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Age and Crime

ABSTRACT

The age-crime curve, increasing to a peak in the teenage years and then decreasing, is well-known. Less well-known is that it seems to reflect variations in prevalence (the proportion of persons who are offenders) rather than incidence (the rate of offending by offenders). Age-crime curves for individuals do not resemble the aggregate curve since incidence does not change consistently between the onset and the termination of criminal careers. This has major implications for criminal justice policy since the greatest residual length of criminal careers, and hence the greatest potential incapacitative effect, may be between ages thirty and forty, not at the peak age. Different types of offenses peak at different ages; this probably reflects crime switching rather than the replacement of one group of offenders by another. There is little specialization in offending, but specialization does increase with age. Age effects need to be separated from period and cohort effects. The age-crime curve probably reflects decreasing parental controls, a peaking of peer influence in the teenage years, and then increasing family and community controls with age.

The relation between age and crime, as seen in official criminal statistics for any given year, is well-known. Typically, the crime rate increases from the minimum age of criminal responsibility to reach a peak in the teenage years; it then declines, at first quickly, but gradually more slowly. While the form of the curve is widely appreciated, its

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meaning is not. For example, does the peak in the teenage years reflect a peak in the number of different offenders, in the number of different types of offenses committed by each offender, or in the number of offenses of each type committed by each offender (or in some combination of these)? Why does the crime rate reach a peak in the teenage years, and why does it decline afterward?

Just as the answers to substantive questions about the age-crime curve are not widely known, methodological questions are also perplexing. For example, the age-crime curve in any one year is essentially a cross-sectional phenomenon, with persons of each age compared with different persons of other ages. Would the same relation between age and crime be obtained in a longitudinal survey in which the same persons were followed up at different ages? Also, how far does the age-crime curve seen in official criminal statistics reflect variations with age in official reactions to crime, as opposed to variations in crimes committed? Would the same curve be obtained if crime rates were measured by self-reports rather than by official records?

Interest in the relation between age and crime has recently been rekindled by a provocative article by Hirschi and Gottfredson (1983). They have argued that the age-crime curve is invariant over different times, places, crime types, sexes, and so on. Furthermore, they have claimed that the relation between age and crime cannot be explained by changes in other factors with age and hence that age has a direct causal influence on crime. These arguments are controversial, but they have important implications for criminology if they are correct. No other factor has yet been shown to have an invariant and directly causal effect on crime.

This essay aims to summarize the current state of knowledge about the relation between age and crime. Section I describes in some detail the age-crime curve seen in cross-sectional official criminal statistics and investigates variations in this curve over time, place, sex, and type of crime. Section II reviews age-crime curves obtained with longitudinal as opposed to cross-sectional methods and with self-reports as opposed to official statistics of crime. Section III attempts to disentangle the different elements of the age-crime curve such as prevalence and incidence and also reviews the ages of onset and termination of criminal careers. Section IV considers a number of explanations for why crime varies with age, and the final section draws conclusions, summarizes needed research, and reviews policy implications.

This essay is concerned with the ages of offenders. There have also been a number of studies of the ages of victims. For example, Langan

and Innes (1985) showed age-victimization curves for the violent crimes of rape, robbery, and assault, based on the U.S. National Crime Survey. Victimization rates for these offenses peaked at ages sixteen to nineteen. Many of the questions about age and offending rates would probably apply also to age and victimization rates. However, partly because the study of age-victimization curves is relatively undeveloped, and partly because of limitations of space, this essay does not attempt to consider the ages of victims.

I. The Age-Crime Curve

Considerable evidence indicates that the relation between age and crime is not invariant. Aggregate age-crime curves are similar in some respects, but measures of distribution and central tendency show that they vary substantially over time, over types of offenses, between males and females, and between England and the United States. While the general age-crime pattern appears to hold independently of sex, the ratios of male to female offending vary substantially with age and with type of offense.

A. Annual Official Criminal Statistics

Figure 1*a* shows the relation between age and (recorded, detected) crime for English males in the years 1983, 1961, and 1938. Figure 1*b* shows the same curves for English females.[1] These curves are based on age-specific figures published annually in the *Criminal Statistics, England and Wales* (e.g., Home Office 1984, table 5.19). At the time of writing, 1983 was the latest year for which data were available; 1938 was the last year before World War II (in Europe); and 1961 was a convenient middle point (and also a census year). The Criminal Statistics currently show age-specific rates for each age from ten to twenty and then for twenty-one to twenty-four, twenty-five to twenty-nine, thirty to thirty-nine, forty to forty-nine, fifty to fifty-nine, and sixty or over. The minimum age of criminal responsibility was raised from eight to ten in 1964.

The "crime rate" is the rate of convictions and police cautions for indictable offenses per 100 population. Convictions and cautions for indictable offenses in England are roughly comparable to arrests for Index offenses in the United States.[2] Convictions and cautions are slightly less inclusive than arrests, although most arrests in England

[1] All references to England should be taken to include Wales.

[2] Index offenses consist of murder, forcible rape, robbery, aggravated assault, arson, burglary, theft, and motor vehicle theft.

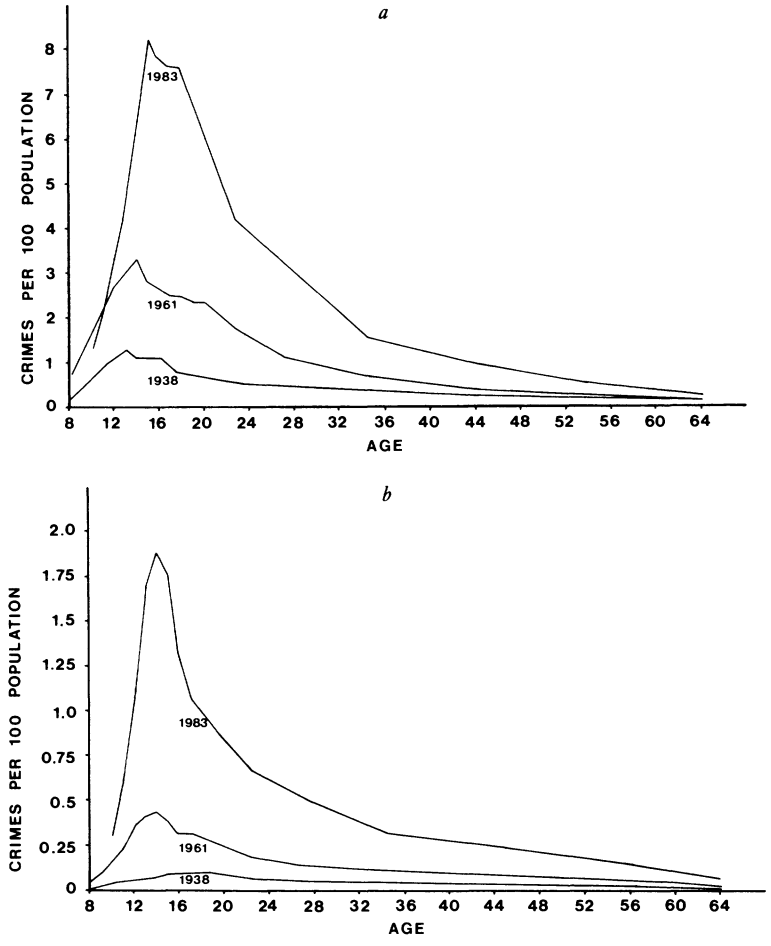

FIG. 1.—*a*, The relation between age and crime for English males. *b*, The relation between age and crime for English females. The graphs in both *a* and *b* show the rate of findings of guilt and cautions per 100 population for indictable offenses in the years 1938, 1961, and 1983. Source: Home Office (1940, 1962, 1984).

lead to convictions or cautions. Unlike all persons arrested, all persons convicted or cautioned have been found guilty of offending. Indictable offenses in England are slightly more inclusive than Index offenses in the United States are since indictable offenses include fraud, receiving, vandalism, and sex offenses other than forcible rape as well as Index offenses.

Figure 1*a* shows that the crime rate for English males peaked in 1983 at age fifteen at 8.2 offenses per 100 population, in comparison with the

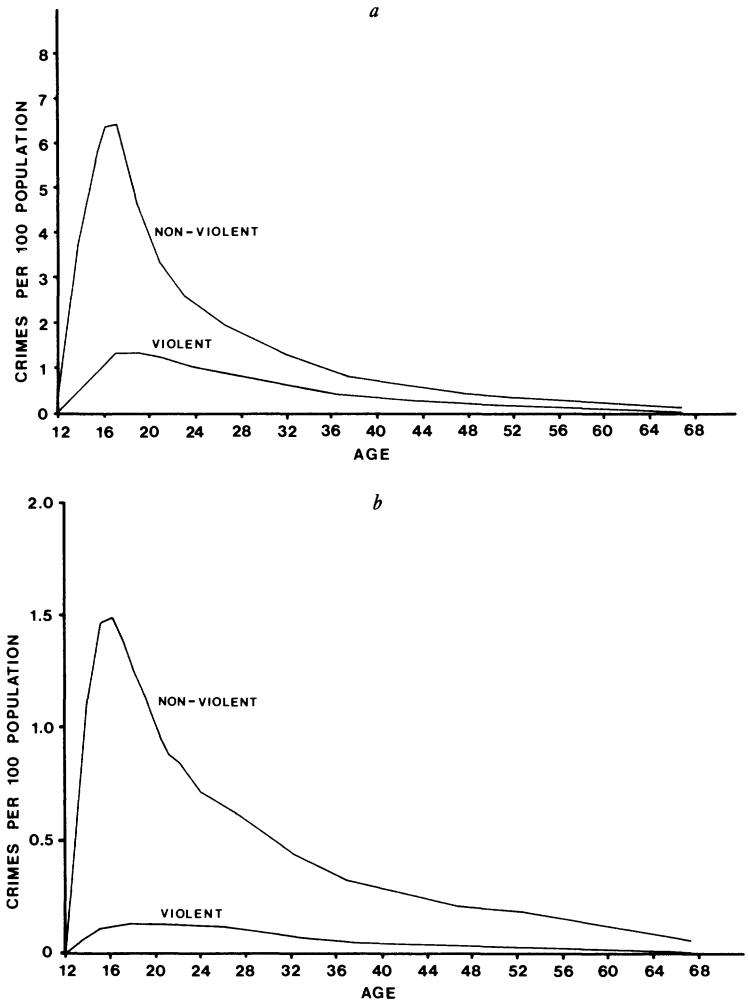

FIG. 2.—*a*, The relation between age and crime for American males. *b*, The relation between age and crime for American females. The graphs in both *a* and *b* show the rate of arrests per 100 population for Index offenses in the year 1982. Source: Federal Bureau of Investigation (1983).

1961 peak at age fourteen of 3.3 and the 1938 peak at age thirteen of only 1.3. Therefore, over time, the peak age has increased slightly, and the rate of offending at the peak has increased considerably. Figure 1*b* shows that the crime rate for females peaked in 1983 at age fourteen at 1.9 offenses per 100 population, in comparison with the 1961 peak at age fourteen of 0.46 and the 1938 peak at age nineteen of only 0.11.

For comparison, figure 2*a* shows the age-crime curves for American males in the year 1982, for violent and nonviolent offenses separately, and figure 2*b* shows the same curves for American females. These figures show the rate of arrests per 100 population for Index offenses. The total crime curve is not shown; it is similar in shape to the nonviolent crime curve and slightly above it. These curves are based on age-specific data published in the *Uniform Crime Reports* for 1982 (Federal Bureau of Investigation 1983, app. 4). It is difficult to obtain comparable age-crime curves for the United States over a long time period, partly because age-specific data are not published every year, and partly because of changes in the geographic coverage of the statistics. The *Uniform Crime Reports* for 1982 show age-specific arrest rates for different offenses at age twelve and under, age thirteen to fourteen, each age from fifteen to twenty-four, at five-year intervals from ages twenty-five to twenty-nine to ages sixty to sixty-four, and then for age sixty-five or over. The English *Criminal Statistics* do not show detailed age-specific crime rates for different categories of offenses.

Figure 2*a* shows that the nonviolent crime rate for American males peaked in 1982 at age seventeen at 6.4 offenses per 100 population, in comparison with the peak for violence at age eighteen of 1.3. Figure 2*b* shows that the nonviolent crime rate for females peaked at age sixteen at 1.5 offenses per 100 population, in comparison with the peak for violence at age twenty of 0.13. It seems, therefore, that the peak age for violent crime is slightly later than the peak age for nonviolent crime. For all Index crimes, the 1982 peak for American males was at age seventeen at 7.7 offenses per 100 population, in comparison with the 1983 peak at age fifteen at 8.2 for English males. For American females, the peak for all Index crimes was at age sixteen at 1.6 offenses per 100 population, in comparison with the peak at age fourteen at 1.9 for English females.

These curves have been reproduced here as a starting point. It was not too implausible for Hirschi and Gottfredson (1983) to conclude that the relation between age and crime was invariant. Superficially, the curves for different places, times, sexes, and crime types are similar, reaching a peak (usually) in the teenage years and then declining.

The curves raise many problems of interpretation that will be discussed later, in regard to offending versus official reactions, prevalence versus incidence, and explaining the relation between age and crime. However, one problem that is not so obvious is in measuring the population at risk or the denominator in the rate calculation. Between censuses (e.g., in England between 1971 and 1981), the population at each

age is estimated, and the following census often indicates that the population estimates were inaccurate (Home Office 1984, p. 102). Also, the population figures typically include persons who are in institutions or temporarily abroad (e.g., in the military), who are not really at risk of offending in the country of origin. This leads to an underestimate of crime rates at each age.

Other problems arise in measuring crime. For example, temporary visitors are typically included in the crime figures but not in the population at risk, leading to an overestimate of crime rates at each age. The use of conviction measures in England is especially problematic because delays between arrests and convictions for adults can distort the age curve. When an offender is remanded to a higher court, the delay between arrest and conviction can exceed one year. Also, one conviction may represent several different offenses, so the distribution of convictions may be different from the distribution of offenses. (National arrest figures are not available in England.) These problems suggest ways in which the national statistics should be modified to produce more accurate age-crime curves.

B. Summarizing the Curve

In general, age-crime curves are unimodal (i.e., have only one peak) and peak in the teenage years. However, from these facts alone it cannot be concluded that the relation between age and crime is invariant. Any researcher who wished to test this hypothesis convincingly would have to compare age-crime curves on a variety of measures such as those outlined below.

