

Biology and Behavior

The Launch Pad

Introduction: Are They Born That Way?

Michael Myers, the pathologically sadistic and unstoppable killer of the *Halloween* slasher movies, appears to come out of nowhere. What could possibly explain the horrendous and unremitting violence of a person such as this? His actions appear utterly without rationality or motive. He is nothing more than a killing machine, an evil force that is not connected in any way to humanity. As he is presented in the films, he has no back story, and no set of social circumstances or conditions are described that could possibly explain or justify his behavior. One can only assume that he was simply born this way and that his behavior reflects the inevitable unfolding of his innate inner being.

Obviously, Myers is a mythological character created by the movie makers to serve a dramatic purpose. Yet, the idea that criminals are somehow "simply born that way" has been around a long time in criminology, and it simmers often not very far below the surface of contemporary public discourse on crime. Life course researchers recognize that, as with so many popular ideas, there is a kernel of truth to the claim that our biological makeup influences how we behave and our likelihood of involvement in crime. Yet exactly how biology influences criminality is only just beginning to be understood. Great strides have been made in the past few decades, but there is still much to learn, and it is clear that trying to predict at a young age the future course that a child will follow through life is still an activity more likely to be filled with error than accuracy. As the great Danish physicist, Niels Bohr, once said,

"Prediction is hard, especially when it's about the future." In this chapter, we review the evidence on biological influences on crime, focusing primarily on the fields of behavioral and molecular genetics.

Starting Behind the Starting Line: Biology and Crime

The idea that criminal behavior has biological causes is not new. Almost 125 years ago, the Italian physician Cesare Lombroso proposed his influential atavistic theory of crime (Lombroso 1887). An atavism is the recurrence in an organism of a characteristic or trait that is supposed to have been possessed in the past by the organism's evolutionary ancestors. According to this theory, some criminals are biological anomalies. They are evolutionary throwbacks, literally primitive humans. These individuals are born with the traits of our evolutionary ancestors. In a sense, they are not fully developed humans, but rather part human and part ape. They reflect a reversion to what is assumed to have been the brutish and apish past of the human race. In Lombroso's eyes, they displayed apish stigmata or physical signs of their degeneracy, such as greater skull thickness, long arms, large jaws, and low and narrow foreheads (Gould 1981). These stigmata indicated that the germs of our ancestral past had come to life in these unfortunate individuals. Thus, Lombroso reasoned, their violent criminal behavior only reproduced the "ferocious instincts of primitive humanity and the inferior animals" (Taylor, Walton, and Young 1973). For them, criminal behavior was a natural outgrowth of their biological makeup. They were literally "born criminals."

In fairness to Lombroso, it is important to note that he did not think that all criminals were biological throwbacks. Neither did he believe that biology was the sole cause of criminality. Indeed, in Lombroso's most famous work, *Crime: Its Causes and Remedies*, he advances a sophisticated multi-causal explanation of crime (Gottfredson and Hirschi 1990). He never claimed that all criminals are driven by hereditary compulsion, only about 40 percent. Other criminal acts resulted from passion, rage, or desperation (Gould 1981). But he did advance the idea that certain forms of crime resulted from biological deficiencies and abnormalities.

Lombroso's theories and those of his many followers have long since been discredited. But the idea that there are biological and hereditary components to crime continues to endure and is an important part of the life course approach. From the perspective of the life course and individual development, biology is not destiny; it does not endow us with "ferocious instincts" over which we have no control, as Lombroso thought. Rather, our biological makeup is conceived as one source of influence on our development. One way to explore this influence is through the study of behavioural genetics.

Behavioral Genetics

Behavioral genetics focuses on understanding genetic influences on human behavior, abilities, and traits (Walsh 2000). This field of research is revolutionizing the way that the social and life sciences understand human development and the connection between genes and the environment. Behavioral genetics has shown that the age-old dichotomy between nature and nurture is a false one. In regard to human development, genes and the environment are inextricably connected, and it makes no sense to think that genetic influences and environmental influences on human behavior can be divided into separable ingredients. The idea that genes solely determine anatomical and psychological traits is outmoded. Genes are but one part of a hierarchically organized system of factors located at different levels that mutually and reciprocally affect individual development. The different levels range from genes through cells, organ systems, and organisms up to the individual's social and cultural environment. How genes express themselves is affected by events that occur at higher levels, including events in our physical environment, and by our own behavior (Gottlieb 1996).

