tested these ideas using eight measures of strain (family and school aspirations), conventional bonding (family and school involvement), and deviant bonding (involvement with deviant peers, deviant attitudes). They carried out causal modeling analyses to investigate how far measures taken in 1976 and 1977 could predict self-reported delinquency in 1977, and how far measures taken in 1977 and 1978 could predict self-reported delinquency in 1978. The best predictor of self-reported delinquency was involvement with deviant peers. However, it is unclear whether this result artefactually follows from the fact that most delinquency occurs in groups. Elliott et al. have spent a great deal of time developing detailed theories, and their attempts to integrate existing ideas are important. However, my own bias suggests that our current need is not so much for theories to guide research as for basic research findings to guide the formulation of theories.

E. Predicting Offenders

E1. Introduction to Prediction

The emphasis in section E is on prediction, as opposed to the emphasis in section D on explanation. During my Visiting Fellowship, I took the opportunity

to extend some unpublished work I had done on comparing prediction instruments, to investigate the predictive efficiency of logistic regression. I also became interested in the problem of predicting chronic offenders. Section E1 reviews some of the key issues in prediction research in criminology at the present time, and briefly describes some of the major methods of constructing prediction instruments. (For more detail, see Farrington and Tarling, 1983).

The work of the Gluecks (1950) is perhaps the best known prediction research in the history of criminology. They compared 500 institutionalized male delinquents with 500 unconvicted boys who were in ordinary schools, had cooperative parents, and were not known to have committed any minor offenses. The two groups were said to be matched on age, IQ, national origin, and residence in underprivileged areas, and were studied at an average age of 14-15. The Gluecks developed a prediction table based on five factors: the discipline of the boy by the father, the supervision of the boy by the mother, the affection of the father for the boy, the affection of the mother for the boy, and the cohesiveness of the family. Each boy was scored on each item according to the percentage of those in his category who were delinquents. For example, if the discipline of the boy by the father was rated as overstrict or erratic, 72.5 would be added to the boy's prediction score, since 72.5% of boys in that category were delinquent.

The scores on this scale ranged from 116 to 414, and the discrimination of delinquents from non-delinquents seemed remarkable. Of those (52) boys scoring 400 or more, 98.1% were delinquents, while of those (172) scoring 150 or less 97.1% were non-delinquents. The Gluecks advocated that their prediction device (the 'Glueck Social Prediction Table') should be used to identify potential delinquents at the time of school entrance (age 6), and this proposal reached the White House in 1970, but was fortunately rejected. According to Psychiatric News (October 21, 1970), a Dr Hutschnecker sent a report to President Nixon stating that '9 out of 10 delinquents could have been correctly identified at the age of 6' and 'suggesting mass testing of all 6 to 8-year-old children'.

Contemporary commentators immediately perceived the difficulties surrounding the Gluecks' research. For example, Anderson (1951) was probably right in saying that 'this book would be substantially improved if chapter XX on the "Prediction of Delinquency" had not been written'. Among the most obvious problems were the following:

(a) the delinquents and non-delinquents were extreme groups;

(b) the proportion of delinquents in the study (50%) made it easier to predict delinquency than in the general population (see e.g. West and Farrington, 1973, p.134);

(c) the interviewers may well have been biased by a knowledge of who was, or was not, a delinquent;

(d) relationships at age 14-15 would not necessarily hold at age 6; and

(e) the absence of a validation sample meant that there was heavy capitalization on chance in deriving the prediction table.

Unfortunately, the work of the Gluecks led to the discrediting of prediction in general and predicting delinquency in particular for many criminologists. This was despite the fact that there were a number of validation studies which showed that the Glueck Social Prediction Table did have some predictive power. This was shown, for example, by Havighurst et al. (1962), Craig and Glick (1963), Hodges and Tait (1963), Trevvett (1965), and Feldhusen, Thurston, and Benning (1973). The table even seemed to have some validity in Czechoslovakia (Veverka, 1971), but it was not impressive in Australian follow-up studies by Dootjes (1972) and Loftus (1974).

Since 1950, almost the only attempts to predict delinquency using multivariate methods have been carried out by psychologists and have been based on questionnaires. A common method has been to derive a delinquency prediction scale from an existing questionnaire, adding up items to make a simple points score. Occasionally, a scale has been constructed in one sample and validated in another. Questionnaires used in delinquency prediction include the Minnesota Multiphasic Personality

Inventory (Hathaway and Monachesi, 1957; Hathaway, Monachesi, and Young, 1960; Briggs, Wirt, and Johnson, 1961), the Eysenck Personality Questionnaire (Putnins, 1982), the Jesness Inventory (Graham, 1981), and the Bristol Social Adjustment Guide (Stott, 1960, 1964).

The volume of criticism by criminologists (e.g. Kahn, 1965; Venezia, 1971; Weis, 1974) suggests that the prediction of delinquency is almost a taboo area. There has been little research on delinquency prediction using modern predictive techniques (for example, see Feldhusen, Aversano, and Thurston, 1976; Wadsworth, 1978). It seems to me that it is desirable to carry out methodologically adequate research on delinquency prediction, and section E2 investigates how far delinquency can be predicted using different prediction techniques.

While delinquency prediction has not developed very fast, there have been many predictive efforts in other areas of criminology. One of the most recent applications of prediction research is the work of Greenwood (1982) on selective incapacitation. This is the latest of a series of studies concerned with the penal aim of incapacitation. Interest in incapacitation increased in the mid-1970s after the well known reviews of Martinson (1974) in the United States and Brody (1976) in England suggested that rehabilitation as a penal aim was not being achieved by existing treatment measures. This controversial conclusion was essentially confirmed by a National Academy of Sciences panel in an impressive, methodologically sophisticated review (Sechrest, White, and Brown, 1979).

Incapacitation research has primarily been concerned with estimating the number of crimes prevented by mandatory sentences of incarceration for certain categories of detected offenders. This estimation process requires detailed knowledge about criminal careers, and interest in criminal career research has also increased greatly in the last 10 years. The conclusions reached in incapacitation research have varied considerably, depending on the methods used (e.g. measuring offending by official records or self-reports) and on the assumptions made about the proportion of crimes committed by undetected offenders.

As an example, Van Dine, Dinitz, and Conrad (1977), using official records, concluded that a mandatory five year prison sentence following all felony convictions would prevent only 4% of recorded violent crimes. On the other hand, also using official records, Petersilia and Greenwood (1978) argued that such a sentence would decrease violent crime by about one-third. In a self-report study, Peterson, Braiker, and Polich (1980) estimated that the release of all state prisoners would lead to an increase in armed robberies of 22%, of burglaries of 6%, and of auto thefts of 7%. The results and methodological problems of incapacitation research have been reviewed in Blumstein, Cohen, and Nagin (1978) and Brody and Tarling (1980).

The increasing interest in incapacitation has coincided with the development of criminal career prosecution programs in many jurisdictions of the United States. These aim to concentrate prosecution resources on serious, repeat offenders, to increase their conviction rates and average periods of incarceration (see e.g. Greenwood, 1980). However, none of the jurisdictions reviewed by Chelimsky and Dahmann (1980) used quantitative predictions of future criminal activity, which these authors considered to be a key element in translating targeted prosecution into crime reduction effects.

This leads me to Greenwood (1982), who was concerned to develop a method of predicting which offenders committed offenses at high rates while they were in the community. On the basis of a self-report study with incarcerated offenders, Greenwood proposed a prediction score based on seven variables:

(a) incarcerated more than half of the two-year period preceding the most recent arrest;

(b) a prior conviction for the crime type that is being predicted (burglary or robbery);

(c) a juvenile conviction prior to age 16;

(d) commitment to a state or federal juvenile facility;

(e) heroin or barbiturate use in the two-year period preceding the current arrest;

(f) heroin or barbiturate use as a juvenile;

(g) employed less than half of the two-year period preceding the current arrest.

Each person was scored 0 or 1 according to the presence of absence of each item, leading to a prediction score between 0 and 7 for each offender. Greenwood showed how these prediction scores were related to crime rates. For example, the median annual offense rate for burglary for California prisoners was 1.4 for those scoring 0 or 1 on the scale, 6.0 for those scoring 2 or 3, and 92.9 for those scoring 4 or more. Greenwood argued that incapacitation should be more selective: predicted high rate offenders should receive longer prison sentences, while predicted low rate offenders should receive shorter ones. If a penal policy of this kind was adopted, he estimated that, in California, it was possible to achieve a 15% reduction in the robbery rate together with a 5% reduction in the incarcerated population.

This kind of a policy option is likely to prove very attractive to legislators, prosecutors, judges, and prison administrators. Previous incapacitation research on mandatory sentences has inevitably involved impractically large increases in prison populations. For example, the mandatory five year sentences considered by Petersilia and Greenwood (1978) would have led to a prison population increase of 450%. Selective incapacitation's promise of a decrease in the crime rate together with no increase in the incarcerated population seems too good to be true.

Unfortunately it may be. Greenwood's (1982) prediction research suffers from many of the problems ignored by the Gluecks (1950) more than 30 years before. For example, his research is entirely retrospective and has no validation sample. Greenwood's research in many ways is much more sophisticated than that of the Gluecks (e.g. in attempting to predict individual crime rates) and he is aware of many of the problems raised by his prediction methodology. It is to be hoped that his prediction device can be validated prospectively in a longitudinal survey.

Validation is necessary in any prediction study because of the phenomenon of shrinkage. In general, the estimate of predictive efficiency in the sample used

to construct a prediction instrument (the construction sample) will always be too high. This is because all statistical measures of association have a sampling distribution about their population mean, so that the value of (for example) the product-moment correlation in a sample will be greater or less than its value in the whole population. In selecting predictors which have the highest correlations with the criterion in a (construction) sample, there will be a tendency to select predictors with sample correlations higher than their population correlations. This means that the sample measure of predictive efficiency will be greater than the corresponding population measure of predictive efficiency.

It is essential to obtain an unbiased estimate of the population predictive efficiency. There are a number of ways of achieving this, but the simplest and most common is to apply the prediction instrument to a different sample of people (the validation sample) and to measure its predictive efficiency in this sample. The decrease in predictive efficiency between the construction and validation samples is called shrinkage.

It is common to divide a total sample at random into two halves, and to use one half for construction and the other half for validation. Unfortunately, the shrinkage between these two samples is not necessarily an accurate guide to the shrinkage between the construction sample and a later validation sample. It is difficult to predict the extent to which prediction instruments can be generalized over time, place, and samples without having some underlying theory of the effects of the predictors on the criterion, and some idea of boundary conditions within which the theory holds. If a prediction instrument is to be used in criminal justice decision making, it is essential that the sample from which it is derived is drawn from the population on which it is to be used.

Most of the advances in the use of prediction methods in criminology have occurred in the area of parole prediction, and prediction methods have had their greatest policy influence on parole. One of the most famous and earliest prediction studies in criminology was carried out by Burgess (1928). In this, each person was given a score or 0 or 1 on each predictor, depending whether the parole violation

rate of persons in the same category was less than or greater than average. Ohlin (1951) further developed this method in parole research by scoring each person +1, 0, or -1 on each of a number of predictors, depending whether the value of the variable was associated with an above average, average, or below average success rate. Unlike Burgess, he only included in his prediction score those variables which were the most closely associated with the criterion (12 out of 27), and also suggested (p.122) that predictors which were closely associated with other predictors might be eliminated to 'avoid over-weighting any one aspect of the parole picture'.

The simple Burgess and Glueck methods have been criticized for their lack of statistical justification and for not allowing sufficiently for the intercorrelations between factors. For example, Wilkins and MacNaughton-Smith (1964) said that they were 'intolerably crude and inadequate', 'have been discredited by many writers and are only mentioned for their historical importance'. Researchers were castigated for not using more 'advanced' methods (e.g. Thurston, Benning, and Feldhusen, 1971).

These kinds of criticisms led to the use of least-squares multiple regression techniques by such researchers as Kirby (1954) and Mannheim and Wilkins (1955) in the 1950s. Kirby used a discriminant function analysis, but with a dichotomous criterion variable this is mathematically equivalent to multiple regression. However, as mentioned in section B3, there are some obvious problems in applying multiple regression techniques to criminological data, and these have been summarized by Palmer and Carlson (1976).