There are many measures that can be used in summarizing distributions, and curves that are similar according to one criterion may be different according to others. Table 1 shows some summary measures derived from the English curves shown in figure 1*a*, *b*. The peak age is shown first, and then the crime rate at the peak. The next two measures show the age at which half the peak crime rate is reached on the increasing (left-hand) side of the curve and the age at which half the peak crime rate is reached on the decreasing side of the curve. These ages were estimated roughly from the figures and give some indication of how narrow or broad the peak is. For example, the peak for females in 1938 was very broad, ranging from a half-peak at eleven before to one at forty-four after. In contrast, the peak for females in 1983 was much sharper, ranging from a half-peak at twelve before to one at nineteen after.

There are other common methods of summarizing the central ten-

TABLE 1

Summarizing English Age-Crime Curves

	English Males			English Females		
	1938	1961	1983	1938	1961	1983
Peak age	13	14	15	19	14	14
Crime rate at peak*	1.32	3.35	8.25	.11	.46	1.89
Half of peak before	10	10	13	11	11	12
Half of peak after	21	23	22	44	21	19
Median age	21	20	21	29	24	21
Twenty-fifth percentile	15	15	16	19	16	15
Seventy-fifth percentile	33	29	29	42	40	34
Mean age	25.3	23.5	24.9	31.5	28.8	26.3
Standard deviation	13.5	11.8	11.8	14.3	15.3	14.1
Skewness	1.18	1.71	1.68	.22	.51	1.10
Kurtosis	3.44	4.35	4.20	2.25	2.38	3.15

SOURCE.—Home Office (1940, 1962, 1984).

* Findings of guilt and cautions per 100 population.

dency of a distribution, using the mean and median, and its dispersion, using the standard deviation and interquartile range (i.e., the distance between the twenty-fifth and the seventy-fifth percentiles). All these are shown in table 1. In calculating these, it has been assumed that each age group contains the same number of people, in order to eliminate effects of different cohort sizes. Also, crime rates of those aged eight and nine have been eliminated from the 1938 and 1961 statistics, to make them consistent with 1983. Table 1 shows that the median age of female offenders has decreased dramatically, from twenty-nine in 1938 to twenty-one in 1983. Also, since the peak age roughly coincides with the twenty-fifth percentile, only a quarter of all offenders have ages below or at the peak. Perhaps more surprisingly, despite the sharp peak of 1983 females at age fourteen (see figure 1*b*), as many as a quarter of female offenders were over thirty-four.

The mean ages of offenders in table 1 are remarkably high. For example, while the peak age for male offenders increased from thirteen to fifteen between 1938 and 1983, the mean age hovered around twenty-four to twenty-five. While the peak age for female offenders decreased from nineteen to fourteen, the mean age decreased from thirty-one to twenty-six. The standard deviations were consistently lower for males than for females, showing that female offenders tended to be more widely distributed over all ages. The interquartile range demonstrates the same phenomenon.

The two remaining measures in table 1 are of skewness and kurtosis. Skewness, as the name suggests, shows the extent to which a distribution is skewed or symmetrical. A skewness of zero reflects a symmetrical distribution, while a positive value (as here) indicates a distribution that is skewed to the right.[3] Table 1 shows that the curve for English females was nearly symmetrical in 1938 (skewness = 0.22) but had become skewed to the right in 1983 (skewness = 1.10). Kurtosis measures the degree to which a distribution is flattened or peaked around its center. The normal distribution has a kurtosis value of three. Values greater than three indicate that the curve is more peaked (or narrower) than the normal distribution, while values less than three show that the curve is flatter. Table 1 shows that the curve for English males in 1983 was more peaked than the normal distribution, while the curve for English females in 1938 was flatter.

For comparison, table 2 shows the same measures for the American curves shown in figure 2*a*, *b*. Generally, nonviolent offenders tended to be younger than violent ones, as shown by a lower peak age, a lower median, and a lower mean. Violent offenders tended to be more variable in age according to the distance between the two half peaks but not according to the interquartile range or the standard deviation. The male

TABLE 2

Summarizing American Age-Crime Curves

	American Males		American Females	
	Violent	Nonviolent	Violent	Nonviolent
Peak age	18	17	20	16
Crime rate at peak*	1.33	6.45	.13	1.51
Half of peak before	15	13	13	13
Half of peak after	32	21	32	23
Median age	25	20	26	23
Twenty-fifth percentile	19	16	19	17
Seventy-fifth percentile	34	29	35	34
Mean age	28.4	24.7	28.5	27.4
Standard deviation	11.6	11.5	11.5	13.2
Skewness	1.08	2.15	.85	1.19
Kurtosis	3.56	4.75	3.32	3.37

SOURCE.—Federal Bureau of Investigation (1983).

* Arrests per 100 population.

[3] If a curve is skewed to the right, the mean is greater than the median, the peak is to the left of the mean, and the long tail is to the right of the mean.

nonviolent offenders tended to have the most skewed and sharply peaked age distribution.

Comparing the ten curves summarized in tables 1 and 2, the peak age varied from thirteen to twenty, but the age at which the half peak afterward was attained varied from nineteen to forty-four. The median age varied from twenty to twenty-nine and the mean from twenty-three to thirty-one; but the interquartile range varied from thirteen years (sixteen to twenty-nine) to twenty-four years (sixteen to forty). Furthermore, the skewness varied from a near symmetrical 0.22 to a highly skewed 2.15, and the kurtosis varied from being flatter than the normal distribution at 2.25 to being sharper at 4.75. On the basis of these figures, it would be difficult to conclude that the relation between age and crime was invariant.

Figure 3 shows curves that can usefully be derived from the age-crime curve and that illustrate the concepts of the maximum ages of acceleration and deceleration. This figure shows the rate of change in the crime rate per year. Assuming that the crime rate is in some sense analogous to a speed of offending, these curves show the acceleration in

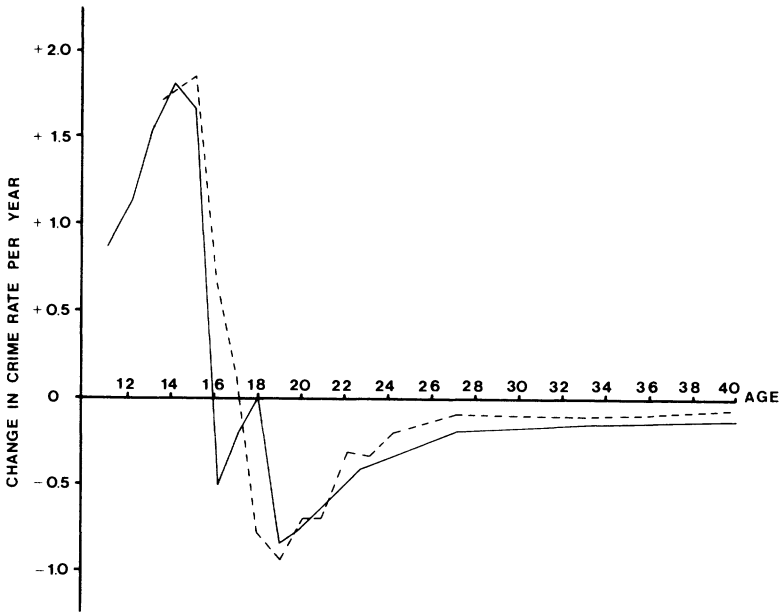

FIG. 3.—Acceleration and deceleration of the age-crime curve. The solid line represents English males (findings of guilt and cautions per 100 population for indictable offenses in 1983) and the broken line American males (arrests per 100 population for nonviolent offenses in 1982). Source: Home Office (1984) and Federal Bureau of Investigation (1983).

that speed before the peak age and deceleration after. For English males in 1983, the peak age of acceleration was fourteen and the peak age of deceleration nineteen. For American males arrested for nonviolent offenses in 1982, the peak age of acceleration was fifteen and of deceleration was nineteen. These ages of maximum change may be more important theoretically than the peak age of offending. They draw attention to ages when important life changes may be occurring that influence the commission of crimes.

C. Different Types of Crimes

It might be expected that the relation between age and crime would vary with the type of crime, and this is indeed true. Using FBI figures for 1977, Cline (1980) calculated median ages of arrest for different offenses. The lowest median ages were for vandalism (seventeen) and for motor vehicle theft, arson, burglary, larceny-theft, and liquor law violations (all eighteen). Cline regarded these as the offenses of adolescence. The next lowest median ages were for handling stolen property (twenty), narcotic law violations (twenty-one), violence, disorderly conduct, and prostitution (all twenty-four), sex offenses other than forcible rape and prostitution (twenty-six), white-collar offenses such as forgery and fraud (twenty-six), and abuse and neglect of family and children (twenty-eight). These were the offenses of young adulthood. Finally, there were the crimes of middle-age, drunkenness and drunk driving (median age thirty-five in both cases) and gambling (thirty-seven). Wilson and Herrnstein (1985) also showed relative changes in the pattern of offenses with age, using FBI figures for 1980. Burglary declined from the third most frequent arrest under age eighteen to the thirteenth most frequent at age forty or over. Robbery declined from eleventh to twenty-first, motor vehicle theft from ninth to twenty-second, and vandalism from sixth to fifteenth. In contrast, drunkenness increased from the tenth most frequent arrest under age eighteen to the most frequent at age forty or over, as did drunk driving (fourteenth to second), fraud (nineteenth to seventh), and gambling (twenty-fifth to twelfth).

As might be expected from the skewness of the distributions, peak ages do not vary as widely as median ages. For example, for males arrested for Index offenses in 1982 (Federal Bureau of Investigation 1983), the lowest peak age was for arson (fifteen), followed by motor vehicle theft (sixteen), robbery, burglary, and larceny-theft (seventeen), and murder, forcible rape, and aggravated assault (twenty). The range for females was from fifteen for arson, motor vehicle theft, and

burglary to twenty-one for aggravated assault and twenty-three for murder. These differences in the peak age again suggest that it is unlikely that the age-crime curve is invariant of type of offense.

D. Sex, Age, and Crime

National criminal statistics are notoriously uninformative. They enable aggregate crime rates to be compared with only a very small number of variables, notably, age, sex, and crime type. In order to explain why age is related to crime, it would be helpful to know, first, if the relation between age and crime held independently of other variables and, second, if the relation between other variables and crime held independently of age. Using national statistics, these questions can be investigated in regard to the "other variable" of sex.

Posing the first question brings out the difficulty of answering it using conventional multivariate methods. Does the relation between age and crime hold independently of sex? A perusal of figures 1*a*, *b*, and 2*a*, *b*, and of tables 1 and 2 suggests that the answer to this question is probably yes since the age-crime curves are generally similar for males and females. However, it would be desirable to quantify our intuition and investigate whether the curve for males was significantly different from the curve for females. This is not straightforward and is discussed in more technical terms in the Appendix.

Figure 4 suggests that the answer to the second question is also yes. This figure shows the male-female ratios at different ages. At all ages, males were more likely to commit offenses than were females. However, for English offenders (who were mainly nonviolent), and for American nonviolent offenders, there were indications of an interaction between age and sex. The male-female ratio reached a peak at age sixteen to twenty-two, at 4.6 for American nonviolent offenders and at 7.5–9.5 for English offenders. It then declined steadily to only about two at the oldest ages. This is another age-crime phenomenon that needs to be explained. For American violent offenders, the male-female ratio reached a peak of 10.4 at age eighteen, but then never fell below 7.7, and reached 10.4 again at age sixty to sixty-four. It would be possible to calculate an "average" strength of association between sex and crime over different age levels, but the interactions seen in figure 4 suggest that any average would be misleading.

II. Other Ways of Studying Age and Crime

Section I was entirely concerned with age-crime curves derived from national criminal statistics showing crime rates in one year for persons

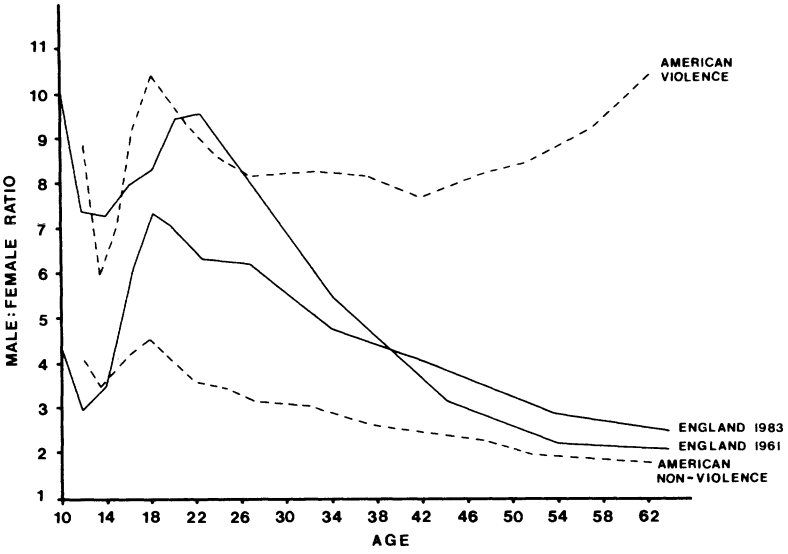

FIG. 4.—Male-female ratios at different ages. Source: derived from figs. 1*a*, *b*, and 2*a*, *b*.

of different ages. This is essentially a cross-sectional method of derivation. It is also possible to obtain age-crime curves longitudinally, by studying crime rates of the same persons at different ages. Furthermore, the longitudinal and cross-sectional methods can be used either with national statistics or in smaller-scale research projects, and the smaller scale studies can yield age-crime curves not only for official records of offending but also for self-reports. All these different methods of studying the age-crime curve are reviewed in this section.

A. Longitudinal Follow-up of Cohorts in Official Statistics

Longitudinal research based on national statistics follows up cohorts of persons born in one particular year. For example, the follow-up of persons born in 1960 would involve studying crime rates of ten-year-olds in 1970, eleven-year-olds in 1971, twelve-year-olds in 1972, and so on. The persons studied in one year are not exactly the same as those studied in any other year because of immigration, emigration, and deaths. However, this is a reasonable approximation to a true longitudinal study in which the same people are followed up.