A simple example illustrates how genetic expression can be influenced by environmental conditions. Phenylketonuria (PKU) is a recessive, single-gene disease that causes mental retardation if it is not properly treated. Babies with PKU cannot produce enough of a certain enzyme needed to break down phenylalanine, a common substance in our diets, for example in meats, cheese, and nuts. If phenylalanine builds up in a baby's body, it damages the child's developing brain, leading eventually to severe retardation and an early death. Fortunately, PKU can be detected as soon as a baby is born and can be treated by simply restricting the amount of phenylalanine in the child's diet until the early school years. By the time the child is in school, the brain has developed enough that excess phenylalanine will not hurt it (Plomin, Chipuer, and Loehlin 1990). In the case of the gene for PKU, its devastating expression can be completely eliminated if the proper environmental conditions exist. Other genes are like the one for PKU. How they express themselves depends on the environment in which the individual carrying them is located. In a sense, genetic expression can be turned on or off depending on environmental factors (Champagne and Curley 2008).

Gregory Carey (2000) suggests a way of thinking about the connection between genes and the environment that illustrates how the two cannot be separated. He uses the analogy of lemonade. Suppose someone asked you this question: "Is lemonade lemons, water, or sugar?" You might respond that the question is phenomenally stupid and does not make any sense. Lemonade is not any one of these things; by definition, it is a combination of the three. Genes and the environment are linked like lemonade. It makes no sense to ask if your behavior or your personality is genetically or environmentally

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Because our genetic makeup influences how we develop over the life course and because genes are the first, though not necessarily the most important, source of influence to appear on the scene, it is an appropriate starting point for our investigation of crime and the life course. We need to understand to what extent children inherit personality traits and behavioral tendencies from their parents. Further, we need to understand just how biologically based traits may influence behavior. For example, if it is possible to inherit an aggressive temperament or a taste for risky behavior, this suggests that some individuals may be biologically predisposed to behave in ways that are often defined as deviant or criminal by society at large. This is not to say that someone born with an aggressive temperament inevitably will engage in criminally violent acts or that a taste for risky behavior will always be manifested as criminal behavior. It depends on the environmental influences present during the child's development. In interactions with particular environmental influences, aggressive males can become football players rather than muggers, and a risk-lover may find his thrills in the stock market rather than in reckless driving and drug use (Shah and Roth 1974). Nevertheless, possession of these traits may increase the likelihood that certain behavioral trajectories will be followed rather than others.

To fashion a metaphor, we might say that your genetic makeup forms a part of your personal launching pad into life. The angle at which a launch pad is fixed determines the initial direction of the trajectory that a projectile will follow. However, just as the initial trajectory of a projectile can be changed if a strong wind is blowing, our individual trajectories through life can be affected by a myriad of other factors that begin to operate after we leave our initial starting point. Of course, this metaphor is not perfect. A real launching pad ceases to affect the path of a projectile after the projectile is launched, but our genes continue to operate throughout our lives. In addition, we must not forget that genes alone do not determine the angle of our launch pad. Another important component of the launch pad is the family you are born into, but we will get to the family in Chapter 3. For now, we turn to a consideration of the links between genetics, personality, and behavior.

Insofar as genetic researchers have been able to determine, it appears that all of our individual traits are influenced to some degree by heredity, that is, by the genes that we receive from our parents (Carey 2000; Rutter 2007). Height, weight, body type, eye color, hair color, and facial appearance are some of the more obvious physical traits for which it often is easy to see physical resemblances between parents and their offspring. In addition to these gross anatomical characteristics, we also inherit psychological characteristics and behavioral tendencies from our parents (Plomin et al. 1990).

For example, aggressive parents are more likely to have aggressive children than non-aggressive parents (Huesmann, Eron, Lefkowitz, and Walder 1984). Some of these inherited personality characteristics and behavioral tendencies may be implicated in criminal behavior in the sense that people who possess them may be more likely than average to engage in antisocial behavior. Antisocial refers to behavior that "intentionally hurts or harms a fellow group member" (Ellis 1990). For obvious reasons, social groups often criminalize such behavior. Indeed, physical assault on others epitomizes antisocial behavior. What children inherit from their parents, then, is not a "crime gene," but rather a tendency toward antisocial behavior that is in part genetically based (Baker, Bezdjian, and Raine 2006).