Disquiet with multiple regression led to the use of hierarchical clustering techniques in the 1960s, such as configural analysis (Glaser, 1962), predictive attribute analysis (Wilkins and MacNaughton-Smith, 1964), and Automatic Interaction Detector analysis (Schumacher, 1974). These essentially aim to classify a heterogeneous population into homogeneous subgroups. They do not make such restrictive assumptions about the nature of the variables as multiple regression, and hence are more suitable for use with criminological data. However, they are undoubtedly somewhat arbitrary and difficult to justify statistically.

Dissatisfaction with both multiple regression and predictive attribute analysis led to the use of loglinear and logistic techniques in the 1970s (see e.g. Payne, McCabe, and Walker, 1974; Solomon, 1976). These methods are statistically justifiable and applicable to the kinds of categorical data typically collected in criminology. Unfortunately, despite hopes that 'logistic regression will prove to be a better competitor [to Burgess] than linear regression has been in the past' (Larntz, 1980, p.68), there is little evidence of this as yet.

Comparisons of methods of selecting and combining predictors, in most cases using parole data, have usually shown that it is difficult to exceed the efficiency of the simple Burgess points score in a validation sample. An early comparison of the Burgess and Glueck methods (Ohlin and Duncan, 1949) showed that they were quite similar in predictive efficiency, and this is not surprising in the light of Kirby's (1954) reported .9 correlation between them. Gottfredson and Ballard (1965) then showed that multiple regression and the Burgess method produced quite similar results, and La Brie (1970) reported that the Glueck method and multiple regression were quite similar (although he did not have a validation sample). Ward (1968) compared the Burgess and Glueck methods and multiple regression, and found that multiple regression was slightly superior.

Moving on to the methods of the 1960s, Babst, Gottfredson, and Ballard (1968) reported that configural analysis and multiple regression worked about equally well, and Simon (1971) discovered that predictive attribute analysis, multiple regression, and the Burgess method were about equally efficient. Simon's English comparison was replicated in Australia by Challinger (1974) and in Canada by Nuffield (1982). Both found that, if anything, a Burgess-type points score was the best.

Little is known as yet about the efficiency of the loglinear/logistic methods of the 1970s in comparison with earlier methods. Van Alstyne and Gottfredson (1978) compared the Burgess technique with a loglinear method, and reported that the Burgess technique was superior. However, Fuchs and Flanagan (1980) argued that they had failed to collapse the data over non-relevant variables and hence spread the sample over too many cells for a valid analysis. The aim of the analysis

reported in section E2 is to investigate the relative efficiency in predicting offending of different methods of selecting and combining predictors.

E2. Predicting Self-Reported and Official Offending

The primary aims of section E2 are as follows: (a) to investigate how far it is possible to predict offending by juveniles (age 10-16) and young adults (age 17-20); (b) to compare the predictions of self-reported and official delinquency; (c) to compare the efficiency of five of the most commonly used methods of combining variables into a prediction instrument: the Burgess points score, the Glueck method, multiple linear regression, predictive attribute analysis, and logistic regression; and (d) to investigate some of the practical implications of the results, especially in relation to incapacitation.

A simple measure of predictive efficiency is used here. The simplest prediction problem is when predicted and non-predicted groups are compared with delinquent and non-delinquent outcomes. In this case, percentages might be used to measure predictive efficiency, but it is difficult to know which percentages to choose. For example, should the focus be on the percentage of the predicted group who become delinquents or on the percentage of delinquents who were predicted? These two percentages may be negatively related. It may be possible to achieve a high percentage of the predicted group becoming delinquents by predicting a small extreme group, but this will probably be at the cost of a low percentage of delinquents being predicted.

In the present research, as far as possible, approximately the same proportion of the sample was predicted to be delinquents as actually became delinquents (about one quarter). This meant that the percentage of the predicted group who were delinquents was about the same as the percentage of delinquents who were predicted. All predictor variables and prediction instruments were dichotomized into the 'worst' quarter and the remaining three-quarters, in the interests of comparability and to avoid capitalizing on chance in the selection of cutoff points (cf. Simon, 1971). The phi correlation (derived from χ^2 adjusted for sample size) was used as the major

summary measure of predictive efficiency, but the percentage of the predicted group becoming delinquent is also given, since this is often more meaningful.

The criterion variables in this analysis were juvenile and young adult official offending, as described in section D1 above. There was also a criterion measure of adult self-reported offending, as described in section D1. The criterion measure of juvenile self-reported offending was based on the questionnaires given at ages 14 and 16. Each boy was scored according to the total number of different acts he admitted at either or both ages. For ease of comparison with the 84 juvenile official delinquents, the 80 boys with the highest self-report scores, all of whom admitted at least 21 different acts, were grouped together and called the juvenile self-reported delinquents. Just about half of the juvenile self-reported delinquents (41) were also juvenile official delinquents, and just about half of the adult self-reported delinquents (49) were also adult official delinquents.

Twenty-five predictor variables were included in this analysis. These were all factors measured by the time a boy was aged 10-11, and so were genuinely predictive of the four criterion variables. They overlapped considerably with the 27 factors measured at age 8-10 and listed in Table D1. The major difference was that, because this was a predictive rather than an explanatory analysis, no attempt was made to use variables which were all theoretically independent. Thus, the predictive analysis included several measures of bad behavior: conduct disorder (rated by teachers and parents) and acting out (a combined rating based on poor conduct and other factors) as well as troublesomeness (rated by teachers and peers). The juvenile criterion measures were included in predictions of the adult criterion measures.

The total sample of 411 boys was divided into two halves using a table of random numbers, producing a construction (C) sample of 205 and a validation (V) sample of 206. It had been anticipated that the C and V samples would not differ significantly in the proportions of delinquents. This was true with juvenile official delinquency (19.1% in C, 22.1% in V), juvenile self-reported delinquency (20.5% in C, 18.6% in V), and adult official delinquency (21.6% in C, 24.5% in V).

However, 19.9% of the C sample became adult self-reported delinquents, in comparison with 30.1% of the V sample, a statistically significant difference ($\chi^2 = 4.83$, $p < .05$). The random allocation, therefore, was not very satisfactory in the case of adult self-reported delinquency, although it is only to be expected that one in 20 randomly chosen pairs of samples would be significantly sifferent at $p = .05$.

Table E1 shows the results of all the prediction exercises, beginning with the best single predictor. In order for the selection and combination of predictors to be worthwhile, a composite prediction instrument should be considerably more efficient than the best single predictor. The best predictor of juvenile official delinquency in the C sample was troublesomeness. Of those rated troublesome, 42.9% became juvenile official delinquents, leading to a phi correlation of .32. These figures are shown in Table E1. In the V sample, 47.6% of 42 boys rated troublesome became juvenile official delinquents, in comparison with 15.4% of the remaining 162 ($\chi^2 = 18.3$, $p < .001$). The best single predictor of juvenile delinquency in the V sample was not troublesomeness but daring.

In the case of juvenile self-reported delinquency, the best single predictor in the C sample was criminal parents. Of the 55 boys with criminal parents, 38.2% became juvenile self-reported delinquents, in comparison with 14.0% of the remaining 150 ($\chi^2 = 13.0$, $p < .001$, phi = .25). However, parental criminality was not significantly predictive in the V sample (28.6% of 49 as opposed to 15.5% of 155: $\chi^2 = 3.39$, not significant, phi = .13). As might have been expected, the best predictor of adult official delinquency in the C sample was juvenile official delinquency (64.1% of the 39 juvenile delinquents being adult delinquents, in comparison with 11.5% of the remaining 165: $\chi^2 = 48.5$, $p < .001$, phi = .49). Juvenile official delinquency was also a highly significant predictor in the V sample, but the best predictor of adult official delinquency in this sample was juvenile self-reported delinquency. Again, as expected, the best predictor of adult self-reported delinquency in the C sample (but only just) was juvenile self-reported delinquency (51.2% of 41 as opposed to 11.6% of 155: $\chi^2 = 29.5$, $p < .001$, phi = .39). However,

Table E1

The Efficiency of Predicting Delinquency

Method	Juvenile Official Delinquency		Juvenile Self-Reported Delinquency		Adult Official Delinquency		Adult Self-Reported Delinquency		Average Over Delinquency Measures	
	19.1 C	22.1 V	20.5 C	18.6 V	21.6 C	24.5 V	19.9 C	30.1 V	20.3 C	23.8 V
Best Single Predictor	42.9 (.32)	47.6 (.30)	38.2 (.25)	28.6 (.13)	64.1 (.49)	57.8 (.40)	51.2 (.39)	61.1 (.31)	49.1 (.36)	48.8 (.29)
Burgess Method	46.9 (.38)	45.1 (.31)	42.2 (.27)	37.5 (.25)	52.7 (.45)	58.3 (.42)	45.5 (.33)	52.4 (.24)	46.8 (.36)	48.3 (.31)
Glueck Method	46.0 (.38)	46.0 (.32)	46.0 (.34)	36.0 (.24)	54.0 (.44)	60.0 (.46)	48.1 (.41)	53.1 (.28)	48.5 (.39)	48.8 (.33)
Multiple Regression	54.0 (.49)	33.3 (.14)	45.3 (.35)	35.3 (.23)	55.6 (.43)	56.9 (.42)	49.1 (.43)	57.7 (.35)	51.0 (.43)	45.8 (.29)
Predictive Attribute Analysis	42.9 (.39)	41.1 (.27)	48.0 (.37)	24.5 (.09)	64.1 (.49)	57.8 (.40)	46.6 (.42)	55.7 (.38)	50.4 (.44)	44.8 (.29)
Logistic Regression	50.0 (.43)	27.5 (.06)	40.4 (.26)	38.0 (.27)	62.5 (.48)	59.1 (.41)	55.3 (.48)	56.0 (.32)	52.1 (.41)	45.2 (.27)

Notes

The figures in each cell show the percentage of the identified group who became delinquents (official or self-reported). In all cases, the identified group are about 50 of about 200 in each of the construction (C) and validation (V) samples. The phi correlations are given in brackets. With N = 200, phi = .14 is significant at p = .05, and phi = .23 is significant at p = .001.

it was again true that the best predictor in the C sample was not also the best predictor in the V sample. The best predictor of adult self-reported delinquency in the V sample was juvenile official delinquency.

In using the points score method ascribed to Burgess (1928), the most important questions which need to be resolved centre on the number of predictors to be chosen and on what to do about predictors which are closely intercorrelated. Burgess' score was based on virtually all the predictors he had available, but in Ohlin's (1951) use of this method he included only predictors which were associated with the criterion and not closely intercorrelated. The method used here was something of a compromise between Burgess and Ohlin. Each prediction score was based on the half-dozen or so factors which were the most closely related to each criterion, disregarding intercorrelations between them. Each boy was scored 1 or 0 on each variable, depending whether the category in which he fell was associated with an above or below average delinquency rate. If a boy was not known on one or more variables, his score on the others was increased pro rata. For example, if a boy scored 3 points on five variables and was not known on the other, his final score would be $3 \times (^6/5)$ or 3.60.

The seven best predictors of juvenile official delinquency in the C sample (all significant at $p = .001$) were troublesomeness, conduct disorder, acting out, criminal parents, social handicap, low IQ, and poor parental behavior (in that order). Each was given a weight of 1.0 in arriving at a prediction score. Two boys in the construction sample had the maximum score of 7, and both were juvenile official delinquents, as were 6 of the 8 boys with the next highest score of 6. As with all other variables, the prediction scores were dichotomized into the 'worst' quarter (the group identified as potential delinquents) and the remaining three-quarters. Of the 49 boys in the C sample with prediction scores of more than 2 points, 46.9% became delinquents, in comparison with 10.3% of the remainder ($\chi^2 = 30.0$, $p < .001$, phi = .38).

Table E1 shows that, in the C sample, the Burgess method was a slight improvement on the best single predictor of troublesomeness, since the percentage of the

identified group becoming delinquents increased from 42.9 to 46.9, and the phi correlation increased from .32 to .38. Of the 51 boys in the V sample scoring more than 2 points, 45.1% became delinquents, in comparison with 14.4% of the remainder ($\chi^2 = 19.2$, $p < .001$, phi = .31). Table E1 shows that this was very little improvement over the predictive power of troublesomeness alone in the V sample. Of the seven best predictors in the C sample, poor parental behavior and low IQ were not significantly predictive in the V sample. Two of the three best predictors in the V sample, daring and psychomotor clumsiness, were not among the seven best predictors in the C sample, and in fact psychomotor clumsiness was not significantly predictive in the C sample.