Figure 5*a* shows age-crime curves obtained from the English criminal statistics in following up cohorts of males born in 1940, 1950, and 1960, and figure 5*b* shows the same curves for females. These curves are directly comparable with those shown in figure 1*a*, *b*, in showing con-

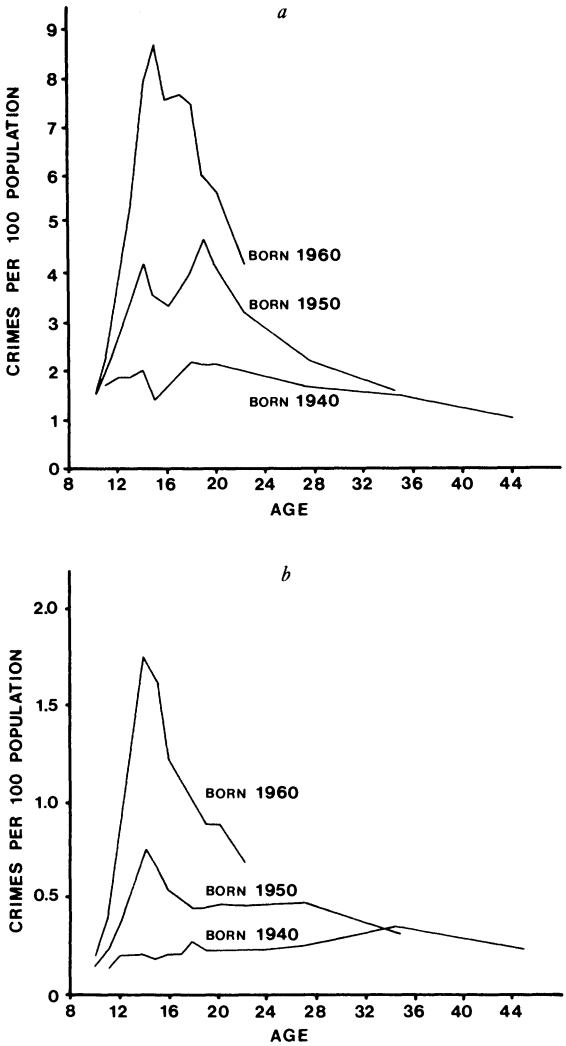

FIG. 5.—*a*, The longitudinal relation between age and crime for English males. *b*, The longitudinal relation between age and crime for English females. The graphs in both *a* and *b* show the rate of findings of guilt and cautions per 100 population for indictable offenses for cohorts born in 1940, 1950, and 1960. Source: Derived from annual *Criminal Statistics, England and Wales.*

victions and cautions per 100 population for indictable offenses. However, some of the curves shown in figure 5*a*, *b*, are very different from the familiar unimodal skewed curves seen in figure 1*a*, *b*. The curves for males and females born in 1960 certainly resemble the corresponding curves for males and females of different ages in 1983. However, the curve for males born in 1950 seems to have two peaks, at ages fourteen and nineteen, and the curve for females born in 1940 is skewed to the left and reaches a peak at age thirty to thirty-nine. How can we say that crime invariably reaches a peak in the teenage years when it clearly did not for females born in 1940?

The basic problem in interpreting these curves is the potential confusion between aging and period effects. Official crime rates in England increased considerably between the mid-1960s and mid-1970s, and this effect could be masking the true relationship between age and crime. There is always a problem of distinguishing between aging, period, and cohort effects. *Period effects* refer to influences specific to a particular time period; for example, a period of high unemployment or economic depression may influence the crime rates of all ages and all cohorts. *Cohort effects* follow from membership in one cohort (e.g., persons born in a particular year) rather than another; for example, persons born at the peak of a "baby bulge" might suffer more intense competition for resources at all ages and all periods. *Aging effects* refer to changes that occur with age; for example, aging eventually leads to physical deterioration for all cohorts at all periods.

In figure 5*a*, *b*, the identity of the birth cohort is held constant in each curve, but aging and period effects are then confounded. In the more usual cross-sectional curves for any given year, the period is held constant, but aging and cohort effects are confounded. Differences in crime rates between fifteen-year-olds and sixty-year-olds in 1983, for example, may reflect differences in cohort composition (e.g., a higher proportion of blacks among fifteen-year-olds than among sixty-year-olds), in cohort size (e.g., there may have been more persons born in 1968 than in 1923, leading possibly to more peer influence), or in other factors specific to a birth cohort.

In an attempt to disentangle aging, period, and cohort effects, it is desirable to study age-crime curves over time. For example, figure 1*a*, *b*, and table 1 show how the English age-crime curves have changed over time. Between 1938 and 1983, the peak crime rate increased dramatically, the curves became more skewed and more peaked, and (in the case of females) the average age of offenders decreased markedly.

These changes could reflect differences in periods or in cohorts or even interactions among aging, period, and cohort effects.

The basic analytic problem is that aging, period, and cohort effects are always confounded because age in general equals current year (period) minus birth year (cohort). Several researchers have tried to disentangle the three effects assuming that the crime rate is some additive function of aging, period, and cohort effects. Fienberg and Mason (1979) justified this kind of an analysis on the ground that, although the measured age, period, and cohort variables were confounded, the theoretical constructs underlying them were not necessarily. Rodgers (1982) also argued that age, period, and cohort variables were not of intrinsic interest in themselves but were used as indicators of biological or intellectual development, economic conditions, or the effects of childhood environments. He proposed that, in order to avoid the confounding, one of the three variables should be replaced by a more valid measure of the underlying theoretical construct; for example, period could be replaced by the unemployment rate if it was felt that unemployment was the important causal factor that varied over time. Unfortunately, it is difficult to establish what the important underlying theoretical constructs are.

There are simpler ways of investigating the three effects, as table 3 (based on Glenn 1977) shows. Aging effects are represented by the 1–4 progression, period effects by the A–D progression, and cohort effects by the I–VII progression. If crime rates were entered into the cells of an age-year table and then contour lines were drawn, predominantly horizontal contours would indicate an aging effect, predominantly vertical contours a period effect, and predominantly left-right diagonal contours a cohort effect. This was investigated for English males, using all ages from ten to twenty and all years from 1961 to 1983. The

TABLE 3

Aging, Period, and Cohort Effects

	Year			
Age	1950	1960	1970	1980
10	1-A-IV	1-B-III	1-C-II	1-D-I
20	2-A-V	2-B-IV	2-C-III	2-D-II
30	3-A-VI	3-B-V	3-C-IV	3-D-III
40	4-A-VII	4-B-VI	4-C-V	4-D-IV

SOURCE.—Based on Glenn (1977, tables 7–9).

contours were predominantly horizontal, beginning around the age fifteen crime rates and then spreading out vertically. There was no sign of cohort effects, as evidenced by diagonal contours. Therefore, the major influences in this English table seemed to be aging and period effects.

This is rather ironic because the major use of age-year tables in criminology has been to investigate cohort effects—the hypothesis of "delinquent generations." Wilkins (1960) examined the table showing convictions of English males aged eight to twenty in the years 1946–57 and compared the observed crime rates with those expected on the basis of row and column totals. He found clear diagonal effects since the cohort of males born in 1935–42 had higher crime rates than expected and concluded that children who had been four or five during World War II were especially crime prone. Somewhat similar results were obtained by Christiansen (1964) in Denmark and Jasinski (1966) in Poland. Interestingly, the peak age for crime in both countries was nineteen, in comparison with fourteen in Wilkins's English data. McKissack (1974) repeated the analysis in Scotland and concluded that children born in 1947 were a less delinquent cohort, perhaps because they were part of the postwar baby bulge.

Unfortunately for the delinquent generations hypothesis, Walters (1963) showed that Wilkins's results essentially reflected two trends over time: a decreasing conviction rate of eight- to eleven-year-olds (probably because the police became increasingly reluctant to take them to court) and an increasing conviction rate of seventeen- to twenty-one-year-olds. Rose (1968) then showed that these trends continued up to 1965 and always made the middle-born cohort appear more delinquent, no matter what time period was studied. The basic problem was that the period effects differed at different ages so that there was an interaction between aging and period effects. Carr-Hill, Hope, and Stern (1972) then used an additive cohort analysis model of the type described above and could not detect cohort effects in the English data. However, using essentially additive models, Slater, Darwin, and Richie (1966) in New Zealand and Maxim (1985) in Canada claimed that there were cohort effects, probably associated with cohort size. Interestingly, none of this research on crime rates in age-year tables has been carried out in the United States, presumably because of the difficulty of constructing comparable national age-year tables, although there has been a great deal of American interest in the use of cohort size in predicting crime rates (e.g., Wellford 1973; Blumstein, Cohen, and Miller 1980).

Finally, whether there are period or cohort effects is less important

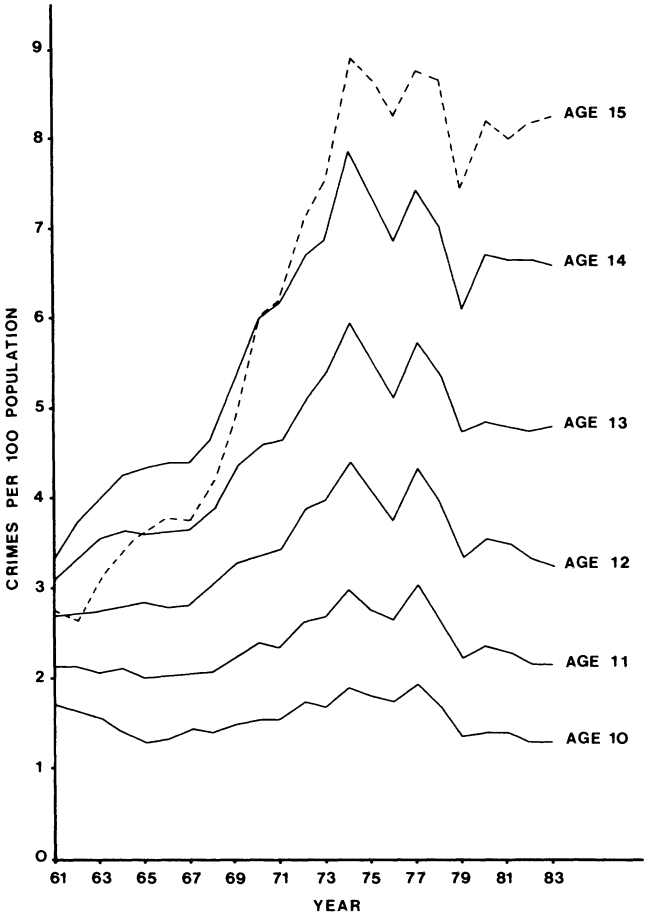

FIG. 6.—Changes in crime rates over time for English males aged ten to fifteen. The graph shows the rate of findings of guilt and cautions per 100 population for males of each age from ten to fifteen. Source: Based on annual *Criminal Statistics, England and Wales.*

for this essay than whether the relation between age and crime holds independently of period and cohort. Figure 6 suggests that it does. This shows the crime rate of English males aged ten to fifteen from 1961 to 1983. There were clear period effects, as already mentioned. For example, the crime rates of males of all these ages increased between 1967 and 1974, possibly because of the great expansion in police cautioning (Farrington and Bennett 1981), then decreased in 1974–76, increased in 1976–77, and decreased again in 1977–79. However, in every year, the crime rate increased from age ten to age fourteen. After 1970–71, it also increased up to fifteen.

Changes in crime rates with age for different birth cohorts can be studied in figure 6 by tracing the points diagonally. Thus fifteen-year-olds in 1983 were fourteen-year-olds in 1982, thirteen-year-olds in 1981, and so on. It can be seen that the increase in crime rate from age ten to age fourteen (or fifteen after the 1955–56 birth cohort) occurred for all cohorts. The curves for ages sixteen to twenty are not shown, but were they shown, they would indicate that the crime rate decreased from fifteen to twenty in almost every year and for almost every cohort. Therefore, the increase in crime rates from ten to fourteen or fifteen and the subsequent decrease to twenty held independently of period and cohort. This analysis suggests that it is desirable to investigate the age-crime curve by following up multiple cohorts in longitudinal research.

B. Smaller-Scale Cross-sectional Research

Studying the crime rates in one year of persons of different ages is essentially a large-scale cross-sectional research project. However, national criminal statistics provide information about only a very limited range of variables. More detailed data can be collected in smaller-scale projects, especially in those using interviews and self-reports.

Not all national statistics are as limited as those published in England and the United States. For example, Sveri (1965) was able to show how the number of persons involved in an offense varied with age, using national statistics for Norway. Generally, the proportion of offenses committed alone increased with age for all types of crimes. Offending in a group of three or more was especially common at the youngest ages (under fifteen). These results are very important since the age-crime curves discussed above show the total number of offenders at each age, not the total number of offenses. No researcher has yet published an age-crime curve for the total number of offenses, correcting for the number of offenders involved in each offense. However, such a curve might not show such a sharp peak in the teenage years, assuming that group offending is most common at this time.

One of the few projects providing information about self-reports of offending by representative samples of people of widely different ages was carried out by Rowe and Tittle (1977) (see also Tittle 1980). They interviewed random samples of persons aged fifteen or over (totaling 2,000) in three states—New Jersey, Iowa, and Oregon—and asked them about crimes they had committed in the previous five years. Rowe and Tittle found that thefts, marijuana smoking, and physical assaults decreased steadily with age, from ages fifteen to twenty-four to

ages sixty-five or over. However, illegal gambling and cheating on income tax increased from ages fifteen to twenty-four to ages twenty-five to forty-four before decreasing. These results are consistent with Cline's (1980) conclusions, which are based on official records.

Gold and Reimer (1975) carried out national surveys of self-reported offending in two years, 1967 and 1972, but only with juveniles. In both years self-reported offending increased from thirteen to sixteen, for males and females. Williams and Gold (1972) were able to compare self-reported and official offending in the first of these surveys and concluded that the relation between age and crime was greater in official records than in self-reports.

One of the most interesting cross-sectional surveys providing information about age and crime was completed by Peterson, Braiker, and Polich (1981). They interviewed over 600 male inmates of five California state prisons and asked them about their commission of eleven types of crimes during the three-year period before their present incarceration. Unlike most other researchers, they divided the crime rate into prevalence, incidence, and the number of types of crimes. Their results are discussed in Section III. They were also careful to relate offending at different ages to "street time" or time not incarcerated.