Although antisocial behavior and criminal behavior may be related, it is important to keep in mind that they are not identical. Young children may engage in behavior that we recognize as antisocial without it being criminal. It is also important to note that just as antisocial behavior is not always criminal, neither is criminal behavior always antisocial. Breaking the law does not always equate with psychopathology (Rutter 1996). Sometimes people deliberately disobey the law out of a sense of duty and principle, as many people did, for example, during the civil rights protests of the 1960s in the United States. Some forms of lawbreaking are also completely acceptable or normal in subgroups of society. Among college students in the 1960s, recreational use of marijuana was entirely normal even though it was (and still is) illegal in most places.

Investigating Genetics and Antisocial Behavior: Twin and Adoption Studies

Parents shape the behavior of their children in more ways than just by passing on their genes. They also raise their children, teach them, and interact with them for many years. Parents create an external environment for their children, which we usually call the family environment. The family environment may also include siblings and other people who affect how a child develops. However, to keep things from getting too complicated, we will ignore other aspects of the family environment for now and focus on the similarities and differences between parents and children. Because both genes and the family environment are sources of influence on the development of children, how do we know that the similarities between parents and children are not caused by the family environment rather than by genetic transmission? This question is the subject of developmental behavioral genetics. Behavioral geneticists collect and analyze data that come from "pairs of people, who share all, some, or none of their genes, and who did or did not grow up in the same home" (Harris 1995).

Assessing the causal role of genetic factors on behavior is complicated because we have to disentangle hereditary influences from environmental influences, especially the family environment. Hereditary influences refer to genetically caused similarities between parents and their offspring. The family environment refers to the effects that the parents' behavior, especially their interactional style and child-rearing practices, may have on the child. Because a parent's own behavior is influenced by his or her genetic makeup, the parent's genes may have both hereditary and environmental effects on the child (Moffitt 2005b). The parent's genes are passed on to the child, resulting in a hereditary effect on the child's behavior. In addition, by influencing how the parent behaves and interacts with the child, the parent's genetic endowment may also have an environmental effect on the child's behavior.

To disentangle hereditary from environmental effects, behavioral geneticists often study twins and adoptees. (The techniques developed by behavioral geneticists can also be applied to siblings and other pairs of related people, but for the sake of simplicity we discuss only twins and adoptees.) Although the basic ideas behind twin and adoption studies are relatively simple, the statistics involved can be quite complex. Here we will try to give an overview of the methodologies of twin and adoption studies without delving too far into the underlying statistical subtleties. To begin, we need to introduce two terms that are fundamental to behavioral genetics—genotype and phenotype. The term genotype refers to the set of genes that an individual organism carries. Except in the case of identical twins (discussed below) each of us has a unique genotype. Phenotype refers to all of the observable or measurable physical, psychological, and behavioral characteristics that each of us has or expresses. The goal of behavioral genetics is to understand how variation in genotypes and environments affects variation in the expression of phenotypes.

The Logic of Twin Studies

Twins provide the best, though not perfect, data for identifying genetic influences on variation in human characteristics. There are two types of twins, identical (called MZ, for monozygotic) and fraternal (called DZ, for dizygotic). Because they develop from a single fertilized egg that splits into two embryos, identical twins share all of their genes. Fraternal twins develop from two fertilized eggs and hence share only about half of their genes, the same as ordinary brothers and sisters. Identical twins are virtually always of the same sex, but the sex of fraternal twins may be the same or different. Although it is possible to have MZ twins of the opposite sex, it is very rare.