These analyses were repeated with juvenile self-reported delinquency, adult official delinquency, and adult self-reported delinquency. Table E1 shows that the Burgess method was a considerable improvement over the best single predictor in predicting juvenile self-reported delinquency in the V sample. This was because the best single predictor in the C sample (criminal parents) was not significantly related in the V sample. Of the six best predictors chosen to make up the prediction score on the basis of their relationships with juvenile self-reported delinquency in the C sample (criminal parents, low vocabulary, daring, low IQ, troublesomeness, and social handicap), three were still significantly predictive in the V sample. The Burgess method was little better than the best single predictor in predicting adult official delinquency, and somewhat worse in predicting adult self-reported delinquency.

These results suggest that, where there is known to be a good single predictor (as juvenile official delinquency is known to be a good predictor of adult official delinquency), little is gained by the Burgess method. When the existence of a good single predictor is less obvious, the Burgess method is likely to be better than the best single predictor. On the other hand, it must be pointed out that, apart from juvenile official and self-reported delinquency, no factors measured between ages 10 and 16 were included in the prediction of adult official and self-reported delinquency. It is possible that later factors combined with the best single predictor by the Burgess method would have produced an improved prediction.

The method of selection and combination of factors used by Glueck and Glueck (1950) is somewhat more complex than the Burgess method. The Gluecks advocated that a prediction table should be based on about five factors which most significantly distinguished between delinquents and non-delinquents. If possible, the factors should be mutually exclusive and independent, although the Gluecks (1950, p.259) said that, 'even if there is some overlapping of the factors, the value of the resulting instrumentality for prediction purposes is not impaired.' As explained in section E1, in deriving prediction scores, each category of each variable is weighted according to the percentage of boys in that category who are delinquents.

In my use of the Glueck method, exactly the same predictors were chosen as in the Burgess method. Only the weightings were different. For example, in deriving a prediction score for juvenile official delinquency, a boy's total would be incremented by .116 if he was rated not troublesome, and by .429 if he was rated troublesome. This was because, in the C sample, 11.6% of the non-troublesome groups became delinquents, and 42.9% of the troublesome group. As explained in the previous section, where a boy was not known on one or more of the factors contributing to the prediction score, his total on the other factors was increased pro rata.

Table E1 shows the efficiency of the Glueck predictions. For example, 46.0% of the 50 boys with the highest prediction scores in the C sample became juvenile official delinquents, in comparison with 10.4% of the remaining 154 ($\chi^2 = 28.7$, $p < .001$, phi = .38). The comparable figures in the V sample were 46.0% of 50 in comparison with 14.3% of 154 ($\chi^2 = 20.3$, $p < .001$, phi = .32). Looking at the values of phi in the V sample, the Glueck method is generally superior to the Burgess method and to the best single predictor, although whether the improvement in predictability justifies the extra effort involved in weighting according to percentages is doubtful.

The Burgess and Glueck methods have been criticized for being subjective and arbitrary, and for not taking sufficient account of the intercorrelations between predictors. With the increasing availability of statistical packages of computer

programs such as SPSS, the most common technique now used for selecting and combining predictors is probably multiple linear regression, popularized by Mannheim and Wilkins (1955). As stated in section E1, the problem with multiple regression is that its statistical assumptions are often violated by criminological data.

The forward stepwise multiple regression technique available in SPSS was used to obtain weights here. In this, predictor variables are added one at a time, at each stage adjusting the weights of all the variables in the equation to produce the greatest possible increase in the multiple correlation between the actual and predicted values of the criterion. The multiple correlation approaches its maximum possible value when only a small number of predictors are included in the equation, and the addition of more predictors does not greatly increase it. As an example, in predicting juvenile official delinquency in the C sample, the multiple correlation was .58 with all predictors in the equation. However, a multiple correlation of .51 was achieved with only five predictors, and one of .55 with eight predictors. The analysis was carried out under two conditions: (a) allowing all variables to enter the equation, and (b) adopting an arbitrary stopping point, such that a predictor was only included in the equation if its addition produced an increase in the multiple correlation of at least .01. (This corresponded to an increase significant at the .10 level.) The figures shown in Table 1 are for the multiple regression with a stopping point. For juvenile official delinquency in the C sample, only eight predictors were included.

Multiple regression was more efficient than the Burgess or Glueck methods in predicting delinquency in the C sample. For example, using prediction scores based on only the eight predictors included in the equation up to the stopping point, 54.0% of the 50 boys with the highest scores became juvenile official delinquents, in comparison with 7.8% of the remaining 154 ($\chi^2 = 49.2$, $p < .001$, phi = .49). The efficiency was even greater for multiple regression without a stopping point (phi = .52). However, predictions in the V sample based on multiple regression were usually inferior to those based on the Glueck method, and this was especially true for multiple regression without a stopping point. It seems likely that multiple

regression is too sensitive to variations which are specific to a particular sample and which probably reflect error or essentially chance effects. Allowing more variables to enter the equation merely adds more error to it.

Predictive attribute analysis is a hierarchical splitting technique which can be used with dichotomous variables, and it has been described by MacNaughton-Smith (1965). Unlike multiple regression, it automatically investigates non-linear interactions. If a factor was positively related to the criterion in one part of the sample and negatively related in another, this would be detected by predictive attribute analysis but not easily by multiple regression, at least not in its standard usage. There seems to be no readily available computer program to carry out predictive attribute analysis, and so it has not been used a great deal (see Gottfredson, Gottfredson, and Garofalo, 1977; Wilkins and MacNaughton-Smith, 1964).

As usual, an attempt was made to identify about 50 boys as potential delinquents, choosing the categories which included the highest percentages who were delinquents. For example, for juvenile official delinquency in the C sample, these were (a) eight troublesome boys with delinquent siblings, (b) 22 troublesome boys with no delinquent siblings but who were said to be acting out, and (c) 33 boys who were not troublesome but who had criminal parents. This produced a total of 63 identified boys, of whom 27 were delinquents (42.9%).

Table E1 shows that the efficiency of predictive attribute analysis was rather similar to that of multiple regression. Predictive attribute analysis was usually superior to the Glueck method in the C sample and inferior in the V sample. The results obtained with adult official delinquency are artefactual in the sense that the identified group were all juvenile official delinquents. There was a very large shrinkage between the C and V samples for juvenile self-reported delinquency, and this agrees with Simon's (1971) finding that this technique can have very large or very small shrinkages in comparison with others.

As pointed out in section E1, logistic regression has rarely been used in criminology, although it is more suitable than multiple regression, for example. As noted in section D4, with dichotomous variables, multiple and logistic regression

tend to select the same predictors for the equation. Therefore, in order to reduce the time taken over the logistic regression analyses, they were only carried out with variables identified (as significant at p = .10) in the multiple regression analyses.

Table E1 shows that, on the basis of the average phi correlation in validation samples, the logistic regression was the least efficient technique, despite its theoretical attractions. This was primarily because of the large shrinkage seen in the analysis of juvenile official delinquency. It seemed that logistic regression became less efficient in the validation sample as the number of predictors included in the equation increased, and the same phenomenon was observed with multiple regression. These techniques may capitalize too heavily on chance when more than four or five predictors are included in the equation. However, the difference between the best technique (Glueck, average phi in V samples .33) and the worst (logistic regression, .27) was not very great.

Returning to the major aims of this section, it was difficult to identify a group with much more than a 50% chance of juvenile delinquency, and conversely this meant that it was difficult to identify more than 50% of the juvenile delinquents. It was easier to predict official convictions than self-reported delinquency, and easier to predict adult offending than juvenile delinquency. The more sophisticated multiple regression, predictive attribute analysis, and logistic regression techniques were if anything worse than the simpler Burgess and Glueck methods, although in most instances the Burgess and Glueck methods were not markedly more efficient than the best single predictor.

There are several possible reasons for the relative inefficiency of delinquency prediction. One is that relevant predictor variables were not measured. However, as already mentioned, attempts were made in this project to measure all variables which were alleged (in 1961) to be causes of delinquency, and information was obtained from the boys themselves, from their parents, from their teachers, from their peers, and from official records. A second possible reason is that the measures of the predictor and criterion variables contained too much error and, because of the

dichotomizing, were too insensitive. A third possible reason is that delinquency depends on events which occur after age 10 or which are essentially unpredictable or due to chance.

How could the efficiency of delinquency prediction be improved? The comparisons of different prediction methods suggest that it will not be improved by devising and using more sophisticated mathematical methods of selecting and combining variables into a prediction instrument, at least with our present methods of measurement. It may be that advances in predictive efficiency will only follow the development of more valid, reliable, and sensitive measurement techniques. Whether predictive efficiency would be greater, and whether the more sophisticated methods would perform better, in larger samples is uncertain. The results of Babst, Gottfredson, and Ballard (1968), with a construction sample of over 3,000, and of Ward (1968) with a construction sample of 1,600, are not in favor of this proposition.

It may be more realistic and feasible to predict not offending in general but the most persistent or 'chronic' offenders who account for a significant proportion of all crime. If these people could be identified at the time of their first convictions, they could be subjected to special preventive measures. Sections E3 and E4 are concerned with these people.

E3. Transition Probabilities in Criminal Careers

In section A4, it was noted that one of the major contributions of the Philadelphia longitudinal survey of Wolfgang, Figlio, and Sellin (1972) was to publish offense to offense transition probabilities. Table E2 shows these probabilities for the first 14 arrests. For example, the probability of a first arrest was .35, of a second following a first was .54, and of a third following a second was .65. Table E2 also shows the raw data on which these probabilities are based. For example, out of a sample of 9,945 boys, 6,470 had no arrests, 1,613 had one arrest, and 650 had two arrests, As mentioned in section A5 above, Wolfgang et al. identified those with five or more arrests as the chronic offenders, and reported that the 6.3% of the sample who were chronics accounted for 52% of all juvenile arrests.

Table E2

Transition Probabilities in Philadelphia

Arrest Number	Probability	No. of Arrests	Observed Frequency	Expected Frequency*
1	.35	0	6470	6470
2	.54	1	1613	1613
3	.65	2	650	650
4	.72	3	344	337.0
5	.72	4	241	243.3
6	.73	5	171	175.6
7	.81	6	88	91.0
8	.77	7	86	72.8
9	.80	8	57	58.3
10	.83	9	39	46.7
11	.79	10	39	37.4
12	.80	11	29	29.9
13	.73	12	32	23.9
14	.88	13	10	19.2

* Based on a five-parameter model with p1 = .35, p2 = .54, p3 = .63, p456 = .72, q = .80.

Blumstein and Moitra (1980) then argued that the Wolfgang et al. data could be fitted by a mathematical model which assumed that the probability of a first arrest was .35, of a second arrest following a first was .54, of a third following a second was .65, and of any subsequent arrest was .72. The implications of this model are that those with three or more arrests are a homogeneous group. After any given arrest from the third onwards, the expected number of future arrests does not vary with the serial number of the arrest. Imprisoning persons who have already been arrested three times (for the remainder of the juvenile period) would avert 2.57 arrests per prisoner, but so would imprisoning those who have already been arrested five times (or even ten times). Therefore, the idea that imprisonment of chronic offenders would prevent a disproportionately large number of offenses was false (unless the chronics were defined as those with three or more arrests).

Unfortunately, the Blumstein and Moitra conclusions are doubtful. A major problem arises from an inconsistency between different figures in the Wolfgang et al. book. Table 10.3 (p.162) shows the transition probabilities, while the data matrices (pp.176-178) show the numbers of people being arrested for the nth time.

The number of people being arrested for the sixth time is 456 according to Matrix 11.6, but it can be calculated as 465 in Table 10.3. Blumstein and Moitra took the figure to be 465. I asked Marvin Wolfgang to resolve this, and he told me in a telephone conversation that the correct figure was 456. The figures in Table E2 are based on this correct figure.

The Blumstein and Moitra analysis attempted to fit the number of people with arrests from 0 to 10. The numbers of people with 0, 1, or 2 arrests were set at the observed figures, and the expected figures for 3 to 10 arrests were generated assuming a constant arrest to arrest transition probability of .72. When I repeated this analysis (using the 465 figure), the difference between observed and expected values produced a χ^2 of 11.77 with 7 d.f., higher than the figure of 8.0 published by Blumstein and Moitra. According to Soumyo Moitra (personal communication, 1982), there was an error in their original calculations. However, this error does not seriously affect their conclusions, since a χ^2 of 11.77 with 7 d.f. is not quite significant at $p = .10$ (which corresponds to $\chi^2 = 12.02$).