Occasionally, cross-sectional victimization surveys provide information about the ages of offenders on the basis of victim reports. This is primarily obtained for crimes in which there was personal contact between the victim and the offender, such as rape, robbery, assault, and theft from persons. Unfortunately, victims' estimates of offenders' ages are likely to be inaccurate. Nevertheless, Hindelang (1981) linked up victim reports with demographic data and concluded that, for personal crimes in which victims saw their assailants, offenders aged eighteen to twenty had the highest crime rates.

There have been many cross-sectional surveys that yield data about the relation between age and behaviors related to crime. For example, Flanagan (1983) reviewed a number of previous American studies and concluded that the most adequately established correlate of misconduct in prison was the age of the inmates. Porporino and Zamble (1984) also found a significant negative correlation between age and disciplinary violations for Canadian prisoners. Of course, since prisoners are generally above the peak age of offending, it is not surprising that prison offenses should decrease steadily with age. Alcoholism, drug addiction, psychiatric distress, and sexual promiscuity also peak in the teenage or early adult years (Gove 1985).

Below the peak age, a number of studies have investigated the relation between age and behavior problems of children. Achenbach and Edelbrock (1981) published graphs showing how more than 100 behavior problems (reported by parents) varied in prevalence between age four and age sixteen. For example, alcohol and drug use increased with age, but stealing outside the home did not. If behavior problems of children vary in the same way crime does, this suggests that the age-crime curve may reflect changes in behavior rather than in police reactions.

C. Longitudinal Studies Using Official Records

Longitudinal studies can be prospective or retrospective (see, e.g., Farrington 1979*b*). The Gluecks were the pioneers of prospective longitudinal research providing information about officially recorded offending at different ages. In their fifteen-year follow-up of 1,000 juvenile delinquents, Glueck and Glueck (1940) reported that 80 percent were arrested within five years of the end of the treatment, 80 percent in the next five years, and 78 percent in the next five years—remarkably consistent figures, between ages fourteen and twenty-nine on average. The average number of arrests per arrested person increased slightly with age, from 3.4 in the first period to 3.8 in the last. The types of offenses changed since crimes against property (burglary, theft, receiving, and forgery) decreased steadily, while crimes of drunkenness increased steadily.

Similar results were obtained by Glueck and Glueck (1943) in their fifteen-year follow-up of 510 reformatory inmates between the average ages of twenty-five and forty. The percentage arrested in each five-year period decreased between these ages from 70 percent in the first period to 58 percent in the third, but the average number of arrests of those arrested increased from 3.3 to 3.6. As before, property crimes decreased dramatically with age and tended to be replaced by drunkenness offenses. In their third long-term study, Glueck and Glueck (1968) followed up the 500 delinquents from *Unraveling Juvenile Delinquency* (Glueck and Glueck 1950) from age fourteen to age thirty-one. Once again, burglary and theft decreased between these ages, while drug and drink offenses increased. It seems clear that the changes in offending patterns with age seen in national statistics (Cline 1980; Wilson and Herrnstein 1985) are at least partly due to crime switching by offenders.

Farrington (1983) also reported changes in officially recorded offend-

ing with age in a prospective longitudinal study of 400 London males. The peak age for the total number of convictions was seventeen, and by age twenty-four this total number had decreased to about a quarter of the peak value. The peak age for burglary and shoplifting was at fourteen to sixteen, while the peak age for assault, damage, and thefts of vehicles was at seventeen to twenty. All offenses increased from ages ten to thirteen to ages fourteen to sixteen and then decreased from ages seventeen to twenty to ages twenty-one to twenty-four, mirroring the familiar curvilinear pattern seen in the national statistics.

Miller, Dinitz, and Conrad (1982) carried out an interesting retrospective longitudinal study of the arrest histories of some 1,600 male violent offenders in Ohio. They published age-crime curves for homicide, rape, robbery, and assault that generally showed peaks at age twenty to twenty-four. Wolfgang, Figlio, and Sellin (1972) also reported age-crime curves in their retrospective Philadelphia cohort study of 10,000 males, but these only extended up to age seventeen. Interestingly, the black-white ratio decreased steadily from age ten or less to age seventeen. Van Dusen and Mednick (1983) replicated the Wolfgang et al. project with a Copenhagen cohort of nearly 29,000 males followed in records from birth to age twenty-six. The peak age of offending in this sample was seventeen to eighteen, although violence peaked later, at twenty to twenty-one. Finally, Shannon (1981) studied three birth cohorts in Racine, Wisconsin, born in 1942, 1949, and 1955. The total number of police contacts peaked at sixteen to seventeen for males and at seventeen to nineteen for females. The results of these projects are reviewed in more detail in Section III.

D. Longitudinal Studies Using Self-Reports

These studies also can be prospective or retrospective. The Farrington (1983) prospective longitudinal survey included self-reports of offending at different ages as well as official records. These self-reports showed that most offenses peaked during the period fifteen to eighteen, although shoplifting and burglary peaked earlier. Self-reports of offending at different ages were also included in the Bachman, O'Malley, and Johnston (1978) national survey of about 2,200 boys and in the Elliott et al. (1983) national study of about 1,700 youngsters. The self-reports in the Bachman et al. project are difficult to interpret because they covered different time periods. However, stealing cars seemed to decrease steadily from ages twelve to fifteen to ages twenty-two to twenty-three, while taking marijuana seemed to increase steadily from

ages seventeen to eighteen to ages twenty-two to twenty-three (although this may be a period effect, from 1969 to 1974). The Elliott et al. study is discussed in more detail in Section III. Unlike any other criminological survey, it included repeated interviews with multiple cohorts (aged eleven to seventeen at the beginning).

An interesting retrospective self-report survey was carried out by Petersilia, Greenwood, and Lavin (1978) with forty-nine prisoners serving sentences for armed robbery. They were asked about offending during their juvenile, young adult, and adult career periods. Generally, the prevalence of burglary and auto theft seemed to decrease with age, while the prevalence of drug sales and robbery seemed to increase. However, it was difficult to make exact comparisons because of the differing lengths of the three periods. The Shannon (1981) and Wolfgang (1980) longitudinal surveys also included retrospective self-reports. Persons in the Philadelphia sample, during an interview at age twenty-six, were asked to report offending during their juvenile and adult years, and Collins (1981) found that robbery, burglary, and shoplifting all decreased with age.

Most of the results presented in this section concern aggregate crime rates at different ages. In Section III, attempts are made to disentangle prevalence and incidence rates and to determine what is really varying with age. Also, many of the quoted surveys have not tried to obtain exact information about ages of offending. It is impossible to draw conclusions about the relation between age and crime if people are merely asked about total offenses before or after age eighteen, for example. These surveys draw attention to the advantages and disadvantages of the different methods of studying age and crime.

E. Advantages and Disadvantages of Different Methods

The relation between age and crime can be investigated in cross-sectional or longitudinal research using official records or self-reports of offending, and the longitudinal research can be prospective or retrospective. These various possibilities all have advantages and disadvantages.

An advantage of cross-sectional research is that the results can be obtained more quickly and contemporaneously. In a longitudinal project, the conclusions are delayed by the necessity to wait while the subjects of the investigation get older. Taking the extreme case, the complete relationship between age and crime can only be determined in a longitudinal project when the subjects die, at which point the infor-

mation will be out of date and inapplicable to persons currently living. Also, in a longitudinal survey including interviews, there are the considerable practical problems of attrition and maintaining contact with the sample, and one interview may affect later ones.

An advantage of longitudinal research is the decreased problem of selection effects. In a cross-sectional project comparing people of different ages, those of one age are likely to differ from those of another in many factors other than age, and it may be difficult to disentangle aging effects from the influences of other factors. In a longitudinal project, to a large extent each person acts as his or her own control, so there is less variation in extraneous factors that is confounded with variation in age. Period effects may be a problem in longitudinal research, but even in cross-sectional research, in which the period is held constant, the results may be distorted by unusual events that occur at one particular time.

Another advantage of longitudinal research is the possibility of studying continuity or discontinuity between different ages, the relation between earlier and later events, prediction, developmental sequences, specialization, versatility, and escalation in offending. In a cross-sectional study, for example, it is impossible to know whether the property offenders at one age switch to violent offending later or whether the property offenders desist and a new sample of violent offenders emerges. Also, longitudinal research is needed to establish cumulative phenomena such as the cumulative prevalence of offending or the proportion of crimes committed by "chronic" offenders. The cumulative prevalence of offending can be estimated in an ostensibly cross-sectional study, but only if essentially longitudinal information is available about the presence or absence of previous offenses.

Another advantage of a longitudinal study is its superiority over cross-sectional research in establishing cause and effect, by showing that changes in one factor are followed by changes in another. Another variant of this is the ability in longitudinal research to establish the effects of specific events on the course of development by quasi-experimental analysis (Cook and Campbell 1979). Ultimately, in studying the relation between age and crime, or any other criminological correlation, the goal must be to establish causal relations.

An advantage of using official records of offending, in comparison with self-reports, is the greater comprehensiveness of the data. The losses in surveys are often substantial. For example, in the Elliott et al. (1983) study, only 1,725 out of a target sample of 2,360 (73 percent)

participated in the first interview, and this number had shrunk to 1,494 (63 percent) by the fifth. This will not matter so much if the people lost constitute a representative sample, but often they are the most delinquent and hence the most interesting to criminological researchers (West and Farrington 1973). Even those who die tend to be disproportionally delinquent (Sarnecki and Sollenhag 1985).

There are losses even in studies based on official records, but these tend to be less serious in prospective than in retrospective projects. In prospective surveys, the number of persons lost can be specified more exactly, and the information collected about them before the loss can be used to calculate the degree of error introduced into estimates. In Wadsworth's prospective national survey (1975), only 1.9 percent of males were lost by emigration and 0.8 percent by death between the eighth and twenty-first birthdays (the period of the official record follow-up). However, Gordon (1976) concluded that the requirement that subjects live in Philadelphia at least between age ten and age eighteen led to a loss of 30.5 percent of the original birth cohort in the retrospective Wolfgang et al. (1972) study.

Another advantage of official records is that they often contain more specific information about the dates of offenses than do self-reports. This is needed especially in investigating the relation between age and crime. There is no reason in principle why self-report researchers should not also seek detailed information about the dates of offenses, although the extent to which people can report these accurately needs to be established by a reverse record check, as in victim surveys.

Official records and self-reports of offending are both biased measures. Official records reflect police reactions to crime at different ages, while self-reports reflect people's willingness to admit offenses at different ages. A great advantage of self-reports is that the researcher is not limited by what is available in records but can choose which questions to ask. Therefore, in self-report surveys it is possible to obtain information about a much richer array of factors, enabling fuller testing of causal hypotheses and better statistical control of extraneous variables.

The main advantages of retrospective surveys are feasibility and speed of obtaining answers to questions. They have many disadvantages. For example, in retrospective self-report surveys, the memory problems are likely to be severe if middle-aged people are asked to remember what happened when they were juveniles. In retrospective surveys using official records, there are likely to be problems caused by the tendency of record-keeping systems to lose records or to destroy

them after a certain length of time. Methodological problems are likely to ensue if a sample is defined by the occurrence of a certain event (e.g., conviction or imprisonment) that is then included in the analysis. Glueck and Glueck (1940) had the sense to exclude the current arrest when calculating the prior arrest history of their 1,000 juvenile delinquents, but some subsequent researchers have not.

In general, all methods of studying age and crime have advantages and disadvantages. The best solution is to combine methods, if possible, by following up multiple cohorts and by deriving information both from official records and from self-reports.

III. What Factors Vary with Age?

The age-crime curves seen in cross-sectional official criminal statistics are essentially aggregate curves. They show how many crimes were committed by persons of any given age, but they do not divide this into prevalence (defined here as the number of different persons committing crimes or the participation rate) and incidence (defined here as the rate at which offenders commit crimes or the individual crime rate). For example, does the peak age reflect a peak in prevalence, in incidence, or in both? This section reviews knowledge about more subtle questions of this kind.

A. Prevalence of Offending at Each Age

A distinction is usually made between the prevalence of offending at each age and the cumulative prevalence up to any given age. The first of these is sometimes called "point prevalence," but it should be realized that both these measures involve cumulation over time. They differ in the length of time over which the cumulation occurs. For example, the prevalence of offending at age seventeen is obtained by comparing the number of people who offend between the seventeenth and the eighteenth birthday with the population at risk. The more familiar cumulative prevalence of offending up to the eighteenth birthday is calculated by comparing the number of people who offend between the minimum age of criminal responsibility and the eighteenth birthday with the population at risk for the whole period.

If offending is viewed as a random process, the period of cumulation can affect the prevalence estimate. For example, in the theory outlined by Cohen (1983), a criminal career begins when a person's individual crime rate (r) is greater than zero. Crimes occur probabilistically according to a Poisson process, so the expected number of crimes committed during any time interval T is rT. With this conception of offend-

ing, there is a certain probability (e^{-rT}) that any "offender" (i.e., a person with a nonzero rate of offending) will not commit an offense during a given time interval T. Therefore, the measured prevalence (i.e., the number of persons who actually commit an offense during the time interval) will be the true prevalence of offenders multiplied by the factor ($1 - e^{-rT}$). For example, if the rate of offending is one crime per year, 36.8 percent of "offenders" will not commit a crime during a year, so the measured prevalence would be only 63.2 percent of the true prevalence. Obviously, this problem becomes less acute as the rate of offending increases; at a rate of two crimes per year, only 13.5 percent would not actually offend, and at a rate of three crimes per year, only 5.0 percent would not actually offend.

Existing prevalence measures are based on crimes actually committed. Generally, the prevalence curve closely mirrors the aggregate age-crime curve. In the Philadelphia cohort study, Collins (1981) reported that the peak age for the prevalence of arrests was sixteen, while in their Copenhagen replication Van Dusen and Mednick (1983) found that prevalence peaked at seventeen to eighteen. In England, Farrington (1983) showed that the age curve for the number of different persons convicted was similar to the curve for the total number of convictions. It seems that the peak age seen in official statistics reflects a peak in the prevalence of offending.

Farrington (1983) also showed that the prevalence of offending according to self-reports peaked at fifteen to eighteen for most offenses. The most extensive American data relating age to self-reports of offending has been produced by Elliott et al. (1983). Unfortunately, their figures seem to be subject to a great deal of sampling variability. Restricting the analysis to ages with at least three estimates from different cohorts, the peak age for the prevalence of Index offenses was fifteen to seventeen (with 18 percent of the sample committing at least one Index offense at each of these ages). Therefore, self-reports also show a peak in the prevalence of offending at about fifteen to eighteen.

B. Cumulative Prevalence

Like other features of the age-crime curve, the cumulative prevalence of offending up to a certain age can be estimated either cross-sectionally or longitudinally. The cross-sectional calculation requires a knowledge of the proportion of persons of each age who offend for the first time in a given year. If these proportions are added up over all ages, this yields an estimate of the cumulative prevalence of offending in a cohort, on the assumption that first offending rates do not change over time.

The first cross-sectional estimate of the prevalence of offending (defined as a court appearance on a delinquency charge) was made by Monahan (1960) in Philadelphia. Unfortunately, Monahan's calculations were incorrect. Gordon and Gleser (1974) explained the error and published the correct figures. These showed that 51 percent of black males, 18 percent of white males, 16 percent of black females, and 3 percent of white females had appeared in court by the eighteenth birthday. Ball, Ross, and Simpson (1964) used the correct method in Kentucky, calculating that 21 percent of males and 5 percent of females had appeared in the juvenile court by the eighteenth birthday. Christensen (1967) then extended the technique to calculate the lifetime probability of arrest for nontraffic offenses in the United States as 50 percent for males and 12 percent for females. More recent estimates have been made by Blumstein and Graddy (1982), showing that the probability of arrest of a male for an Index offense by age fifty-five in large American cities was 51 percent for nonwhites and 14 percent for whites. These cumulative prevalence figures are surprisingly high.

The cross-sectional method of estimating prevalence has also been used in other countries. In England, McClintock and Avison (1968) calculated the lifetime risk of conviction for a nontraffic offense to be 31 percent for males and 8 percent for females. Just over a decade later, these rates had increased to 44 percent for males and 15 percent for females (Farrington 1981). The lifetime prevalence of convictions may be lower in the Scandinavian countries. Christiansen and Jensen (1972) used 1968 figures to estimate that 12 percent of males and less than 2 percent of females in Denmark would be convicted and receive sanctions more severe than fines in their lifetimes.[4] (These severe sanctions constituted about 60 percent of all sanctions.)

Longitudinal methods of estimating cumulative prevalence have become common since the pioneering work of Wolfgang et al. (1972). They showed that the cumulative prevalence of nontraffic arrests in their cohort of Philadelphia males was 35 percent up to age eighteen, with a marked racial differential (50 percent of the blacks versus 29 percent of the whites). Later work by Wolfgang (1983) demonstrated that the overall prevalence increased to 47 percent by age thirty, and Wolfgang and Tracy (1982) reported a cumulative prevalence of 33 percent up to age eighteen for males in a second Philadelphia cohort. In Racine, Wisconsin, Shannon (1981) studied three birth cohorts, fol-

[4] The low prevalence in this study is partly due to the severe criterion for counting offenses. The longitudinal prevalence figures quoted below for Copenhagen are higher.

lowed up in records to ages thirty-three, twenty-six, and twenty-one, respectively. The proportions with police contacts up to these ages for relatively serious offenses (felonies and major misdemeanors) were 22–23 percent for males and 2–6 percent for females. In another small-town study, in Marion County, Oregon, Polk et al. (1981) found a cumulative prevalence of 25 percent up to the eighteenth birthday for police contacts of males for nontraffic offenses.

Similarly high cumulative prevalence figures have been reported in England. In a national sample, Wadsworth (1975) discovered that 15 percent of males were convicted or cautioned for nontraffic offenses by the twenty-first birthday, and Farrington (1983) found that about one-third of a cohort of London males were convicted of nontraffic offenses by the twenty-fifth birthday. A national follow-up of persons born in 1953 in the official criminal records (Home Office 1985) showed that 31 percent of the males and 6 percent of the females had been convicted of nontraffic offenses by the twenty-eighth birthday.

The cumulative prevalence of police contacts is also high in other countries. In Copenhagen, Wolf (1984) in the Danish *Project Metropolitan* reported that 35 percent of males had been registered by the police for an offense committed by age twenty-three. According to Wolf (personal communication), 21 percent were registered for nontraffic offenses. In the Swedish *Project Metropolitan*, Wikstrom (1985) found that 31 percent of males had a police record by age twenty-five to twenty-six.

These cumulative figures show that, at least for males, police records are not confined to a small deviant minority. Indeed, in some studies the noncriminals are in the minority. Little seems to be known about the cumulative prevalence of offending as measured by self-reports. It would be desirable to publish national cumulative prevalence figures versus age on a regular basis. The ages at which cumulative prevalence is increasing fastest (the ages of maximum acceleration) may be particularly significant in the explanation of crime, as these indicate the most usual ages at which nonoffenders become offenders.

C. Incidence

"Incidence" here refers to the rate of committing crimes by offenders. Comparatively little is known about how incidence varies with age. This is surprising in light of the pioneering work of Glueck and Glueck (1940, 1943), who published the average number of arrests per arrested person in successive five-year periods. It is clear from the Gluecks' figures that the prevalence of arrests varied far more than the incidence.

For example, Glueck and Glueck (1940) reported that, while the percentage of their released offenders arrested for property crimes such as burglary and theft decreased from 60 percent (between, on average, fourteen and nineteen) to 25 percent (between, on average, ages twenty-four and twenty-nine), the incidence of such arrests decreased only from 2.3 to 1.9. Similarly, while the prevalence of arrests for drunkenness increased from 11 percent to 27 percent, the incidence increased only from 2.4 to 4.1.

Knowledge about the incidence of offending advanced little during the forty years that separated the Gluecks' work and Blumstein and Cohen's (1979), who more recently have emphasized the importance of the individual crime rate. In a sample of adults arrested for serious crimes in Washington, D.C., Blumstein and Cohen found that the individual arrest rate decreased with age, from below age twenty to above age thirty. However, they explained this decrease away on two grounds. First, there were cohort effects confounded with age since arrest rates were higher among those born more recently. Second, the calculation did not take account of time incarcerated, which affected the older offenders more than the younger ones. When Blumstein and Cohen allowed for both these effects in more sensitive analyses, they found that the arrest rate did not tend to decrease with age. They have consistently argued that the individual crime rate or incidence of offending is constant during a criminal career and that changes in aggregate crime rates reflect changing prevalence.

In support of Blumstein and Cohen's (1979) arguments, Farrington (1983) in the London cohort found that the peak in the number of convictions was primarily affected by prevalence, not by incidence. The number of convictions per convicted person varied only between 1.0 and 1.5 at each age. However, the problem with convictions and arrests as measures of incidence is that there are limits on the number that can be incurred in any time period, partly because of the official reaction that follows. Also, the probability of an arrest or a conviction following an offense may vary systematically with age. It might be more satisfactory to measure incidence using self-reports, taking account of time at risk.

Peterson et al. (1981) obtained self-reports in their cross-sectional survey of California prisoners and published figures showing how prevalence and incidence varied with age. Unfortunately, while the prevalence figures generally decreased with age, the incidence figures showed no consistent pattern. For example, the incidence of burglary was high at twenty-one to twenty-five and twenty-six to thirty and low

at under twenty-one and over thirty; in contrast, the incidence of auto theft was high at under twenty-one and over thirty and low at twenty-one to twenty-five and twenty-six to thirty. Peterson et al. also calculated the probability of an offense being followed by an arrest at different ages, but again there were no clear trends. Earlier, Petersilia et al. (1978) had found that this probability increased with age during the adult years.

Farrington (1983) obtained incidence rates from self-reports as well as from official records. As with the official records, the peak in self-reported crime at age fifteen to eighteen generally reflected a peak in prevalence, not in incidence. The decrease in prevalence after the peak could coincide with a decrease in incidence (for fighting and burglary), with an increase in incidence (for damaging property and stealing from vehicles), or with no consistent change in incidence (for shoplifting and stealing from automatic machines). It is also possible to calculate incidence rates for Index offenses in the Elliott et al. (1983) national self-report survey, and these also did not seem to vary systematically with age.

The reciprocal of the incidence rate is the average time between offenses. This was calculated by Glueck and Glueck (1940, 1943) for arrests but by few subsequent researchers. As might have been expected, the average time between arrests did not vary greatly in the Gluecks' research: from one arrest every fourteen months at age fourteen to nineteen to one arrest every 12.6 months at age twenty-four to twenty-nine, for example (Glueck and Glueck 1940). The Gluecks deducted time spent in institutions in making these calculations. Subsequent researchers who have studied time between arrests (e.g., Miller et al. 1982) have not related it to age and not deducted time spent in institutions.

The limited amount of present knowledge, then, suggests that the peak in the crime rate in the teenage years reflects a peak in prevalence and that incidence does not vary consistently with age. This has the clear implication that individual curves relating age and crime will be very different from aggregate curves.

D. Age of Onset

The age of onset of offending is of course related to the cumulative prevalence. If the age-crime curve reflects primarily prevalence, it follows that the peak age of onset should coincide with the peak age of acceleration of the age-crime curve, just as it must coincide with the peak age of acceleration of the cumulative prevalence curve. Both

curves are accelerating because more nonoffenders are becoming offenders. Figure 3 suggests that the peak age of onset will be before the peak age of offending, at fourteen to fifteen for English and American males in the 1980s. It would be interesting to plot age of onset curves not only in relation to the whole population but also in relation to the number of nonoffenders at each age. The proportion of nonoffenders who become offenders at each age can be regarded as a "hazard rate" (Gordon and Gleser 1974).

Several of the studies of cumulative prevalence include detailed curves showing age of onset. This is true, for example, in the Blumstein and Graddy (1982) research on cumulative prevalence in large American cities. It is clear from their results that the age of onset curves for white and nonwhite males both peak at fifteen, although the nonwhite probabilities are much higher. Similarly, Fry (1985) has provided detailed age of onset information for the Swedish *Project Metropolitan* in Stockholm. The peak ages of first arrests for males and females were both at thirteen.

The peak ages of onset in English studies seem to be less sharp. In Wadsworth's (1975) national longitudinal survey, the peak for convictions and cautions was at fourteen to sixteen. In Farrington's (1983) London cohort, the peak age was at thirteen to seventeen, with two noticeable peaks at fourteen and seventeen. The boys in this survey were born mostly in 1953. Interestingly, in the Home Office (1985) follow-up in the criminal records of a national sample of persons born in 1953, there were also two peaks for first convictions of males, at fourteen and seventeen. In contrast, the peak age of onset for females was at seventeen. These peak ages may be related to English legal categories; at fourteen a "child" becomes a "young person," while at seventeen a "young person" becomes a "young adult."

In their longitudinal self-report survey, Elliott and Huizinga (1984) provided interesting information not only about the prevalence of different kinds of offending at each age but also about the percentage of persons initiating and terminating. Unfortunately, it is difficult to be sure that all initiations and terminations are genuine, in view of the limited period covered by this survey (five annual interviews). However, their combined data from three birth cohorts indicated that initiation peaked at thirteen to fifteen, prevalence at sixteen to seventeen, and termination at eighteen to nineteen.

It is important to know how age of onset is related to incidence as well as to prevalence. Hirschi and Gottfredson (1983) argued that groups with a higher aggregate peak offending rate (such as blacks)

would inevitably have an earlier age of onset, a later age of termination, and hence a longer criminal career. This is essentially arguing that the whole age-crime curve tends to be magnified for blacks or that, once the peak of the curve is known, every other feature of it follows. Unfortunately, Hirschi and Gottfredson did not distinguish between prevalence and incidence in their article. However, one possible interpretation of their argument is that an early age of onset tends to be followed by a high incidence of offending.

A number of studies have related the age of onset to the number of offenses per year after onset. Hamparian et al. (1978), in a retrospective longitudinal survey of violent juveniles in Columbus, Ohio, showed that the number of arrests after the age of onset increased linearly with the time available up to the eighteenth birthday. In other words, after the age of onset, these juveniles offended at a constant (incidence) rate. Similar results were obtained by Miller et al. (1982) with violent adults in Ohio, by Van Dusen and Mednick (1983) in Copenhagen, and in the English follow-up of cohorts by the Home Office (1985). However, Farrington (1983) found that those first convicted at the earliest age (ten to twelve) offended consistently at a higher rate and for a longer time period than those first convicted at later ages, up to age twenty-five. Similarly, McCord (1980) reported that those first convicted under age sixteen were more likely to be convicted later, at different ages.

There are many other questions that could be asked about age of onset. How do those who offend at an early age differ from those who do not offend until later? In the London cohort, West (1982) reported that those first convicted after age eighteen were less likely to share the deprived backgrounds—low-income families, convicted parents, and poor parental child-rearing behavior—of those who offended at earlier ages. However, the latecomers to crime were just as likely to have had low intelligence at age eight to nine. Another important issue is the extent to which the early offenders who persist in crime differ from those who desist. Blumstein, Farrington, and Moitra (1985) showed that factors that predicted those who became chronic offenders out of all convicted youths were offending at an early age, having a convicted sibling, being troublesome, and performing badly at school at age eight to ten.

E. Age of Termination

Less is known about the age at which offending ceases than about the age at which it begins. This is partly because of the difficulty of distinguishing between a gap in a criminal career and true termination and of

the very long term follow-ups that are required to establish the age at termination. Assuming that offending occurs probabilistically, there are bound to be crime-free periods in the middle of criminal careers. Barnett and Lofaso (1985) carried out an interesting analysis of the Philadelphia cohort, showing that the primary predictor of future arrest rate was past arrest rate. They could find no evidence of termination of offending up to the eighteenth birthday. Virtually all apparent termination was "false desistance" caused by the artificial truncation of the data at eighteen.

Glueck and Glueck (1943) were probably the first to publish information about the age of termination. They concluded that 140 of their 510 reformatory inmates had "reformed" since they had no recorded arrests during the third follow-up period (average ages thirty-five to forty). Eighteen were last arrested under age twenty-one, thirty-eight at age twenty-one to twenty-seven, forty-five at age twenty-seven to thirty-three, and the remaining thirty-nine over age thirty-three. The Gluecks were interested in predicting those who reformed. Unfortunately, a five-year or even a ten-year crime-free period is no guarantee that offending has terminated. For example, Gibbens (1984) followed up a sample of 200 English borstal boys in records for twenty-five years after conviction. After ten years, forty-three had not been reconvicted, but as many as one-third of these were reconvicted subsequently.