Unfortunately, repeating the analysis with the correct figure of 456 makes a considerable difference. The χ^2 now comes to 15.66, which is significant at $p = .05$ (which corresponds to $\chi^2 = 14.07$). Therefore, it can be concluded that the Blumstein-Moitra model significantly deviates from the Wolfgang et al. data. Furthermore, the deviation gets more serious as more data is added. Adding in three more arrests, as in Table E2, yields a χ^2 of 28.74 with 10 d.f., which is significant at $p = .005$.

An attempt was therefore made to fit the data shown in Table E2 using a variety of models. Perhaps the simplest one-parameter model assumes that the whole sample is homogeneous, with the same probability of a future arrest (q) after any given number of arrests (from zero onwards). In testing this model, q was set at the average of the probabilities shown in the second column of Table E2, which was .72. This model clearly did not fit the data ($\chi^2 = 7{,}193.94$, 13 d.f., $p < .001$).

Therefore, the next most complex (two-parameter) model was investigated, setting the probability of a first arrest (p1) at about .35 (actually .3494218), so that

the number of people with no arrests was 6,470. The probability of any subsequent arrest, q, was set at the average of all the remaining probabilities, which was .75. However, this model also did not fit the data (χ^2 = 952.85, 12 d.f., $p < .001$). Therefore, the next most complex (three-parameter) model was investigated, setting p1 = .35, p2 = .54, and q = .77. However, again, this model did not fit the data (χ^2 = 186.97, 11 d.f., $p < .001$).

The next model which was investigated was essentially the four-parameter Blumstein-Moitra one, except that q was set to be .78 (the average of the probabilities of arrest 4 to arrest 14). Again, this model did not fit the data (χ^2 = 62.71, 10 d.f., $p < .001$). The next logical model (five parameters, p1 = .35, p2 = .54, p3 = .65, p4 = .72, q = .79) also did not fit the data (χ^2 = 42.56, 9 d.f., $p < .001$).

The next five-parameter model which was tested was based on a visual inspection of the probabilities in Table E2. The probabilities of arrests 4-6 were all about .72, while the probabilities of arrest 7 onwards fluctuated around .80. Therefore, the model set p1 = .35, p2 = .54, p3 = .65, p456 = .72, and q = .80. This model fitted the data (χ^2 = 11.5, 9 d.f., N.S.). The expected frequencies are shown in Table E2. It seems likely that this is the simplest model which can fit the Wolfgang et al. data. It suggests that there are chronic offenders who are qualitatively different from less serious offenders, but the chronics are those with six or more arrests (rather than five or more, as Wolfgang et al. proposed).

This five-parameter model was then compared with one inspired by Wolfgang et al.'s ideas assuming that chronic offenders were those with five or more arrests. In this, p1 = .35, p2 = .54, p3 = .65, p45 = .72, and q = .79. This model did not fit the data (χ^2 = 26.40, 9 d.f., $p < .005$).

These analyses were then repeated with the Cambridge Study in Delinquent Development data on convictions, shown in Table E3. The simplest one-parameter model (q = .75) clearly did not fit the data (χ^2 = 365.81, 10 d.f., $p < .001$). Nor did a two-parameter model (p1 = .33, q = .79; χ^2 = 28.15, 9 d.f., $p < .001$). A

Table E3

Transition Probabilities in the Cambridge Study

Conviction Number	Probability	Number of Convictions	Observed Frequency	Expected Frequency*
1	.33	0	265	265
2	.63	1	49	49
3	.74	2	21	22.9
4	.69	3	19	16.5
5	.76	4	10	11.9
6	.69	5	10	8.6
7	.91	6	2	2.8
8	.90	7	2	2.5
9	.78	8	4	2.1
10	.86	9	2	1.9
11	.92	10	1	1.6

* Based on a four parameter model with p1 = .33, p2 = .63, p3456 = .72, q = .87.

three parameter model did fit the data (p1 = .33, p2 = .63, q = .80; χ^2= 12.09, 8 d.f., N.S.). However, the value of χ^2 corresponding to this model was not far off the .10 level. One problem with the relatively small numbers of convictions in the Cambridge Study is that a badly fitting model would not necessarily appear to be significantly different from the data, since χ^2 increases with sample size.

A much better fit to the data was achieved by a four-parameter model assuming a population of chronic offenders with six or more convictions (p1 = .33, p2 = .63, p3456 = .72, q = .87; χ^2 = 3.25, 7 d.f., N.S.). The expected frequencies from this model are shown in Table E3. Therefore, it is plausible in the Cambridge Study to identify those with six or more convictions as a distinctive group of chronic offenders.

E4. Predicting Chronic Offenders

Blumstein and Moitra (1980) argued that, because every distribution has a right hand tail, a group of chronic offenders accounting for a disproportionately large number of offenses can always be identified in retrospect. The key question is whether chronic offenders can be predicted prospectively. If they cannot,

career criminal prosecution programs and a policy of selective incapacitation may have little impact on the crime rate. The aim of this section is to investigate how far chronic offenders in the Cambridge Study (those with six or more convictions) can be predicted. As pointed out in section C3, the 23 chronic offenders in this sample accounted for about half of all convictions.

A policy of general incapacitation of offenders seems impracticable. The Cambridge Study data are useful in investigating incapacitation, because of the availability of self-reports of offending and official convictions of a fairly representative sample (as opposed to a sample of detected offenders, on which most of the existing incapacitation research is based). As mentioned in section C5, during the interview at age 18, the youths were asked how many of certain specified crimes they had committed in the previous three years. For example, the 389 youths interviewed admitted a total of 342 burglaries. During this three-year period, 28 youths had been convicted of burglary, and they admitted 136 burglaries, or 39.8% of the total admitted by the whole sample. They also reported 223 acts of damaging property (35.7% of the total of those admitted), 111 of stealing from vehicles (24.3% of the total), 88 of taking and driving away vehicles (20.8%), and 194 of shoplifting (16.0%).

It might therefore be predicted that, if there had been a mandatory sentence of three years incarceration for every convicted burglar aged 15-18, the total numbers of crimes in these categories would have decreased substantially. There are methodological problems with this argument (see e.g. Blumstein, Cohen, and Nagin, 1978). There is also a substantial practical problem. Of the 28 boys convicted of burglary, only seven actually were given institutional sentences for it. Of the remainder, nine received probation, six received a fine, and six were given a discharge. Of the seven institutionalized youths, four were sent to a detention center, which would have involved two months incarceration each. The other three (two going to borstal and one to an approved school) probably were incarcerated for a total of 36 months (see Langan and Farrington, 1983). The total incarceration actually experienced by these 28 burglars, therefore, was about 44 months. To incarcerate all 28

for three years each would mean increasing the average daily population incarcerated by a factor of about 22, which is clearly impossible.

Slightly more realistically, imagine that the total amount of incarceration for burglary could be doubled from 44 to 88 months. Each boy convicted of burglary committed an average of about 1.6 burglaries per year. Therefore, doubling the incarceration might possibly have prevented about six of the total 342 burglaries reported - less than 2%. The implications of this analysis are that the probability of conviction for burglary is too low and the number of burglaries committed by unconvicted boys is too high for a penal policy of incapacitation to be effective in reducing the burglary rate significantly.

Incapacitation is likely to have its greatest possible effect if it is applied selectively to the chronic offenders. These 23 youths not only accounted for half of all the convictions, but also for substantial proportions of the self-reported offenses at age 18-19 (32.2% of all taking and driving away vehicles, 30.4% of all burglaries, 23.7% of all shopliftings, and 20.8% of all thefts from cars). It is difficult to investigate how far they could have been predicted at age 10, because their numbers are really too small to carry out special predictive analyses with construction and validation samples. However, all of them were first convicted as juveniles, and they might be regarded as extreme examples of juvenile official delinquents. Therefore, the previously completed predictive analyses of juvenile official delinquents (see section E2) should give a reasonable indication of the predictability of the chronic offenders. The Burgess method was scrutinized, since it was the simplest, least likely to capitalize on chance, and about as efficient as any other. As stated earlier, the Burgess scale was based on seven predictors, each weighted 1.0. Three were measures of bad behavior (troublesomeness, conduct disorder, acting out), one reflected a deprived background (social handicap), and the others were criminal parents, poor parental child rearing behavior, and low IQ.

Taking the construction and validation samples together, 55 boys scored four or more out of seven points on this scale. These included the majority of the chronic offenders (15 of the 23), 22 other convicted boys (up to the twenty-fifth

birthday), and 18 unconvicted ones. The predictive efficiency was similar in the construction and validation samples. In the construction sample, 30 boys scored four or more, comprising eight chronic offenders, 11 other convicted boys, and 11 unconvicted ones. In the validation sample, 25 boys scored four or more, including seven chronic offenders, 11 other convicted youths, and seven unconvicted ones. These results suggest that, to a considerable extent, the chronic offenders can be predicted at age 10.

If any preventive action was to be taken with chronic offenders, realistically the first opportunity would be at the time of the first conviction. Therefore, a final analysis was carried out to investigate how far it was possible to predict, out of all convicted youths, those who were destined to become chronics. Included in this analysis were all variables measured at age 8-10, the age of the first conviction, and the seriousness of the first offense. The comparison was between the 23 youths with six or more convictions and the remaining 109 convicted youths at risk up to the twenty-fifth birthday. Table E4 shows the only variables which discriminated significantly between these groups. It can be seen that, in comparison with other convicted youths, the chronics tended to come from low income families, to be rated troublesome in their primary schools, to have low IQ and attainment, to be clumsy on psychomotor tests, to have convicted older siblings, and to come from Roman Catholic families (which often indicated Irish immigrants).

Table E4

Predicting Chronic Offenders

Variable at Age	% of 23 Chronics	% of Remaining 109 Convicted	Corrected χ^2	p<
Convicted 10-13	60.9	18.3	15.80	.001
Low Family Income 8	65.2	27.5	10.39	.005
Troublesome 8-10	69.6	33.0	9.14	.005
Poor Junior Attainment 10	66.7	30.4	8.38	.005
Psychomotor Clumsiness 8-10	56.5	27.5	6.01	.025
Low Non-Verbal IQ 8-10	60.9	31.2	6.00	.025
Convicted Sibling 10	39.1	14.7	5.89	.025
Catholic Family 8	56.3	26.6	4.33	.05

Notes: Not knowns excluded from table; χ^2 corrected for continuity.

The 34 youths who were legally children when first convicted (aged 10-13) were significantly more likely to become chronics than the remaining 98. In contrast, the type of offense committed on the first conviction did not seem to be predictive. As in section C2, offenses were roughly dichotomized into the more serious ones of burglary or violence and the remainder (primarily theft and taking motor vehicles). This analysis was restricted to first offenses as juveniles (under age 17), to give offenders ample time to accumulate six convictions. Of 17 youths whose first convictions were for more serious offenses, 6 (35.3%) became persistent offenders, in comparison with 17 of 63 (27.0%) whose first convictions were for less serious offenses (χ^2 = 0.14, N.S.).

The extent to which it was possible to predict the chronics was investigated using a logistic regression. This capitalizes on chance, and so it gives an indication of maximum rather than actual predictability. Seven of the eight variables shown in Table E4 were included in the analysis. Coming from a Catholic family was deleted, because of the large number of 'not known' cases (22). When all seven variables were included in the equation, their weightings were as follows:

Convicted 10-13	1.51
Low family income 8	0.71
Troublesome 8-10	0.86
Poor junior attainment 10	0.81
Psychomotor clumsiness 8-10	0.23
Low non-verbal IQ 8-10	0.59
Convicted sibling 10	0.71

The fit of this model was acceptable (G^2 = 89.0, 124 d.f., N.S.).

Of 17 youths with the highest predicted probability of being a chronic (p = .46 or greater), 14 (82.4%) were actually chronics. When the criterion predicted probability was lowered to .35 to predict the same number of youths as actually were chronics (23), the number of chronics predicted was still only 14. None of the nine non-predicted chronics had a predicted probability of .20 or greater. When the 14 predicted chronics were compared with the nine non-predicted chronics, it was clear that the predicted chronics had a much more extensive juvenile offending record. The predicted chronics had 5.9 juvenile and 5.2 adult convictions on average, whereas the non-predicted chronics had 2.9 juvenile and 6.0 adult con-

victions on average. The non-predicted chronics seemed to be later developing offenders.