It might be thought that recidivism is the other side of the coin from termination. A great deal is known about the relation between age and recidivism. For example, Hoffman and Beck (1984, p. 617) stated that "one of the most firmly established pieces of statistical knowledge is that the older a man is when released from prison the less likely he is to return to crime." They carried out a study that showed that, for federal prisoners, the recidivism rate (defined as the commission of an offense leading to imprisonment for sixty days or more, within two years of release) varied from 36 percent for those under twenty-five to 23 percent for those over forty. Kitchener, Schmidt, and Glaser (1977), in an eighteen-year follow-up of federal prisoners, showed a more dramatic relationship between recidivism and age at first arrest. Unfortunately, it is difficult to draw conclusions about termination from information about recidivism because those who do not recidivate within two years include true desisters, undetected offenders, and those who will persist later.

Assuming that the age-crime curve primarily reflects prevalence, the peak age of termination should coincide with the peak age of deceleration of this curve. As already mentioned, Elliott and Huizinga (1984)

provided information about the proportion of persons initiating and terminating at each age in their five-year follow-up study. Also, Polk et al. (1981) produced a distribution of the year of the last arrest for their sample, for men with no arrests in the last three years of their project (ages twenty-seven to thirty). This peaked at age seventeen. However, the table published by Hamparian et al. (1978, p. 71) is potentially more interesting, as it shows the age of the first arrest versus the age of the last arrest. This makes it possible to calculate the length of criminal careers and to relate length to the ages of onset and termination. Unfortunately, the Hamparian et al. analysis is limited to juvenile arrests, but it might serve as a useful model for other researchers.

Just as little is known about ages of termination, the same is inevitably true of the lengths of criminal careers. Blumstein, Cohen, and Hsieh (1982) drew attention to the importance of the concept of residual career length at each age. Using cross-sectional data and assuming that offending was a probabilistic process, they used a life-table method to calculate both career length (which averaged 5.6 years for Index arrests) and residual career length (which peaked between age thirty and age forty). It is important to know both residual career length and the incidence rate in order to estimate the number of crimes prevented by incapacitation. It may be that incapacitation has its greatest crime-reducing potential for offenders aged between thirty and forty despite the peak age of offending in the teenage years. This is an example of how more subtle relationships between age and crime than the well-publicized gross curve are often needed.

There is a great deal yet to be established about how criminal careers vary with age, including the interrelations among prevalence, incidence, age of onset, age of termination, and career length (residual or total). It is also important to know how these factors are related to other variables such as sex, race, family background, intelligence, and so on. Predictive analyses are especially desirable to establish how far the future course of a criminal career (in terms of residual length and incidence rate) can be predicted at any age on the basis of the past course (in terms of the length of time elapsed in the career, the incidence rate, and perhaps even the rate of acceleration or deceleration of the incidence rate; see Barnett and Lofaso [1985]).

F. Crime Types and Transitions

Changes in the commission of different types of crimes with age have already been discussed. Violent crimes generally peak at a later age than property crimes, for example. However, there is a need for careful

data on the prevalence and incidence of different types of crimes at different ages, and the overall age-crime curves do not help in answering questions about changes between ages for particular individuals. Does the seriousness of offending tend to increase with age, or is it just that less serious offenders drop out and more serious ones appear for the first time? How far are offenders specialized or versatile in their offending patterns at different ages? How far do the types of offenses committed at one age predict the types committed at another, and how far can offending at one age be predicted from offending at another? These are the questions of interest here.

Unfortunately, studies of changes in the seriousness of offending with age have produced inconsistent results. In the Philadelphia cohort, using the Sellin-Wolfgang (1964) index of seriousness, Wolfgang (1980) found that the average seriousness of offenses was reasonably constant during the juvenile years but then increased during the young adult years. Collins (1981) reported that the seriousness of Index offenses peaked at age twenty to twenty-one. However, in the older two of Shannon's (1981) Racine cohorts, the average seriousness of offenses decreased steadily with age. This may be because Shannon's data, unlike Wolfgang's, included traffic violations. In Van Dusen and Mednick's (1983) replication of the Philadelphia study in Copenhagen, the average seriousness of Index offenses decreased with age to reach a minimum level at age seventeen to eighteen and then increased again. None of these results show changes in offense seriousness for individuals. It may be that changes in the pattern of offending with age can only be understood by investigating the actual types of crimes committed rather than by using summary measures of seriousness.

Petersilia et al. (1978) and Peterson et al. (1981), in their retrospective self-report studies of prisoners, both found that the number of different types of crimes committed decreased with age, in agreement with the hypothesis of increasing specialization. Petersilia et al. concluded that the average seriousness of offenses decreased from the juvenile to the adult years, but this seemed to be largely because of the low seriousness score of drug sales, which increased markedly with age.

Wolfgang et al. (1972) popularized the study of offense to offense transitions with increasing age. Generally, their transition matrices show no specialization from one age to the next, just as they showed no specialization from one arrest to the next. However, the probability of an Index offense being followed by no offense declined steadily with age (from ten to sixteen), just as the probability of no offense being

followed by any offense increased steadily with age (from ten to sixteen). The probability of transition from a non-Index to an Index offense remained fairly constant over age, as did the probability of transition from one Index offense to another.

Rojek and Erickson (1982) essentially replicated the Wolfgang et al. transition matrices analysis for arrests. However, they also showed that the lack of specialization held independently of the age at the first arrest. Rankin and Wells (1985) derived transition matrices for self-reported offending in their reanalysis of the Bachman et al. (1978) longitudinal survey. They were interested in the concept of escalation, but they found that there was almost as much de-escalation from delinquency to status offenses (between age twelve to fifteen and age sixteen to eighteen) as escalation from status to delinquency offenses.

These analyses of transition matrices are bedeviled by methodological problems. First, there is the difficulty of disentangling the effects of age from those of other variables confounded with age, such as the number of previous offenses. Second, the more frequent offenders contribute more transition matrices to the total than do the less frequent offenders, so that a lack of specialization may be true of the more frequent offenders but possibly not of the less frequent ones. Third, some offenders may switch only between a small number of types of crimes, so it may be misleading to refer to them as generalists. Fourth, it is important to determine how the results are affected by the number of categories of crime used. As the number of categories decreases, the likelihood of concluding that offenders specialize should increase, but so too will the likelihood of this conclusion being misleading.

Most important, there is a need for a standard summary measure of specialization versus generalization. One possibility will be illustrated by reference to table 4, which is derived from Phillpotts and Lancucki's (1979) six-year follow-up in records of a nationally representative sample of 5,000 English nontraffic offenders. Table 4A shows the type of offense committed on conviction and on the first reconviction for 1,194 males who were under twenty-one on conviction and who were reconvicted, while table 4B shows the same figures for 1,130 males who were twenty-one or over on conviction. Offenses were divided up into three types, personal (violence and sex), property (burglary, robbery, theft, handling), and others (principally fraud, forgery, and damage to property).

The figures in parentheses show the expected cell entries on the assumption that there is no relation between conviction and reconvic-

TABLE 4

Specialization in Offending

A. Under Twenty-one on Conviction

Conviction Offense	Reconviction Offense			Total	Coefficient	z
	Personal	Property	Other			
Personal	42	67	21	130	.15	3.77
	(25.8)	(84.7)	(19.5)			
Property	182	630	123	935	.06	3.06
	(185.6)	(609.2)	(140.2)			
Other	13	81	35	129	.14	4.09
	(25.6)	(84.1)	(19.3)			
Total	237	778	179	1194		

B. Twenty-one or Over on Conviction

Conviction Offense	Reconviction Offense			Total	Coefficient	z
	Personal	Property	Other			
Personal	52	55	38	145	.26	8.25
	(20.0)	(87.4)	(37.6)			
Property	76	515	151	742	.23	8.68
	(102.4)	(447.2)	(192.4)			
Other	28	111	104	243	.23	6.77
	(33.5)	(146.4)	(63.0)			
Total	156	681	293	1130		

SOURCE.—Phillpotts and Lancucki (1979, table 4.3).

NOTE.—Figures in parentheses are expected figures based on row and column totals. See text for definition of coefficient. z = the adjusted standardized residual.

tion offenses (i.e., complete generalization). It can be seen that the observed figures are greater than the expected figures in all diagonal cells (personal conviction–personal reconviction, etc.), suggesting some degree of specialization. The observed and expected figures in both tables are significantly different according to the χ^2 test, again showing some specialization (under twenty-one: $\chi^2 = 36.0$; twenty-one or over: $\chi^2 = 115.1$; both significant at $p < .001$). Furthermore, the larger value of χ^2 in table 4B indicates that specialization increases with age.

The following coefficient of specialization is proposed for each diagonal cell:

$$\text{Coefficient} = \frac{\text{observed} - \text{expected}}{\text{row total} - \text{expected}}.$$

This coefficient seems useful because it is zero when there is complete generalization (and hence the observed figure equals the expected one) and one when there is perfect specialization (and hence every conviction offense becomes the same type of reconviction offense). The coefficients are shown in the right-hand column of table 4. They are not very high, indicating perhaps that these tables show a low degree of specialization superimposed on a high degree of generalization. The coefficients in table 4B are higher, again indicating more specialization at older ages. The statistical significance of each coefficient could be tested using the adjusted standardized residual (Bursik 1980). All the coefficients were significantly different from zero, at least partly because of the large numbers involved in the tables.

One interesting question is the extent to which offenders at one age tend also to be offenders at other ages. Farrington (1986) showed that the best predictor of offending at all ages between ten and twenty-five was offending at the immediately prior age and that these results held for both self-reported and official measures of offending. Generally, there is considerable continuity in offending between the juvenile and the adult years (Langan and Farrington 1983).

Shannon (1985) has argued that juvenile offending is not a useful predictor of adult offending. He concentrates on errors in prediction. For example, in his 1949 cohort, fifteen out of forty-five males (33 percent) with three or more juvenile offenses also had three or more adult offenses, in comparison with sixteen out of 560 males (3 percent) with two or fewer juvenile offenses. Therefore, having three or more juvenile offenses would only identify about half of those with three or more adult offenses. However, the contrast between a "hit rate" of 33 percent and one of 3 percent does nothing to shake my belief in the continuity of offending from the juvenile to the adult years.

IV. Why Are Age and Crime Related?

Hirschi and Gottfredson (1983) argued that the relation between age and crime was invariant or, in other words, that it held independently of, and could not be explained by reference to, other variables. Conse-

quently, age had a direct causal effect on crime. They also argued that the causes of crime were the same at every age, so longitudinal research was unnecessary in studying crime causation. In discussing possible causal relationships involving age and crime, the key questions are those raised earlier in connection with sex. First, does the relation between age and crime hold independently of other variables? Second, does the relation between other variables and crime hold independently of age?

Before discussing these questions, it is desirable to clarify the concept of a causal relationship. Ideally, what is meant is a functional relationship of the following kind: $y = f(x)$. For example, in physics, Boyle's law specifies that decreasing the volume of a gas will cause a predictable increase in its pressure. In other words, the pressure (y) is a reciprocal function of the volume (x). This relationship, like many others, only holds within certain boundary conditions of pressure and volume. In criminology, the dependent variable of interest might be conceptualized as the underlying rate of offending, or incidence rate, which may be probabilistically related to actual offending as in the Cohen (1983) model.[5] In other words, the number of offenses a person actually commits in any given time period depends on his or her incidence rate and on situational factors that can be viewed as random or unpredictable. The key causal question in criminology is, How does the incidence of offending change as a function of changes in other variables?

Answering this question is complicated by the different kinds of other variables that are possible. Some factors (e.g., the number of delinquent peers) can vary within individuals and, at least in principle, can be manipulated in an experiment. Age is a factor that varies within individuals but that cannot be manipulated. Other factors vary only between individuals and cannot be manipulated (e.g., sex and race). Again, some factors can vary continuously, while others (e.g., the death of a parent) occur at one particular time. The simplest way of interpreting the statement that "x is a cause of crime" is that "changes in x will cause changes in the incidence rate." Clearly, it is easiest to demonstrate that a factor causes crime if it varies within individuals and if it can be manipulated in an experiment. For example, Feldman,

[5] Hirschi and Gottfredson (1985*b*) have proposed a distinction between criminality (the propensity to commit crimes) and crimes. In some respects, this seems similar to Cohen's (1983) distinction between underlying and observed incidence rates.

Caplinger, and Wodarski (1983) demonstrated experimentally that antisocial youths placed in groups of prosocial peers showed less antisocial behavior than those placed in groups of antisocial peers.

Saying that age causes crime is equivalent to saying that changes in age in some way cause changes in incidence rates. It seems more likely that age measures an underlying theoretical construct that causes crime than that age is itself a causal factor. Since age cannot be manipulated in an experiment, it is essential to show that changes in incidence rates that are correlated with changes in age are not caused by changes in other factors. This requires information about how incidence rates (and other variables) vary with age within individuals. In turn, this means that longitudinal research involving frequent data collection is required. Unfortunately, almost all existing age-crime curves are essentially aggregate curves that probably bear little relation to individual ones. Much more detailed information is needed about how age and crime vary within individuals before it is possible to determine whether any relationships hold independently of other variables.

It may be easier to determine whether relationships between other variables and crime hold independently of age. Some factors only apply at certain ages. For example, the relation between marriage and crime cannot be studied among ten-year-olds, any more than the relation between truancy and crime can be studied among sixty-year-olds. Other factors may have different meanings at different ages. For example, since the socioeconomic status of youngsters is determined according to the jobs of their parents, while the socioeconomic status of older people depends on their own jobs, different relations at different ages between socioeconomic status and crime (Thornberry and Farnworth 1982) are not too surprising. Again, increased unemployment of adults may lead to increased crime by adults but to decreased crime by juveniles (Glaser and Rice 1959), perhaps because the unemployed adults are able to exercise closer supervision over their children. It seems implausible to argue that all variables are related to crime in the same way at all ages.

The present state of knowledge does not permit an answer to either of the questions posed above. However, if it is accepted that the best way of determining the causes of crime is to study changes within individuals, this indicates that the best method of investigation is longitudinal (preferably including experimental elements; see Farrington, Ohlin, and Wilson [1986]).

A. Possible Explanations

Many explanations have been proposed for the aggregate age-crime curve, on the basis of individual or environmental factors that change with age. If the age-crime curve primarily reflects prevalence, researchers should concentrate on explaining onset and termination rather than changes in incidence.

There may be biological factors that influence some crimes at different ages. For example, it has often been argued (Gibbens and Prince 1962) that shoplifting by females increases at the time of menopause. Crimes have been linked to testosterone levels in males, which increase during adolescence and early adulthood and thereafter decline. However, the age-testosterone curve does not have the same sharp peak in the teenage years that the age-crime curve does (Gove 1985; Hirschi and Gottfredson 1985*a*). Physical factors may be important in some crimes. For example, the ability to climb buildings and hence to commit burglaries may peak in the teenage years. Some offenses, such as car theft, depend on skills and knowledge acquired during the period from childhood to adulthood. As skills and knowledge increase, so too will offending.

Kohlberg (1976) suggested that offending was linked to changes in moral reasoning with age. Each person was supposed to pass through three stages of moral development: preconventional, conventional, and postconventional. The preconventional person was one who had not yet come to understand and obey the law and whose conformity to the law depended on the likelihood of legal punishment. According to Kohlberg, this was the level of most children under nine, some adolescents, and many criminal offenders. The conventional person was one who obeyed the law purely because it was the law, because of conscience, or to avoid the breakdown of society. The postconventional individual obeyed the law to the extent that it conformed with higher moral principles such as rights and duties. The conventional level was said to characterize most adolescents and adults, while the postconventional level was reached by a minority, usually only after age twenty. This theory has been criticized (Kurtines and Grief 1974), but there is some empirical support for it (Scharf and Hickey 1976). By itself, it cannot explain why crime reaches a peak in the teenage years, but it may account for the termination of offending. It is similar in some respects to Glueck and Glueck's (1940) proposal that desistance from offending is linked to maturation.

Explanations that link the age-crime curve to changes in the social

environment are more popular and probably more important than those stressing changes only in individual factors. From birth, children are under the influence of their parents, who generally discourage offending. It is interesting that the best predictor of the onset of offending is poor parental control (Loeber and Dishion 1983). However, during their teenage years, children gradually break away from the control of their parents and become influenced by their peers, who may encourage offending in many cases. Elliott, Huizinga, and Ageton (1985) found that the most important correlate of offending in their longitudinal survey was having delinquent friends, and this factor also proved to be an important predictor in the Farrington (1986) survey. Group offending is most common in the teenage years.

After age twenty, offending declines as peer influence gives way to family influence, except this time the family influence originates in spouses rather than in parents. Spontaneous comments by the youths in the London longitudinal survey indicated that withdrawal from the delinquent peer group was seen as an important factor in ceasing to offend (West and Farrington 1977). Also, West (1982) reported that marriage led to a decline in offending, providing that a young man married a nondelinquent woman. If he married a delinquent woman, his offending seemed to get worse.

Trasler (1979) outlined a variant of this theory in which the emphasis was on reinforcement contingencies in the environment. Parents tended to reward conformity and punish offending, and these external controls in many cases led to internal controls (a strong conscience) in the child. However, during the teenage years, offending tended to be reinforced by peer approval and excitement, and so it became more likely. As adults, people tended to desist from offending as adult reinforcers (employment, income, spouses, and children) became available. A similar explanation was proposed by Wilson and Herrnstein (1985), who also emphasized people's increasing ability with age to delay gratification and to take account of the possible future consequences of their actions. A major implication of this approach is that offending can be reduced by changing the pattern of reinforcements in the community (Farrington 1979*a*).

It is interesting to study the reasons given for crime at different ages. Petersilia et al. (1978) reported that the main reasons given by their armed robbers for crimes in the juvenile years were thrills and peer influence. In the adult years, the main reason given for crime was to obtain money, most commonly for drugs, alcohol, or self-support, but

sometimes for women or for family support. West and Farrington (1977) also found that a significant proportion of reasons given in the juvenile years mentioned excitement or enjoyment (especially in stealing cars, vandalism, and shoplifting), while more rational or economic reasons stressing material gain became more common as their cohort got older.

Greenberg (1979*a*, 1983) has emphasized the role of economic factors in explaining the age-crime curve. He argued that juveniles desire to participate in social activities but that, because they are excluded from the labor market or limited to part-time, poorly paid jobs by child labor laws, they have insufficient funds from legitimate sources to finance these. Therefore, they commit crimes in order to meet their perceived needs. Furthermore, the absence from home of parents working means that juveniles are often not subject to informal social control. When they become adults, employment, leaving school, military enlistment, and marriage eliminate major sources of criminogenic frustration and at the same time supply informal social control. Greenberg also drew attention to the changing opportunities for crime (e.g., employee theft) with age. However, Hirschi and Gottfredson (1985*b*) argued against this theory, claiming that the adult institutions of employment and marriage were not related to offending as predicted.

McKissack (1967, 1973) noted that, in England, the peak age of offending coincided with the last year of compulsory schooling. It may be that this is the age of maximum boredom for many low-achieving children and hence the age at which the need for excitement outside school becomes most intense. If the school has a role in producing offending, crime should decrease after people leave school. In agreement with this, Elliott (1966) and Elliott and Voss (1974) found that dropping out of school seemed to produce a decline in offending.

Many of the ideas put forward in this section can be found in classic theories of delinquency. For example, Cohen (1955) emphasized the role of school failure in producing delinquent subcultures and argued that working-class boys were likely to fail in school 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. Cloward and Ohlin (1960) stressed the rational element in delinquency as a way of achieving culturally induced goals (such as material success) by illegitimate means. Hirschi (1969) proposed that offending depended on the strength of a person's bond to society, which in turn depended on

attachment to parents and internalization of their wishes, and also emphasized the rational weighing of costs against benefits in deciding whether to offend. The differential association theory of Sutherland and Cressey (1974) would also predict that offending would vary with changes in social influence, from parents to peers, for example. Hence, as Greenberg (1985) argued, a substantial part of the relation between age and crime could be explained by familiar social concepts. Nevertheless, while it may not be necessary at present to propose that age causes crime, it cannot yet be concluded that the relation between age and crime has been explained convincingly by reference to other factors.

B. Criminal Justice System Influences

The most obvious way in which the criminal justice system influences the age-crime curve is through cutoff points defined by law. In England, the age of criminal responsibility is ten, so no person under ten can commit a crime in the strictly legal sense. However, in behavioral terms, it seems likely that many children under ten engage in stealing, vandalism, aggression, and so on. Committing an offense at an early age is a bad sign since the earliest offenders tend to be the most serious and persistent in later life. It may be that more attention should be given to "offending" before the age of criminal responsibility, to establish whether this is followed by an especially serious and persistent adult criminal career. Another important question is whether interventions designed to prevent crime are more effective if applied at earlier ages, possibly under age ten. The preschool "Head Start" program described by Berrueta-Clement et al. (1984) was surprisingly effective in preventing later arrests.

Setting a minimum age of criminal responsibility was originally justified by reference to the intellectual capacities of children. Keasey and Sales (1977*a*) reviewed some of the many definitions of criminal responsibility, including knowledge of the nature and illegality of the offense, awareness that the act is wrong, capability of entertaining a criminal intent, comprehension of the consequences of the offense, power to discriminate right from wrong, demonstration of intelligent design and malice in executing the act, and a mischievous inclination or disposition. They argued that the key element underlying a court's enquiry into mens rea was whether the child intended to commit the act and hence that research on the development of the concept of intention was especially important.

Many years ago, Piaget (1932) found that children under seven judged naughtiness not in terms of intentions but in terms of the consequences of the act (e.g., the resulting damage). This research was used to justify the age of criminal responsibility of seven that had prevailed in England from the seventeenth century up to the 1933 Children and Young Persons Act (Kean 1937). If children under seven could not understand the concept of intent, then they could not intentionally commit criminal acts. However, Keasey and Sales (1977*b*) asked children aged five, six, and seven to judge stories about arson, assault, theft, and homicide. They found that the judgments of naughtiness were based on intent rather than consequences for 67 percent of the five-year-olds, 83 percent of the six-year-olds, and 89 percent of the seven-year-olds. Therefore, it is hard to justify an age of criminal responsibility of even seven on the grounds of children's lack of understanding of the concept of intent.

There are a number of key questions about the minimum age of criminal responsibility that are as yet unanswered. At what age is it better to deal with offending through the criminal justice system as opposed to the social welfare system? What is the effect on children's offending of the possibility of criminal justice system intervention? For example, do English nine-year-olds feel that they can commit offenses with impunity? And how much offending is there by children under ten? It would be desirable to breach the legal barrier to complete the age-crime curve and obtain more accurate information about the age of onset of offending.

Rather similar questions arise in connection with an arguably more important legal cutoff point, namely, between juvenile and adult offending. In England, it is notable that the peak age for convictions of seventeen coincides with the minimum age of adult court processing. In general, the police hold off prosecuting offenders as long as they are legally juveniles (preferring instead to caution them), but these inhibitions disappear once an offender becomes legally adult. Again, it is important to establish the effect of juvenile as opposed to adult court processing. In the United States, Ruhland, Gold, and Hekman (1982) compared the official and self-reported offending of seventeen-year-olds in states where they were legally juveniles and in states where they were legally adults. They found that seventeen-year-olds who would be processed as juveniles committed more offenses, suggesting that the adult criminal justice system had more of a deterrent effect.

The increasing severity of legal penalties is often cited as a major reason for the decline in offending with age (Greenberg 1979*a*). Shover

(1983) interviewed fifty previously incarcerated men at an average age of fifty-one and asked them why they had given up crime. Generally, what had changed was their calculation of costs and benefits. The perceived costs of crime increased greatly as they got older, not only in terms of the increased likelihood of lengthy prison sentences, but also in terms of the consequent risk of losing their families and their jobs. Many felt that the criminal justice system had gradually worn them down over the years.

While it is widely believed that the probability and length of prison sentences increase with age (at least from eighteen to thirty), there is surprisingly little evidence about this. Petersilia et al. (1978) showed that both the probability of conviction after an arrest and the probability of incarceration after a conviction increased for their robbers from the juvenile through the young adult to the adult years. However, Greenwood, Abrahamse, and Zimring (1984) and Greenwood, Petersilia, and Zimring (1980) did not find a consistent increase with age in incarceration probabilities in various sites across the United States, and neither did Langan and Farrington (1983) in England. In investigating the relation between age and sentence severity, what is needed is research that controls for other relevant factors such as type of offense and number of previous convictions. Greenwood et al. (1984) reported that young adults with extensive juvenile records were sentenced more severely than those without such records.

V. Conclusions

The age-crime curve is not invariant. Many curves appear to be superficially similar in peaking in the teenage years, but more subtle aspects of the distribution (such as the extent to which it is skewed or sharply peaked) vary considerably with such basic variables as sex and crime type. The more detailed summary measures of the curves show that offending is not predominantly a teenage phenomenon. The average age of offenders is twenty-five to thirty, and only about a quarter are aged up to and including the peak in the teenage years.

The familiar age-crime curve is an aggregate curve and reflects variations in the prevalence of offending rather than in incidence. Age-crime curves for individuals are likely to be very different from the aggregate curve since current evidence suggests that incidence does not increase or decrease systematically between onset and termination. The aggregate age-crime curve peaks at about sixteen to seventeen, with the peak age of acceleration at about fourteen to fifteen and of deceleration at about eighteen to nineteen. These peaks in acceleration and decelera-

tion, which probably coincide with peak ages of onset and termination, are likely to identify ages at which important developmental changes are occurring. The cumulative prevalence of arrests over age is surprisingly high, and in some cases (e.g., black males) nonarrested persons are in the minority.

Different types of offenses peak at different ages, and this probably reflects crime switching by offenders rather than one group of persons ending their criminal careers and another group starting. Characteristics of crimes change with age, with group offending and the motive of excitement peaking in the teenage years. There is generally little specialization in offending, but this does seem to increase with age, and the number of types of crimes committed decreases. There is continuity in offending from one age to the next since the worst offenders at one age tend also to be the worst at others. However, there is no consistent evidence of escalation in the seriousness of offending with increasing age. An early age of onset seems to be followed by a long criminal career, but whether it is followed by a higher incidence rate is not clear. The residual length of criminal careers may peak at age thirty to forty.

It is unnecessary to postulate that age has a direct effect on crime. It is difficult to study whether age is related to crime independently of other variables because of the nonlinear relationship between age and crime. Also, it is desirable to take account of the different kinds of variables and especially of whether they vary within or only between individuals, whether they are manipulable, and whether they change at one time or vary continuously. Age effects need to be separated from period and cohort effects in particular as well as from the influences of other variables. The most plausible theory is that the age-crime curve reflects decreasing parental controls, a peaking of peer influence in the teenage years, and then increasing family and community controls with age.

It is very unlikely that other variables are related to crime in the same way at different ages. For example, the ratio of male to female offenders generally decreases with age. Therefore, it cannot be deduced that longitudinal research is unnecessary. The advantages of longitudinal studies have been discussed earlier in this essay.

A. Implications for Policy

That the age-crime curve primarily reflects changing prevalence has major implications for policy. A court faced with an offender aged

twenty-five, for example, cannot necessarily assume that that person's criminal behavior will decline in the next few years as the aggregate curve does. The probability of termination may be lower at twenty-five than at eighteen, the expected residual career length may be higher, the incidence of offending may be just as great, and the seriousness of offenses may be higher. In other words, characteristics of the aggregate age-crime curve cannot necessarily be imputed to the individual offender at any given age. It is important to develop predictors of quantities such as the residual career length, termination, and the future incidence rate at different ages, in evaluating penal policy options such as incapacitation.

Since the age-crime curve reflects prevalence, a major aim of public policy should be to prevent onset and encourage termination. It is especially desirable to prevent the onset of offending at an early age since that is often a precursor of a long criminal career. In the past, some commentators have deduced from the age-crime curve that the best policy is to "leave them alone and they will grow out of it." This policy is most plausible if applied to offenders of relatively late onset (say at fourteen or fifteen), who may offend in groups primarily for excitement and who may have short criminal careers. It would be ineffectual with those first offending at an early age. It may be that the criminal justice system should not deal so leniently with offenders under age thirteen since effective treatment at this age would have disproportionate benefits. It is certainly essential to target these offenders for special efforts, whether within or outside the criminal justice system.