A second logistic regression analysis was carried out, based only on the independently important variables. In this, variables were added one at a time. Convicted at 10-13 was added first, and of course had a significant effect (G^2 = 15.9, $p < .001$). The next most significant variable (in improving the fit of the model) was a convicted sibling (G^2 = 7.0, $p < .01$), which was added next. Troublesomeness entered next (G^2 = 4.24, $p < .05$), and finally poor junior attainment, although this was significant only at .10 (G^2 = 3.13). None of the other variables had a significant effect over and above these four. Also, none of the possible interactions of these variables was significant. The fit of this model including only the four independently important variables was acceptable (G^2 = 92.2, 127 d.f., N.S.). The weightings of the four variables were as follows:

Convicted 10-13	1.70
Convicted sibling 10	1.18
Troublesome 8-10	1.04
Poor junior attainment 10	0.97

Of 18 youths with the highest predicted probability of being a chronic offender (p = .43 or greater), 12 (66.7%) actually were chronics. When the criterion predicted probability was lowered to .33 to predict about the same number of youths as actually were chronics (because of ties, 25 were predicted), the number of chronics predicted rose to 14. These were the same 14 who were predicted in the analysis including all seven variables.

It might be thought surprising that low family income did not emerge as an independent predictor in this analysis. The major reason was because low family income and convicted sibling were significantly related (phi = .387, $p < .001$). Convicted sibling produced a slightly better fit than low family income when variables were added to the model after convicted at 10-13 (G^2 = 7.0 as opposed to 6.8). Once convicted sibling was in the model, low family income did not have an independent effect. Similarly, psychomotor clumsiness was significantly related

to troublesomeness (phi = .366, $p < .001$), and low non-verbal IQ to convicted sibling (phi = .238, $p < .01$), and so psychomotor clumsiness and low non-verbal IQ did not significantly improve the fit of the model.

Of the 34 youths first convicted at 10-13, 14 became chronics, and 13 of these were among the 14 predicted in the above analyses. Returning to the first logistic analysis, what this shows is that the addition of elementary school variables such as troublesomeness and poor junior attainment to early convictions could greatly improve the predictability of the chronics. Of the 34 early convicted youths, 15 were among the 17 with the highest scores in the first predictive analysis, and 13 of these 15 became chronics. This is a better prediction than, for example, studying only the earliest convicted youths (11 of 19 convicted at 10-12 becoming chronics).

These analyses show the extent to which chronic offenders can be predicted at an early age. While a policy of selective incapacitation would have its maximum possible effect if targeted on the chronic offenders, it seems unlikely that such a policy could have a very great impact on total crime figures without a considerable increase in institutional capacity.

F. Other Analyses

F1. Two-Track versus One-Track Justice

In collaboration with Dr Patrick Langan, a number of analyses were carried out to investigate the topic of two-track versus one-track justice. For more details of these analyses, see Langan and Farrington (1983).

Boland and Wilson (1978) described the typical state criminal justice system as a 'two-track' system, argued that such a system had undesirable consequences, and then urged that separate tracks for serious repeat offenders should be eliminated. A two-track system consists of two separate institutions: one administering juvenile justice, the other administering adult justice. The distinctive feature of this arrangement is that the official records of juvenile criminality that are created and compiled by agents of the juvenile system are not shared with agents of the

adult system. The result is that agents of the adult system dispense 'two-track justice' on the basis of incomplete criminal history information.

To see what is distinctive of two-track justice it is only necessary to imagine a former serious, chronic juvenile delinquent just beginning his adult criminal career at around age 18 or 19 and coming to the attention of the legal authorities for the first time as an adult. Convicted in the adult court for the first time, he will be sentenced erroneously as a first offender because agents of the adult system are unaware of his lengthy and serious juvenile court record. As a first offender in the adult court he will receive a more lenient sentence than a 16 or 17 year old chronic juvenile delinquent who has committed the same offense but who, because he has not yet turned 18, is convicted in the juvenile court. Looked at another way, the former chronic juvenile delinquent now being sentenced as an adult will receive the same sentence as, not a harsher one than, a first time adult offender who has committed the same offense but who really has no juvenile record.

Boland and Wilson also maintain that significant punishment will befall the former chronic juvenile delinquent only later in his adult career, when he has had time to amass a long and serious adult record. This is when the brunt of the 'social-debt' justification for punishment (the justification that says that the penalty for an offense is increased roughly in proportion to an offender's prior record) finally catches up to him. However, by this time the sentence of a long prison term may occur too late in his career to prevent many crimes, because by then (they argue) his criminal activity is low and declining (see section A5).

In short, the two-track system is said to produce a two-track form of justice characterized by distinctive sentencing inequities that mean undeserved leniency for chronic juvenile delinquents who become adult criminals and by prison sentencing practices that provide inefficient protection of the general public. Boland and Wilson urged that these two defects be remedied by centralizing serious criminal history records on offenders of all ages, and indeed the Attorney General's Task Force on Violent Crime (U.S. Department of Justice, 1981, p.82) recommended that 'the Attorney General should direct, and if necessary seek additional resources

for, the Federal Bureau of Investigation to accept ... criminal history information of juveniles convicted of serious crimes in state courts ...'.

It is difficult to evaluate the truth of Boland and Wilson's arguments, and consequently the necessity for the Attorney General's Task Force proposal, because of the lack of relevant well-designed American research. For example, in investigating whether young adults are less likely to be incarcerated than older juveniles, it is desirable to compare groups who are similar in factors other than age. If other factors are not controlled, it is always possible that one of them (rather than age) might be responsible for any observed differences in incarceration rates. The two factors which are likely to have the most important influences on sentencing, and which therefore need especially to be controlled, are the type of offense and the number of previous convictions. The same comment applies to the comparison of incarceration rates of young adults and older adults.

Another problem is that, in evaluating the incapacitative efficacy of sentences, it is necessary to know the average time served as well as the probability of incarceration. In the few studies which attempted to investigate incarceration rates at different ages, the average time served was not included in the calculation of incarceration rates. Other problems are raised in studies based on samples of prisoners. Conclusions from these studies may not apply to more representative samples of juvenile or adult court defendants.

A number of analyses were carried out to obtain English data relevant to the Attorney General's Task Force recommendation. The youths in the Cambridge Study in Delinquent Development were processed by a <u>one-track</u> system, in the sense that their juvenile criminal records were routinely provided on their adult court appearances. Therefore, these English results might provide some clues about the likely effects in the United States if the Attorney General's Task Force recommendation is brought into effect.

In England, as pointed out in section B1, the age of criminal responsibility begins on the tenth birthday, while juveniles become adults, as far as the criminal law is concerned, on the seventeenth birthday. A juvenile offender is dealt with

by a juvenile court unless he or she is accused of a grave offense such as murder or is charged jointly with an adult. In addition, the juvenile court magistrates can remand a person to the higher (crown) court for sentencing, after a finding of guilt has been established, if they feel that their sentencing powers are inadequate. The most usual reason for this is where the magistrates feel that the juvenile should be sent to borstal, because this sentence can only be given in the higher court (Smith, 1979).

The range of dispositions available for juveniles is different from that available for adults. In particular, a juvenile cannot be given a prison sentence, although the very small number found guilty of murder can be ordered to be detained at Her Majesty's Pleasure (an indeterminate institutional sentence). The most severe disposition normally available for juveniles is borstal, which is an indeterminate institutional sentence with a minimum of six months and a maximum of two years. The other major custodial disposition for juveniles is detention in a detention center for between three and six months. Borstals and detention centers are also available for young adults up to the twenty-first birthday. Juveniles can also be committed for an indeterminate period (usually between six months and three years) to an approved school. (These statements refer to the system in the late 1960s and early 1970s, when the study youths were juveniles and young adults.)

While juveniles and adults are, in general, sentenced in different courts, there is a free flow of information from the juvenile court to the adult one. A juvenile convicted for the first time as an adult would have his previous juvenile criminal record quoted in the adult court at the sentencing stage. At least in London (the site of the present research), juveniles found guilty of indictable offenses are routinely fingerprinted, and their records are stored in the central Criminal Record Office (Smith, 1979).

In a one-track system, it might be expected that (a) young adults would not be sentenced more leniently than older juveniles, and (b) young adults with juvenile criminal records would be sentenced more severely than young adults without such records.

In investigating whether young adults were sentenced more leniently than older juveniles, sentences given after first adult convictions at age 17 were compared with those given after juvenile convictions at age 16 which were similar in offense seriousness and in the number of previous juvenile convictions. (Youths committing offenses at age 16 but not convicted until age 17 were excluded from this analysis, as were youths whose first adult conviction at age 18 was for an offense committed at age 17.) As before, the offenses were dichotomized into the more serious ones of burglary or violence and the less serious remainder. Sentences were classified as follows: custodial (the most severe, including prison, borstal, and detention center), discharges (the most lenient), and the remainder (of intermediate severity, most commonly fines).

It was possible to match 36 youths convicted for the first time at age 17 with 36 convicted at 16 on offense seriousness and number of prior juvenile convictions. The matching was deliberately carried out in ignorance of the sentences, so that knowledge about sentences could not influence the choice of matched pairs. Of the 36 matched pairs, the 17-year-old received a more severe sentence on 13 occasions, the 16-year-old on four occasions, and there were 19 instances of no difference (using three categories of sentence severity as above). On a sign test (using the binomial distribution), the probability of 13 or more occasions out of 17 is .05 (two-tailed). Therefore, it can be concluded that 17-year-olds were dealt with more severely than 16-year-olds roughly matched on offense seriousness and number of previous juvenile convictions.

In investigating whether young adults with juvenile criminal records were sentenced more severely than those without, the first adult convictions of all 110 youths convicted as adults were studied. Just over half of these youths (58) had been convicted as juveniles. Sentences were divided into three categories of severity as above.

It was found that youths with a previous juvenile conviction were given a harsher sentence after their first adult conviction than those with no previous juvenile convictions. Twelve of those with previous juvenile convictions (20.7%) were given.

custodial sentences, in comparison with only one of those without (1.9%); and only two of those with previous juvenile convictions (3.4%) were given discharges, in comparison with 13 (25%) of those without. The relationship between previous juvenile convictions and sentence severity was statistically significant (χ^2 = 17.56, 2 d.f., $p < .001$).

It might be thought that this significant result reflected the fact that youths with previous juvenile convictions tended to be convicted for more serious offenses on their first adult court appearance. However, dividing offenses into more serious versus less serious as above, there was no tendency for those with previous juvenile convictions to be convicted of more serious offenses (32.8% of those with previous juvenile convictions were convicted of burglary or violence on their first adult court appearance, in comparison with 32.7% of those without).

There was a tendency for the more severe sentences to be given for the more serious offenses (e.g. 19.4% of 36 burglary or violence offenses were followed by custodial sentences, in comparison with 8.1% of 74 less serious offenses). When the three-way table relating previous juvenile convictions, seriousness of offense, and sentence severity was constructed, it was clear that the order of sentence severity was as follows: (1) previous juvenile conviction plus more serious offense; (2) previous juvenile conviction plus less serious offense; (3) no previous conviction plus more serious offense; (4) no previous conviction plus less serious offense. A loglinear analysis showed that previous juvenile convictions were significantly related to sentence severity independently of seriousness of offense, but that the reverse was not true. At least with the present method of measuring seriousness, previous juvenile convictions were more important than offense seriousness in influencing sentence severity after the first adult conviction.

There was a tendency for youths with previous juvenile convictions to be younger at the time of their first adult conviction (69.0% of them were aged 17-18, in comparison with 51.9% of those with no previous juvenile conviction; corrected χ^2 = 3.34, $p < .10$). However, a loglinear analysis showed that previous juvenile convictions were significantly related to sentence severity independently of age, and that the reverse was not true.

It can be concluded that previous juvenile convictions influenced sentence severity on the first adult conviction independently of offense seriousness and age. Furthermore, sentence severity tended to increase with the number of previous juvenile convictions (35.7% of 14 with four or more juvenile convictions were given custodial sentences, in comparison with 25% of 16 with two or three juvenile convictions, and 10.7% of 28 with only one juvenile conviction). It was interesting to note that only one of the 14 youths with the most persistent juvenile conviction records (four or more juvenile convictions), who were also convicted as adults, did not receive an institutional sentence as an adult. These analyses suggest that the sentencing inequities identified by Boland and Wilson do not occur in England.

It might be expected that, in a two-track system in which juvenile records are not available to adult courts, the probability of incarceration will (a) gradually increase up to the final juvenile year; (b) decline between the last juvenile year and the first adult year; and (c) gradually increase from the first adult year onwards. This kind of distribution would not be expected in the English system.

Table F1 shows how the probability of incarceration after a conviction varied with age. This probability was highest for offenses at age 23-24 and lowest for offenses at age 10-11, but it did not increase steadily with age. The problem is that the overall probability of incarceration was a combination of four different probabilities, and these are shown separately in Table F1. Approved schools were available for those aged 10-16 inclusive, detention centers for ages 14-20 inclusive, borstals for ages 15-20 inclusive, and prison for those aged 17 or more. It can be seen that the use of approved schools peaked at age 14, of detention centers at age 17, of borstals at age 19, and the use of prison was still increasing at age 23-24.

The relationship between incarceration and age is further complicated when the time served is taken into account. It is difficult to discover the time incarcerated in any given case. However, it is known that the average time spent in approved schools was 18 months, in detention centers two months, in borstals nine months, and in prison two-thirds of the sentence passed (discounting parole). With these

Table F1

Incarceration at Different Ages

Age at Offense	Number of Convictions	Per Cent leading to Incarceration	Per Cent Approved School	Per Cent Detention Center	Per Cent Borstal	Per Cent Prison	Average Time (months) per institutional Sentence	Incarceration Rate (months per Conviction)	Average Serial Number of Conviction**	Per Cent Burglary or Violence
10-11	17	0.0	0.0	*	*	*	-	-	1.5	11.8
12-13	41	7.3	7.3	*	*	*	18.0	1.3	1.8	26.8
14	44	15.9	15.9	0.0	*	*	18.0	2.9	2.8	36.4
15	43	7.0	4.7	2.3	0.0	*	12.7	0.9	2.5	34.9
16	47	14.9	6.4	6.4	2.1	*	9.9	1.5	4.0	38.3
17	63	20.6	*	11.1	9.5	0.0	5.2	1.1	3.4(1.3)	34.9
18	50	14.0	*	4.0	8.0	2.0	6.9	1.0	3.6(1.9)	30.0
19	47	21.3	*	8.5	10.6	2.1	7.7	1.6	4.9(2.6)	34.0
20	41	12.2	*	0.0	0.0	12.2	8.0	1.0	5.0(2.8)	22.0
21-22	53	17.0	*	*	*	17.0	9.2	1.6	5.9(3.8)	32.1
23-24	29	24.1	*	*	*	24.1	18.7	4.5	6.3(4.1)	31.0
Total	475	14.9	3.2	3.6	3.4	4.8	10.1	1.5	3.9(2.6)	31.6

Note: Based on convictions not offenders. Extreme categories combined because of small numbers.
* Sentence not applicable.
** Average serial number of adult convictions in parentheses.

assumptions, it can be seen that the average time served per institutional sentence declined from 18 months at age 12-13 to about five months at age 17 (the age at which detention centers were used most), and then increased back to about 18 months at age 23-24. The incarceration rate (months per conviction) fluctuated between 1.0 and 1.6, with two exceptions. At age 14, the peak age for approved schools, it reached 2.9 months per conviction, and at age 23-24, the peak age so far for prison, it reached 4.5. It seems clear that the maximum rates of incapacitation of this sample occurred at ages 14 and 23-24. This conclusion is not changed by taking conviction rates into account (e.g. multiplying the probability of a conviction by the average months per conviction).

The probability of a conviction leading to incarceration increased with the serial number of the conviction. Only 0.7% of youths were incarcerated on their first conviction, 8.3% on their second, and 15.9% on their third. These figures increased to 23.0% on convictions 4 to 6, 30.2% on convictions 7 to 9, and 35.9% on a tenth or later conviction. Table F1 shows the average serial numbers of convictions at each age, and the average serial numbers of adult convictions only. In general, these both increased with age. For example, at age 23-24 the average conviction was about the sixth altogether, or the fourth adult conviction. If the adult courts had not known about juvenile convictions, they would have assumed that the average convicted adult had two convictions less than he really had.

Convictions for more serious offenses of burglary or violence were more likely to be followed by incarceration than convictions for less serious ones (22.7% of 150 as opposed to 11.4% of 325; $\chi^2 = 9.41$, $p < .005$). The percentage of convictions which were for burglary or violence increased up to age 14 but then stayed fairly stable (at about 30%) up to age 23-24. Changes in the probability of incarceration were not related to changes in the proportion of more serious offenses. To conclude, changes in incarceration rates with age in England seemed to depend primarily on changes in institutional provision with age.

F2. Studying Biological Variables in Criminology

As a result of an invitation to contribute a paper to a conference on biology and crime (Farrington, 1983a), I carried out some analyses of the major biological variable measured in the Cambridge Study in Delinquent Development - pulse rate. In my opinion, biological findings are sufficiently promising to justify criminologists attempting to measure biological variables in their research projects. Biological variables have several advantages over the social and psychological variables usually measured in criminological research. In particular, biological variables are usually measured on interval or ratio scales and are usually normally distributed. This means that parametric techniques such as multiple linear regression and path analysis can be used with them and that it makes sense to talk about the percentage of the variance explained.

Another advantage of biological variables is that it should be possible to measure them with less error than social and psychological variables, although this may depend on how carefully the conditions of measurement can be controlled. Furthermore, the reliability of measurement can be established more accurately, and indeed the concepts of reliability and validity can be used more effectively. The problem with a variable like parental discipline is that there is no yardstick by which it can be measured and no generally accepted unit of measurement. There are yardsticks and measurement methods for biological variables such as heart rates and testosterone levels.

Unfortunately, the measurement of biological variables raises a number of problems. For example, the sensitivity of measurement of biological variables can create difficulties in comparing these variables with social and psychological ones. Heart rate can be accurately measured on an interval scale which is normally distributed, whereas parental discipline is usually a rough, subjective, categorical measure. A variable which is measured more accurately (such as heart rate) may have a stronger measured relationship with an index of crime or delinquency than one measured less accurately (such as parental discipline), even if the underlying theoretical constructs were equally closely related to the construct of criminal or delinquent behavior.

The major difficulties raised by the measurement of biological variables center on the practical problems of biological measurement outside the laboratory. In order to carry out important research on biology and crime, it will be necessary to measure biological variables outside the laboratory and outside institutions, in conditions which are not optimal for this kind of research. It might be theoretically desirable to keep people under controlled conditions in a laboratory for 24 hours or more, and to make repeated biological measurements on them during this period, but this is likely to create practical problems in criminological research. It is important to study representative samples of the population rather than institutionalized offenders, and this often necessitates interviews in the field - in research offices, or even in interviewees' homes. The most feasible biological research on crime is likely to involve measures which can be taken in these non-optimal conditions.

There are also legal and ethical problems arising in biological research which are likely to be greater than those arising in social-psychological research, especially where biological measurement involves physical interference or pain. In order to obtain legally effective informed consent, it may be necessary to explain in great detail all possible risks (however improbable) which are attendant upon a procedure. This may lead to a low rate of participation in the research. Unless investigators are confident that social benefits will result from a project, it may be difficult to justify the infliction of physical pain ethically.

Biological research which involves little or no physical interference with people is likely to be the most practicable. It is hard to imagine a field project involving the implantation of electrodes in the brain, for example. What can be achieved in field research has been demonstrated by Witkin et al. (1976) in Denmark. Out of a target sample of 4,558 men over six feet tall, blood samples and buccal smears (to determine chromosomal constitution) were obtained in home visits for 4,139 (nearly 91%). Of the remainder, only 174 refused, and the rest were not contacted, in some cases because they had left the area. These kinds of biological measures seem feasible, and it is important to establish which other kinds can be collected in field research.

Biological research may prove to be more expensive than the more usual kinds of social research, because of the equipment, recording hardware, and biologically trained technicians that may be needed. It may be that biological research in criminology has to involve cooperation between researchers from different disciplines, as Shah and Roth (1974) advocated. There is a great deal of technical biological literature and knowledge about biological techniques which is likely to be outside the competence of most criminologists, for example. Interdisciplinary collaboration is often useful in broadening the horizons of all the researchers involved.

Biological variables are rarely included in criminological theories at the present time. It could be argued that the adequacy of criminological theories in predicting or understanding either the development of criminal tendencies or the occurrence of criminal acts would be improved by including biological variables. Whether this is true is not yet known, but it could at least be investigated. It would be desirable to develop and test theoretical models including biological and non-biological variables. There could be an interaction between theory and empirical research, with the theory guiding the research and the results of the research leading to modifications in the theory.

What is needed is a theoretical model including all the different kinds of variables. This should specify, for example, how changes in biological variables produce changes in social and psychological ones, how changes in social and psychological variables produce changes in biological ones, and how social and psychological variables interact with biological ones to produce changes. I think this approach is preferable to the alternative of keeping the different kinds of variables separate in different theories (e.g. having all the biological variables in one theory and all the social variables in another).

Whether the addition of biological variables to criminological theories will improve their predictive or explanatory power depends on a number of things, such as the precise causal linkages between the theoretical constructs, whether the biological variables are measuring the same or different theoretical constructs as the non-biological ones, and the reliability and validity of measurement. For example,

if low income produced poor nutrition, which in turn produced biochemical factors which produced delinquency, measuring the biochemical factors might lead to improved prediction of delinquency than the low income. On the other hand, if low income produced delinquency through one causal chain and low income produced biochemical factors through another separate one, measuring the biochemical factors would not improve the prediction of delinquency. As another example, if conditionability was a key theoretical construct, it might make little difference to the efficiency of prediction if conditionability was measured biologically or non-biologically, if the two measures had similar reliability and validity. On the other hand, if the biological measure of conditionability had higher reliability and validity, including it might improve predictive efficiency.

In many ways, it is desirable to carry out a prospective longitudinal survey, preferably with a representative sample of the population and with frequent measurement of biological and non-biological variables thought to be both important and feasible to study. Such a project is needed to establish basic relationships between variables and to generate hypotheses about (e.g.) which changes in biological factors lead to changes in social factors, and vice versa. There have already been some interesting longitudinal studies including biological variables (e.g. Magnusson, Duner, and Zetterblom, 1975; Mednick, Volavka, Gabrielli, and Itil, 1981; Wadsworth, 1979).

In the Cambridge Study in Delinquent Development, as mentioned in section B1, a small number of physical and biological variables were studied. Heights and weights were measured at ages 8, 10, and 14, without jackets and shoes, by the psychologists working in the medical room of each school. They were scored according to the boys' percentile rankings in relation to frequency distributions obtained from normal samples, correcting for the exact age of the boy at the time of measurement. Grip strength was measured at age 10 using a dynamometer. It was used to identify probable mesomorphs from among the boys whose weights were relatively greater than their heights.

This section concentrates on results obtained with a fourth variable, pulse rate (heart rate), which was measured at age 18. Previous work (Davies and Maliphant, 1971) linked low pulse rates to low autonomic reactivity, and suggested that there was an association between low pulse rates and bad behavior in school. In addition, parallel research by Wadsworth (1976) reported that violent and sexual offenders had low pulse rates. Pulse rate was measured in the present research using a pulsimeter, which included a pressure cap which was fitted over the right middle finger. The pulse was made visible by a needle movement across a dial, and this was counted using a stopwatch. The readings were taken towards the end of the interview (which lasted two hours on average) with the youth sitting quietly, resting his arm on a desk. The cumulative number of beats was recorded after 30 seconds and 60 seconds. If a youth moved, the procedure was recommenced. All except two youths (387 out of 389 interviewed) had pulse rates measured, although in 23 cases the figure was based on the 30 second reading.

It had been expected that the frequency distribution of pulse rates would be approximately normal. Table F2 shows the actual distribution in comparison with a normal distribution (rounded to whole numbers) with the same mean (70.8) and standard deviation (10.0). The two distributions were not significantly different on a Kolmogorov-Smirnov test (maximum difference .0598 at the 69-70 level; .0691 would be significant at $p = .05$). However, they were significantly different on a χ^2 goodness of fit test. Because of small expected values at the extremes, this was based on 20 categories, collapsing 50 or less, 51-54, 87-90 and 91 or more. The χ^2 value came to 32.0 with 17 degrees of freedom (in view of two estimated parameters) and it was significant at $p = .025$.