It is important to establish the relative effects of different kinds of interventions at different ages. At present, penalties are thought to be lenient in the juvenile years and then increasingly severe for adults. It is interesting that the increasing legal penalties are quoted as a reason for giving up crime, just as is the influence of a spouse or a job. If the penalties for juveniles were increased, or if the separate juvenile court were abolished, would offenders terminate earlier? An alternative strategy would be to increase agency efforts to help ex-offenders settle down with spouses and jobs as early as possible.

The remarkably high cumulative prevalence of arrests and convictions is a matter for concern. Is it in the best interests of society to criminalize such a high proportion of the population, especially when there is some evidence that one effect of a conviction is to make the convicted person more hostile to the police (Farrington 1977)? It might

be better to concentrate resources on the more serious crimes and ignore some of the more trivial ones, at least in the absence of evidence of escalation. What is needed is more information about the future criminal careers of different types of offenders at different ages, to know in which cases trivial crimes are stepping stones in a developmental sequence leading to more serious offenses.

B. Future Research

In order to advance knowledge about the relation between age and crime, multiple cohort longitudinal studies are needed. It is impracticable to follow a single cohort from the cradle to the grave. The most feasible design is to follow a number of cohorts for a number of years, combining the results to build up a complete picture of the relation between age and crime. It should be possible to take advantage of the cross-sectional and longitudinal elements to achieve some separation of aging, period, and cohort effects. Frequent data collection is essential, using a variety of methods, including interviews and searches of records. This would make it possible to relate changes in criminal behavior at different ages to changes in parental controls, peer influences, unemployment, and so on. In turn, this would help in establishing the extent to which the age-crime curve can be explained by changes in other variables with age.

The aim should be to collect detailed information for individuals at different ages about prevalence, incidence, and different types of crimes committed. Efforts should be made to identify ages of onset and termination for different types of crimes and hence lengths of criminal careers. It is important to establish relations between these different variables. For example, do those who offend at the earliest ages differ in the types of crimes committed or in subsequent incidence rates? Predictive analyses are desirable at different ages. There is scope for obtaining much more detailed information from self-reports about the exact ages of offending, transition matrices between different ages, group offending, reasons for offending, cumulative prevalence, and so on.

In my estimation, a multiple cohort longitudinal study focusing on age and crime as a unifying principle would greatly advance our knowledge about the causes of crime and would also help in evaluating public policies for dealing with crime.

APPENDIX

It is not easy to summarize the relation between age and crime. In general, measures of association in the social sciences assume linear (straight line) rela-

tions. The product-moment correlation, for example, essentially measures how closely the relation between two variables approximates a straight line. A low correlation is usually interpreted as indicating no relation between the variables, whereas in fact it may reflect a nonlinear relation. Where two variables have a nonlinear relation (as in the case of age and crime), there is no generally accepted method of measuring strength of association. The best way of summarizing such a relation is probably to propose a mathematical function that fits the data. Essentially, the same approach underlies the use of the product-moment correlation for the special case in which two variables have a straight line relation. If crime rates increased linearly with age, there would be no problem.

Just as there is no generally accepted measure of association for two variables that are not linearly related, there is no generally accepted measure of partial association after controlling for a third variable. Conventional partial correlation measures assume not only linear but also additive relations, of the following kind:

$$y = a + b_1x_1 + b_2x_2,$$

where y is a dependent variable and x_1 and x_2 are independent variables. In studying how age was related to crime independently of some third variable, it would be necessary to specify not only the functional relation between the third variable and crime but also how crime varied as a function of age and of the third variable. Again, different mathematical functions and methods of combining functions could be tested to see which ones fit the data best. By appropriate transformations and substitutions, it may be possible to derive an equation like the above, where y is a function of crime, x_1 is a function of age, x_2 is a function of the third variable, and there are interaction terms such as $b_3x_1x_2$. In this case, b_1 would measure the contribution of age independently of the third variable, b_2 would measure the contribution of the third variable independently of age, and b_3 would measure the interaction between age and the third variable.

This approach is undoubtedly complex. One unfortunate implication is that it is difficult to answer questions such as, Is age or sex more strongly related to offending? However, an advantage of studying the relation between age and crime is that it forces researchers to study distributions and to grapple with the problem of nonlinear relations. Researchers may be too ready to assume that a relation is linear, because of mathematical convenience, without testing whether it approximates a straight line in reality. There may be variables that have been neglected in the literature because of their low correlations with criminal behavior but that on closer inspection show marked nonlinear relations.

Because sex is a dichotomous (as opposed to a continuous) variable, it is more feasible to investigate whether age is related to crime independently of sex than independently of other variables. The hypothesis to be tested is that the age-crime curve is the same for males and females. Each age could be regarded as analogous to a score on a test. The distribution of "scores" of male offenders could then be compared with that of female offenders, to see whether they differed significantly. The usual test for differences between distributions of

scores is Student's *t*-test, based on means and standard deviations. Even if the scores are not normally distributed, the *t*-test can be used with large samples because the sampling distribution of the difference between two sample means will be normally distributed (Blalock 1972, p. 220). Another possible approach is to use a nonparametric test of the difference between two distributions, such as the Kolmogorov-Smirnov test (Siegel 1956, p. 127). Another possibility is to analyze the relation between age, sex, and crime (the number of offenders and nonoffenders) as a large contingency table, using loglinear methods (Fienberg 1980).

All these methods are complex and/or not easily applicable to types of variables other than sex. It might be more satisfactory to base analyses on mathematical functions linking crime with age and other variables.

Mathematical Specification of the Age-Crime Curve

In specifying the mathematical function relating age and crime, the problem is as follows. If crime = y and age = x, what is the function f in $y = f(x)$? It is clear that $f(x)$ must specify a unimodal, positively skewed probability distribution. It would no doubt be possible to fit a complex polynomial equation to the empirical curve, but it would be more satisfactory to discover a simpler function, especially one that made sense theoretically.

An immediate problem is where to set the origin for age. In England, where the minimum age of criminal responsibility is ten, all crime rates under age ten are by definition zero. Therefore, in fitting curves derived from official records, it would be plausible to set

$$x = (\text{age} - 9) \text{ years},$$

where age is an integer. One of the simplest probability distributions that resembles the age curve, and that has only one parameter (or theoretical variable), is the Poisson distribution. This has been used widely in criminology (e.g., Cohen 1983). The equation is as follows:

$$y = \frac{e^{-\lambda}\lambda^{x}}{x!},$$

where λ is the parameter. However, despite the superficial resemblance, it is clear that the age-crime curve is not a Poisson distribution. In a Poisson distribution, the mean and variance are equal to each other and to λ. However, in the age-crime curve, the variance far exceeds the mean. For example, table 1 shows that, for English males in 1983, the mean age was 24.9 and the standard deviation was 11.8. The variance, which is the square of the standard deviation, was 140.2 or 8.8 times the mean value of x of 15.9 (age − 9).

Another simple probability distribution that resembles the age curve and that has only one parameter is the χ^2 distribution. The equation is as follows:

$$y = \frac{e^{-(x/2)}x^{(v/2)-1}}{2^{v/2}\left(\frac{v}{2} - 1\right)!},$$

where v is the parameter or the number of degrees of freedom of the distribution. However, since the mean of this distribution is v and the variance is only $2v$, it is clearly not a good model for the age-crime distribution.

Moving up to two parameters, another simple distribution that resembles the age-crime curve is the gamma distribution (e.g., Greenberg 1979*b*, pp. 271–72). The equation is as follows:

$$y = \frac{b^a e^{-bx} x^{a-1}}{G(a)},$$

where a and b are parameters and $G(a)$ is the gamma function:

$$G(a) = \int_{z=0}^{\infty} z^{a-1} e^{-z} dz.$$

With this distribution, the mean equals a/b and the variance equals a/b^2. Given a mean value of x of 15.9 for English males in 1983 and a variance of 140.2, $a = 1.8$ and $b = 0.11$. Figure A1*a* shows the gamma distribution in comparison with the age-crime curve for English males, and figure A1*b* shows the same curves for English females. The age-crime curves are expressed as probability distributions, again assuming the same number of people at each age. Thus the curve for English males peaks at age fifteen at .065 (or 6.5 percent of all crimes) rather than at 8.2 crimes per 100 population, but otherwise it is identical to the curve in figure 1*a*. Figure A1*a*, *b*, shows that the gamma distribution is not as sharply peaked as the age-crime curve. Also, the peak age, which occurs at $x = (a - 1)/b$, is slightly too high, being sixteen for males and fifteen for females.

A better fit can be achieved by moving up to three parameters and assuming the following functional relationship between x and y:

$$y = ax^b e^{-cx},$$

where a, b, and c are parameters. Essentially, what this equation indicates is that the age-crime curve is a combination of two functions, one (x^b) increasing with age and the other (e^{-cx}) decreasing. The χ^2 and gamma distributions are both of this general form. An increase in b will shift the peak to the right, while an increase in c will shift the peak to the left. The third parameter (a) essentially sets the overall height of the curve.

There are various ways of determining the parameters. Because of the importance attached to the peak age, I decided to require that the peak age of the fitted curve was correct. For any unimodal curve of the form $y = f(x)$, the peak occurs when $dy/dx = 0$. If

$$y = ax^b e^{-cx},$$

then

$$\frac{dy}{dx} = ax^{b-1} e^{-cx}(b - cx).$$

Therefore, at the peak, $b - cx = 0$, or $x = b/c$. For English males in 1983, the peak age was at fifteen. Since x = age $- 9$, it followed that $b = 6c$. The

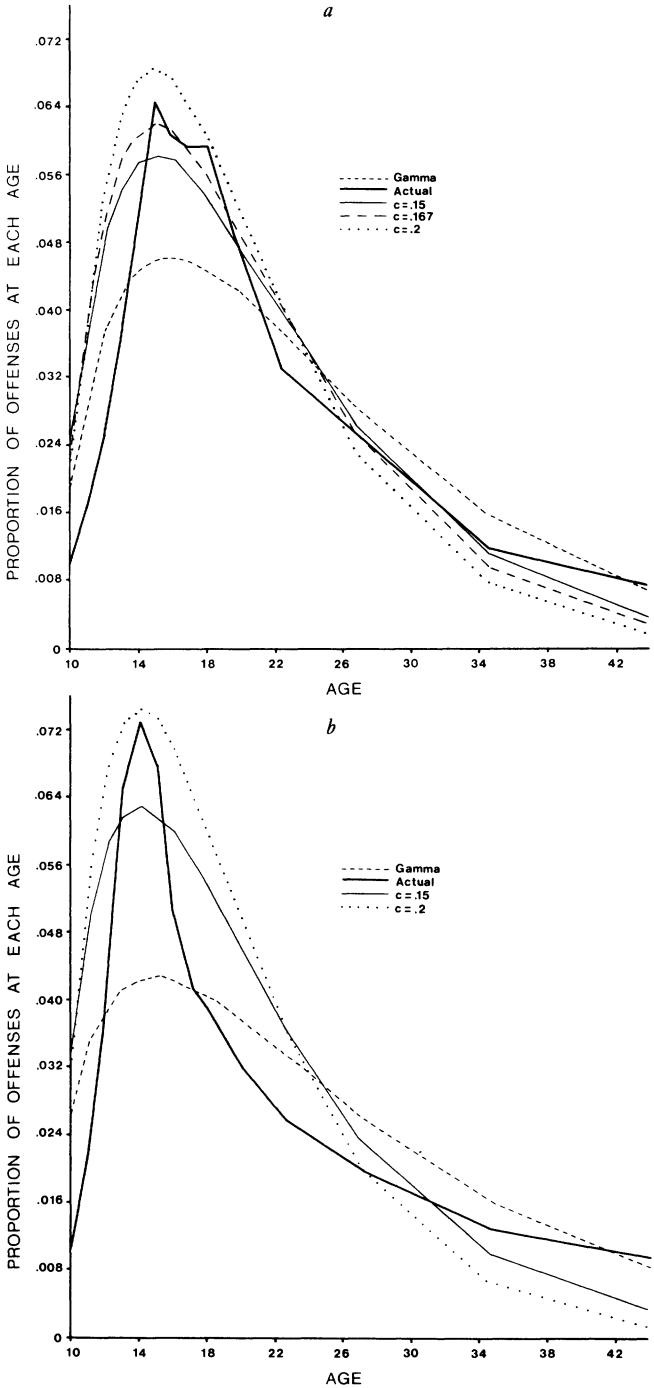

FIG. A1.—*a*, Fitting the age-crime curve for English males in 1983. *b*, Fitting the age-crime curve for English females in 1983. Source of actual curves: Home Office (1984).

parameter a was set to determine a probability distribution with the sum of all the crime rates at all ages as one. Figure A1*a* shows that values of c of .15 and .20 produced reasonable fits to the observed distribution, as did the special case of $c = .167$ (when $b = 1$). For English females in 1983, the peak age was at fourteen, leading to a requirement that $b = 5c$. Figure A1*b* shows that values of c of .15 and .20 (when $b = 1$) again produced reasonable fits to the observed distribution. In both cases, the fit might have been improved by assuming that $x =$ age $- 10$, but it would have been incorrect and undesirable to assume that the crime rate was zero at age ten.

This section shows that it is possible to fit the age-crime curve approximately with a mathematical model containing only three parameters. One (*b*) determines the speed of increase of the curve up to the peak, one (*c*) determines the speed of decrease of the curve after the peak, and one (*a*) determines the height of the peak. The relative sizes of b and c determine the peak of the curve in the teenage years. For $c = .15$, $a = .0287$ for males and .04 for females. Age-crime curves can be compared more easily if they can be summarized by only three parameters.

No doubt a better fit to the data could be achieved with a more complex mathematical model containing more parameters. For example, in figure A1*a*, $c = .167$ is a reasonable fit to the left-hand peak, but $c = .10$ is a better fit to the right-hand tail of the distribution. Therefore, a more complex model might be

$$y = a_1 x^{b_1} e^{-c_1 x}$$

for ages up to forty and

$$y = a_2 x^{b_2} e^{-c_2 x}$$

for ages over forty, with $c_1 = .167$ and $c_2 = .10$. However, there is a trade-off between the complexity of a model and the fit to the data. The most useful model is often a simple one with a reasonable fit, and that is what has been proposed here.

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