It can be concluded that the use of biological variables does not necessarily guarantee normal distributions, although the distribution of pulse rates is sufficiently near the normal one for parametric methods to be appropriate. The major deviations from the normal distribution come in the categories 69-70 (expected 31, actual 48) and 91 or more (expected 9, actual 16). The former case may represent interviewer error. Given that the most common pulse rates were 70 and 71, it could

be that the interviewers preferred to record 70 rather than 71 in doubtful cases.

Table F2

Frequency Distribution of Pulse Rates

Pulse Rate	Frequency	Expected Frequency (Normal Distribution)
48 or less	5	5
49-50	1	3
51-52	3	5
53-54	4	7
55-56	8	10
57-58	12	12
59-60	20	17
61-62	21	20
63-64	26	23
65-66	34	27
67-68	30	29
69-70	48	31
71-72	28	31
73-74	27	29
75-76	19	28
77-78	20	25
79-80	24	21
81-82	18	17
83-84	7	14
85-86	5	10
87-88	5	8
89-90	6	6
91-92	4	3
93-94	1	3
95-96	1	1
97-98	6	1
99 or more	4	1
Total	387	387

Of the 387 youths who had their pulse rates measured, five were not at risk of being convicted up to their twenty-fifth birthdays, because they died or emigrated. Of the remaining 382, 34 were first convicted between ages 10 and 13 inclusive, 35 at 14 or 15, 30 at 16 or 17, and 31 between ages 18 and 24 inclusive. The mean pulse rates of youths first convicted at 10-13, 14-15, and 16-17 were slightly, but not significantly, lower than the mean of the 252 unconvicted youths (see Table F3).

About a quarter of the convicted youths (32 out of 130) had at least one conviction for violence. A youth was only included in the violent group if he had been convicted of an offense that must have involved violence against another person (such as causing grievous bodily harm) or if a police report said that he had used,

Table F3

Mean Pulse Rates

Definition of Group	N	Pulse Rate	
		Mean	S.D.
Unconvicted Youths	252	71.4	9.6
First Convicted at 10-13	34	69.5	8.1
First Convicted at 14-15	35	68.2	9.2
First Convicted at 16-17	30	68.7	11.5
First Convicted at 18-24	31	72.5	12.8
Convicted of Violence	32	67.7	9.1
Chronic Offenders	22	67.7	5.4

or threatened to use, physical violence against another person during the commission of an offense. The criteria for inclusion in this officially violent group were strict. Robberies that involved mere jostling or snatching were not counted, and neither was carrying an offensive weapon without actually using it or threatening to do so. The 32 convicted violent youths had significantly lower pulse rates than the 252 unconvicted youths (mean 67.7 as opposed to 71.4; $t = 2.06$, $p < .05$). This essentially replicates Wadsworth's (1976) finding. The chronic offenders had the same average pulse rate as the violent offenders, although the chronics' pulse rate was not significantly different from the mean pulse rate of the unconvicted youths. (Twelve youths were in both the violent and chronic groups, and their mean pulse rate was 67.2).

Table F4 shows the cumulative percentages of youths convicted at different pulse rates. It can be seen that those with a below average pulse rate (70 or less) tended to have above average conviction rates. If the sample is dichotomized into those with pulse rates of 70 or less and those with pulse rates of 71 or more, a significant difference is obtained (40.9% of 208 with below average pulse rates were convicted, in comparison with 25.9% of 174 with above average rates; $\chi^2 = 8.84$, $p < .005$). However, it is statistically invalid to choose a cutoff point to maximize a difference.

These results were reasonably satisfactory, but problems began to emerge when pulse rate was included in the analysis with all other variables. When

pulse rate was dichotomized into the lowest quarter (64 or less) versus the remainder, like all other variables, it was not significantly related to any of the conviction measures. The only variable to which low pulse rate was significantly related was self-reported violence at 14 and 16 combined. This was based on the admission of seven violent acts (mostly describing street fighting; see Farrington, 1973). Unfortunately, the relationship was in the opposite direction to that expected. Only 11 of the 100 with pulse rates of 64 or less were among the 77 who admitted four or more violent acts, in comparison with 23.0% of those with higher pulse rates; $\chi^2 = 5.96$, $p < .025$). Therefore, low pulse rates seemed to be negatively related to self-reported violence and positively related to convictions for violence. In view of the close relationship between self-reported and official violence (see e.g. Farrington, 1978), these results are surprising.

Table F4

Percentage Convicted at Different Pulse Rates

Pulse Rate	N	Percentage Convicted up to Age:			
		13	15	17	24
60 or less	52	7.7	17.3	32.7	40.4
61-64	45	6.7	20.0	26.7	37.8
65-68	64	12.5	31.3	39.1	45.3
69-70	47	17.0	23.4	29.8	38.3
71-74	55	10.9	18.2	23.6	27.3
75-80	62	0.0	4.8	11.3	21.0
81 or more	57	8.8	12.3	19.3	29.8
Total Convicted		34	69	99	130

For completeness, the results with height, weight, and grip strength will be mentioned. Weight was not significantly related to convictions, and the youths identified as probable mesomorphs on the basis of the height:weight ratio and grip strength were, in anything, less likely to be convicted than the remainder. However, low height at 8-10 and 14 was significantly related to juvenile convictions, especially those occurring at the earliest ages (10-13). Low height at 8-10 was also related to many other variables, notably low family income at 8, large family

size at 10, poor housing at 8-10, low vocabulary at 10, poor parental supervision at 8, convicted parents at 10, and separations from parents up to 10. Low height at 8-10 did not predict convictions at 10-13 independently of troublesomeness at 8, poor housing at 8-10, Roman Catholic family at 8, and low IQ at 8-10, and hence dropped out of the analysis.

The problem in summarizing these results is that the findings depend on the analytic methods used. The rough tabular methods, and the dichotomizing, were dictated by the rough nature of many of the variables. If all variables had comprised normally distributed interval scales, more sensitive parametric techniques could have been used, and pulse rate, for example, might have proved to be more important. The key question is whether pulse rate, or any biological variable, is related to delinquency independently of non-biological variables. The analyses which have been carried out so far indicate that observed relationships between pulse rate, height, and convictions may not hold independently of the more important variables of economic deprivation, family criminality, parental mishandling, and school failure (see section D6). However, more research is needed to establish the precise linkages between biological and non-biological variables.

G. Conclusions

G1. Summarizing the Results of this Project

The aim of this project was to carry out further analyses of data collected in the Cambridge Study in Delinquent Development, a prospective longitudinal survey, using modern (logistic and loglinear) statistical methods for categorical data. It was pointed out that, unlike any existing American longitudinal survey of crime and delinquency, the Cambridge Study combines (a) more than three interviews with the subjects - actually seven, (b) covering a period of at least five years - actually 16, (c) a reasonable sized sample - 411, and (d) information from multiple sources - the subjects, records, parents, peers, and teachers.

In the Cambridge Study, the peak age for the incidence of most offenses was around the seventeenth birthday, although shoplifting and stealing from machines seemed to peak earlier, and fraud later. There was some indication that the later offenses, while less frequent, were more serious. The peak was much more in incidence than in individual crime rates. Official records and self-reports were in reasonable agreement in regard to the incidence of offenders (at least for the more serious offenses), but disagreed in their information about rates of committing offenses. To my knowledge, these are the first comparisons of official records and self-reports of the same sample at different ages, although Elliott and his collaborators have collected similar data.

There was a close relationship between juvenile and adult offending, and there was continuity in offending from one age range to the next, in official records and self-reports. The youths convicted at the earliest ages (10-12) tended to be the most persistent offenders and to have the longest criminal careers. There seemed to be continuity or a developmental sequence between troublesome behavior at age 8 and criminal behavior at age 21-24. The youths who were convicted or who admitted large numbers of offenses tended to have been identified as troublesome, daring, dishonest, and aggressive by their teachers, peers, and parents from an early age.

Over and above the continuity in behavior, some factors had persistent effects. The most important of the earliest factors were economic deprivation, family criminality, parental mishandling, and school failure, while the most important of the later ones were truancy, delinquent friends, anti-establishment attitudes, and an unstable job record. A tentative theory was put forward to explain these results, with four elements: (a) the arousal of desires for material goods, status among intimates, and excitement; (b) the choice of illegal methods of achieving these goals; (c) the operation of beliefs that delinquency is right or wrong, built up in a learning process; and (d) the decision to commit delinquent acts, depending on the perceived costs and benefits in the immediate situation.

In attempting to predict offending, it was difficult to identify a group with much more than a 50% chance of juvenile delinquency, and conversely this meant that it was difficult to identify more than 50% of the juvenile delinquents. It was easier to predict official convictions than self-reported delinquency, and easier to predict adult offending than juvenile delinquency. The more sophisticated multiple regression, predictive attribute analysis, and logistic regression techniques were if anything worse than the simple Burgess and Glueck methods, although in most instances the Burgess and Glueck methods were not markedly more efficient than the best single predictor.

A small proportion (5.8%) of chronic offenders accounted for about half of all recorded offenses, and for substantial proportions of self-reported offenses. On the basis of transition probabilities, it was argued that these offenders were qualitatively different from others. To a considerable extent, they could be predicted prospectively. A policy of selective incapacitation would have its maximum possible effect if targeted on the chronic offenders, but it seems unlikely that such a policy could have a very great impact on total crime figures without a considerable increase in institutional capacity.

Unlike American criminal justice systems, the English system is to a large extent a one-track system. In it, young adults were sentenced more severely than older juveniles, and young adults with juvenile criminal records were sentenced more severely than young adults without such records. The probability of incarceration did not decrease between the final juvenile year and the first adult year. The use of incarceration seemed to depend on the pattern of institutional provision, and was greatest at ages 14 and 23-24. These results suggest that the sentencing inequities identified by Boland and Wilson (1978) do not occur in a one-track system such as England's.

It was argued that there were advantages in including biological variables in criminological theories and trying to measure them in longitudinal research projects. In this survey, pulse rate was related to convictions for criminal violence, but it did not appear to be important in a multivariate analysis. This

may be because the rough nature of many of the variables dictated categorization techniques which involved a considerable loss of information.

G2. Desirable Future Longitudinal Research

There are a number of key choices which have to be made in planning future longitudinal surveys. The first is whether or not to include experimental manipulations. In my view (see Farrington, 1983e) these manipulations are essential. We are still lacking compelling evidence about the causes of criminal behavior, and we still find it difficult to know which factors are causes and which are merely correlates. If we knew more about the causes of crime, then, in principle at least, we would be better able to prevent it. Experimental interventions in a longitudinal survey could be used to establish causal order and to test hypotheses about prevention and treatment. Long-term surveys on crime and delinquency have rarely contained experimental manipulations, so this would be a real step forward.

Let me give some idea of the kind of manipulations which are desirable. The Cambridge Study in Delinquent Development shows that the educationally retarded children from poor, socially handicapped, criminal families are especially at risk of committing offenses. This suggests that scarce welfare resources should be concentrated on this vulnerable group. It can be argued that current attempts to prevent and treat offending do not have their intended reformative or deterrent effects (e.g. Farrington, 1977) because they occur much too late in a person's life. If delinquency is part of a larger syndrome beginning in childhood and continuing into adulthood, as our research suggests, special help and support in the first few years of life seems most likely to be successful.

Large social programs should not be put into effect until small scale experiments to investigate their likely effectiveness have been carried out. One possible experiment would be to offer free day care facilities to mothers of high risk children. This day care should aim to provide an intellectually stimulating environment, consistent and loving caretakers, desirable parental role models, and training in desirable social skills. It could be offered to convicted women who

are about to have children, and also to some control women (to avoid possible negative labelling effects).

The women who accept the offer would be randomly assigned to receive the experimental day care program (or specific elements of it), a control program, or no program (since resources will not be sufficient to treat everyone). The children would have to be followed up from birth to age 6-8. Since troublesomeness in the elementary school predicts future offending, the program will be successful if it improves school behavior at age 6-8. The day care program could be backed up by parent training and could be followed at age 6-8 (for some children who have or have not received it) by an elementary school program attempting to encourage school attendance, academic achievement, the constructive use of leisure, and other desirable features. These kinds of experimental manipulations cannot be spelled out in detail here, but it is my view that they are important in any future prospective longitudinal survey.

A second important feature of a future longitudinal survey is frequent contacts with the subjects. For example, imagine that we are interested in testing the hypothesis (which might well be derived from a larger theory) that poor parental supervision causes delinquency. In this hypothesis, parental supervision and delinquency are theoretical constructs, and we then have the problem of measuring them using empirical variables and of establishing a causal relationship. However, let us forget measurement for the moment and look at the theoretical constructs themselves. On any theoretical basis, it seems likely that both parental supervision and delinquency vary continuously over time. Neither can easily be located only at one point in time. Therefore, it might make more sense to hypothesise that changes in parental supervision cause changes in delinquency.

One problem with this hypothesis is that we might be interested in absolute magnitudes of parental supervision and delinquency as well as in changes. For example, a decrease in parental supervision might have a different effect it it is a decrease from a high level or a decrease from a low level. Another problem is that the concept of cause has a time dimension too. Does a decrease in parental

supervision have an immediate effect on delinquency or a delayed effect? These kinds of considerations lead me to think that what we should be concerned with in our theories are not theoretical constructs so much as distributions of theoretical constructs over time. A longitudinal survey could make a real contribution by establishing the forms of these distributions and the relationships between them, and our knowledge about crime and delinquency would be advanced if we gave more attention to the time dimension and studied distributions over time in some detail.

In order to plot distributions of offending (or of possible explanatory variables) over time, it is essential to have measurements at frequent intervals. At the extreme, daily measurements may be feasible (see e.g. Patterson, Chamberlain, and Reid, 1982). However, it is more important that the measurement intervals should make it possible to detect changes in the variables of interest, so the frequency of measurement depends on the frequency of change of variables. It should be possible to relate increases or decreases (or rates of acceleration or deceleration) of possible explanatory variables to increases or decreases (or rates of acceleration or deceleration) of offending. This would provide useful information about possible causal relationships.

A third key issue is whether a future longitudinal survey should be designed to include one or several cohorts. There are many advantages of having several cohorts. One is to increase the generalizability of the results. Existing surveys tend to have been concerned with one cohort living in one particular location at one particular time. A second advantage is the possibility of distinguishing between aging and period effects. If the cohorts are investigated consecutively, a third advantage is that the study of later cohorts can take account of later developments in measurement, theory, and methodology. It would be desirable to build on and extend the existing multi-cohort studies of Wolfgang, Shannon, and Elliott.

A fourth choice concerns the location of a survey. There are advantages in having a national survey, from the point of view of drawing conclusions about the whole population. Also, if true random samples are drawn, it should be possible

to present results with appropriate confidence intervals. Also, it is important to compare the development of people in different settings - different criminal justice systems, different school systems, different neighborhoods and housing conditions, different employment conditions, etc. This would make it more possible to specify boundary conditions under which effects hold. It is also an argument for cross-national research, to compare different cultures. However, it was argued in section A that it was desirable to collect information from multiple sources - the subjects, records, parents, peers, teachers, etc. How far this is feasible in a wide-ranging survey is not clear.

A major effort should be made to minimize attrition in any future survey, and it may be that attrition is much more of a problem in some locations than in others. It may be that subjects in some areas are less mobile, and that official agencies in some areas will cooperate more in allowing access to records and in helping to locate subjects. It may be that record systems are better organized, more extensive, and more accessible in some locations than in others. Research is needed to identify the best locations for a long-term study and also on other ways of tracing subjects and minimizing attrition.

Future longitudinal surveys should also: (a) aim to estimate reactive effects, by having subjects followed up in records but not contacted personally; (b) attempt to investigate the effects of specific events on the course of development; (c) attempt to investigate intergenerational transmission; (d) attempt to estimate the importance of retrospective bias; (e) attempt to develop more sensitive, reliable, and valid methods of measuring theoretical constructs of interest; and (f) attempt to develop better methods of analyzing categorical data.

Three kinds of longitudinal surveys are especially worth carrying out. One involves following up a sample from the general population, covering both sexes, the major ethnic groups, and urban, suburban, and rural areas. The second involves following up a first offender cohort. The date of the first recorded offense is, realistically, the first opportunity for intervention or treatment. It is important to try to evaluate the effectiveness of different treatment methods

on first offenders (preferably by randomized experiments), and also the extent to which chronic or violent offending can be predicted at this time. The third desirable survey is a follow-up of an entering cohort of prisoners with long sentences, to attempt to assess the effects of imprisonment.

G3. Planned Future Work on the Cambridge Study

As already mentioned, I plan to reinterview as many as possible of the men in the Cambridge Study at age 31, beginning in 1984. The interview will be supplemented by further searches of criminal and other records of the men, their parents and siblings, and their wives/cohabitees. It will attempt to obtain information about the following topics:

(a) Marriage/cohabitation history since age 25. Date(s) of marriage(s). Name and date of birth of wife/cohabitee. Name and date of birth of all children.

(b) Housing conditions. Who is the man living with? Overcrowding in the home. Contact with welfare agencies.

(c) Type of job. Recent employment history. Job of wife/cohabitee. Family income. Debts.

(d) Contact with parents. Are the parents still alive? Date of deaths of parents. Contact with siblings.

(e) How well does the man get on with wife/cohabitee? Disagreements.

(f) How well are the children being brought up? Parental attitude, neglect, supervision, discipline, interest in children. Separations from children. Joint activities with children.

(g) Any problems with children (e.g. bad behavior at home/school, telling lies, disobedience, fighting)?

(h) Leisure activities. Frequency of going out at night, and usual companions. Drinking, smoking, gambling, drug use, sexual activity, getting into fights, driving after drinking.

(i) Health: illnesses and accidents.

(j) Criminal activities since age 25, e.g. burglary, taking cars, stealing from

work, tax evasion, benefit fraud.

(k) Contact with police and courts since age 25. Estimated probability of being caught, and opinion of legal and social consequences of conviction.

(l) Anti-establishment and aggressive attitudes.

The main aims of the long term follow-up are as follows:

(a) To extend knowledge about the course of development of criminal careers, showing the incidence and prevalence of different kinds of crimes at different ages (according to official records and self-reports), up to and beyond age 30. The aim of the follow-up is to obtain information about patterns of offending between 25 and the early 30s, about circumstances of offending (e.g. alone or with others), and about motives for offending. This research will show if the most serious offenders at age 25-30 tended to be convicted at an early age and tended to come from the typical backgrounds of juvenile delinquents (e.g. from low income families, with criminal parents, with low IQs), or whether a new group of later entrants to crime is becoming more important. It will also be possible to extend previous work on the probability of one crime being followed by another, and on the probability of offending during one age range being followed by offending during another age range. A great advantage of extending the analysis into the early 30s is that more criminal careers will have finished by then, making it possible to do analyses of completed careers. For example, it will be possible to study lengths of careers in relation to factors such as the age of onset or type of first crime, lengths of different types of criminal careers (e.g. violence) and the residual lengths of careers at any given point (e.g. defined in terms of age, type of crime, or number of crimes previously committed). It will also be possible to extend previous research on decreasing crime after age 20 (e.g. to establish whether the main factor is a decrease in the number of active offenders or a decrease in the rate of committing crime by active offenders), and on the proportion of crimes committed by apprehended as opposed to non-apprehended people. It will also be possible to investigate whether specialization in different kinds

of offending increases with age.

(b) To investigate the extent to which it is possible to predict the most serious adult offenders, on the basis of factors measured at earlier ages. Our previous research suggests that a small proportion of the sample accounts for a large proportion of all the crimes committed. The follow-up will investigate how far this result holds for crimes committed after age 25, and how far these chronic offenders can be predicted.

(c) To investigate in more detail the characteristics of late-comers to crime, and the extent to which these people can be predicted. Only 17 people were first convicted for offenses committed between their twentieth and twenty-fifth birthdays, but the number of people first convicted after the twentieth birthday should be considerably greater when the analysis is extended into the early 30s.

(d) To extend previous analyses concerned with predicting the ending of criminal careers. In previous research on this, a 'temporary recidivist' group was defined as those who had at least two convictions by the nineteenth birthday and no more in the next five years. However, four out of 22 temporary recidivists were convicted at age 24, and these people tended to be quite similar to the 'persisting recidivists' reconvicted between the nineteenth and the twenty-fourth birthdays. This suggests that a five-year conviction-free period is not long enough to give a reliable indication of the ending of a conviction career.

(e) To investigate the social and personal adjustment of men in their early 30s in comparison with earlier ages. For example, it would be interesting to establish the extent to which juvenile delinquents have become conforming members of society, or the extent to which they still have social problems or a deviant life style. Deviant life styles associated with crimes of dishonesty (including aggression, drug use, reckless driving, sexual promiscuity, heavy drinking, etc.) are likely to have declined by age 30, but it will be interesting to establish if those who are still getting convicted are still

relatively deviant in other respects, and if those who are relatively deviant in their early 30s were relatively deviant at earlier ages.

(f) To extend previous work on the effect of convictions on self-reported offending up to the early 30s. As already noted, sentences of incarceration are more probable, and longer, after age 20 than in the teenage years. The research will attempt to investigate the effects of imprisonment on offending.

(g) To investigate the effects of marriage in more detail. Previous research suggested that getting married at an early age had little effect on criminal behavior. By age 31 the majority of men will be married. It will also be possible to study the relationship between the choice of wife and the quality of the marriage, and the different effects of different kinds of wives (e.g. with or without criminal records).

(h) To investigate the relationship between employment history and crime in more detail and to establish, for example, whether crimes are especially likely to be committed during periods of unemployment.

(i) To investigate how the men are bringing up their own children. By age 31 many of them will have children aged 5-10, and the way they are bringing up their own children can be compared with how they themselves were brought up. Earlier we concluded that a constellation of adverse family background factors (including poverty, large families, parental criminality, marital disharmony, and ineffective child rearing methods) led to a socially deviant life style in adolescence and early adulthood (including delinquency, aggression, drinking, gambling, drug use, reckless driving, and sexual promiscuity). It would be interesting to establish whether the more delinquent youths tend to recreate for their own children the same undesirable family environments in which they were brought up, and hence perpetuate from one generation to the next the range of social problems of which delinquency is one element. It would also be interesting to establish whether present day child rearing techniques are different from those used 20 years ago, and to establish factors which determine how some men from adverse backgrounds are able to break out of the cycle of

deprivation and provide more favorable home environments for their own children than they experienced. The research will compare the home environments of the men now with their home environments 20 years ago, to study social changes over a generation (e.g. in unemployment rates, working mothers, divorce and separation rates, physical amenities such as bathrooms and unshared toilets, methods of discipline and supervision, etc.)

(j) To study the long term outcomes of certain groups. For example, if those who were high on self-reported offending at earlier ages but unconvicted have a more favorable outcome than those equally high on self-reported offending but convicted, this might suggest again that convictions have undesirable effects. Similarly, it would be interesting to study the long term outcomes of those with antisocial life styles at 18 (and convicted or not). Again, it would be useful to know what was happening after age 30 to those from typical delinquency-producing backgrounds (e.g. low income, criminal parents, low IQ) who have never been convicted. Previous research suggests that they are rather withdrawn, isolated people with social problems different from those of the typical delinquent. If this was confirmed at age 30, it would justify our earlier argument that intervention and help is desirable for this group even when the predicted convictions do not occur. Another group who will be studied are convicted men from relatively good backgrounds.

(k) To extend previous analyses comparing criminal records of our sample with those of their fathers. It may be that types of offenses committed by fathers and sons become more similar as the sons get older.

(l) To study the effects of events such as the death of a parent or the birth of a child on the course of development.

(m) To obtain information on deterrence by comparing self-reports and official records of offending with subjective estimates of the probability of detection and of the severity of the (legal and social) consequences of conviction.

(n) To obtain identifying information (names and dates of birth) for wives and children, and hence make it possible to carry out searches of records in the future to study the transmission of crime and delinquency between three generations (the men's parents, the men themselves, and the men's children).

(o) To carry out some methodological research. Men will be randomly allocated to the interviewers, in order to study interviewer bias. (Previous research showed that it was not serious.) Comparisons with official records and with earlier data on the same people will give some indication of validity and reliability. It would be useful to ask some retrospective questions and compare the answers with contemporaneous data collected years ago, to provide information about the extent of retrospective bias and the consequent necessity for prospective longitudinal research.

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