To estimate the extent of genetic involvement in a phenotype, behavioral geneticists compare the degree of similarity between identical and same-sex

fraternal twins regarding a particular phenotype, such as, for example, antisocial behavior. Opposite-sex DZ pairs can also be used in twin studies as long as controls for sex are included in the analyses, but we discuss here only the simpler case of same-sex twins. The comparison approximates a kind of naturally occurring controlled experiment (Wilson and Herrnstein 1985). Twins experience the same prenatal environment and the same family environment. Thus, the effects of these environments can be considered controlled. That is, in theory, they can be considered to be equal and thus ignored when we compare identical and fraternal twins. Because identical twins share all of their genes, whereas fraternal twins share only about half, if identical twins are more alike on a phenotype than fraternal twins then that is evidence that genetic factors influence that phenotype. Using statistical procedures, behavioral geneticists can produce various numerical estimates of the contribution that genes make in regard to a phenotype. These estimates vary between 0 and 1 and are indicated by the symbol h^2 , which stands for heritability. If genes have no influence on a phenotype, then its heritability is 0. If a phenotype is completely determined by genes, such as, for example, eye color, then its heritability equals 1. Behavioral geneticists argue that this strategy of comparing identical and fraternal twins can be used to estimate genetic effects on more than just obvious physical traits, such as height, weight, eye color, and hair color. It can also be applied to psychological traits, such as self-esteem, happiness, or intelligence. Further, it can be used to measure genetic contributions to behavior, including criminal behavior. For example, one could compare twins in regards to their arrest records. If there are genetic contributions to criminal behavior, then identical twins should show greater similarity in arrest records than fraternal twins.

There are different ways statistically to estimate the heritability of criminality or any other biological, psychological, or behavioral trait. All of the different statistical techniques involve making comparisons between pairs of identical twins and pairs of fraternal twins. To illustrate the basic logic behind behavioral genetics, we review one relatively simple measure of heritability known as the *pairwise concordance rate*. (See Box 2.1 for examples of other ways of estimating heritability.) The pairwise concordance rate is defined as the ratio of concordant pairs (that is, pairs in which both twins are criminal) to all criminal pairs. A criminal pair is any pair of twins in which at least one member is defined as a criminal. (If neither twin in a pair is defined as a criminal, then the pair is not included in the calculations.) Thus, the formula for the pairwise concordance rate is $PwCR = C / (C + D)$, where C is the number of concordant pairs and D is the number of discordant pairs (that is, pairs in which only one twin has a criminal record). If criminality were entirely heritable, then identical twins would be identical in criminality, whereas fraternal twins would be only as similar as ordinary

siblings. If criminality is not at all heritable, then identical twins will be no more alike in criminality than fraternal twins. The difference in the pairwise concordance rate between identical twins and fraternal twins indicates the amount of genetic contribution to the trait. If a trait is heritable, the identical twins will have a higher PwCR than the fraternal twins.

For example, in a large and famous study that spurred hundreds of investigations, Karl O. Christiansen examined criminality among 3,586 twin

Box 2.1 Methods of Estimating Heritability

Correlation coefficient Correlation between parents and offspring on some phenotype. The value of the correlation coefficient (called r) varies between -1 and 1 . The closer it is to the absolute value of 1 the greater the potential heritability of the trait.

The difference in the value of the correlation coefficient between identical (MZ) twins on a phenotype and the correlation coefficient between fraternal (DZ) twins on the phenotype is a measure of heritability. If the correlation coefficient for MZ twins equals $.6$ and the correlation coefficient for DZ twins equals $.2$, then the difference is $.6 - .2 = .4$. A crude estimate of heritability using this technique is to double the difference. So, in this example, h^2 would be $.8$, and the phenotype would be considered highly heritable.

Regression coefficient The regression coefficient (R^2) varies between 0 and 1 . It quantifies how much of the variation in one variable can be explained or accounted for by another variable. Regress the parents' score on some phenotype on the offspring's score. The closer the value of R^2 to 1 , then the higher the heritability of that phenotype. R^2 considers one of the variables to be the independent variable and the other to be the dependent variable. Variation in the independent variable is assumed to cause variation in the dependent variable. This makes some sense for parents and offspring, but it does not make sense when comparing twins.

Intraclass correlation coefficient ICC varies between 0 and 1 . The closer it is to 1 the higher the estimated heritability of the phenotype. Unlike the correlation coefficient and the regression coefficient, the intraclass correlation coefficient does not assume any order between the pairs of observations, such as MZ or DZ twins.

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TABLE 2

Number	Criminality	Concordance	Discordance	Concordance
1	Adapted	Adapted	Criminality	Criminality
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pairs selected from the Danish Twin Registry. All of the twins in the study were born in Denmark between 1881 and 1910 and survived at least until the age of 15 (Christiansen 1977). To measure criminality, Christiansen searched the National Police Register and the Penal Register of Denmark. Of the 7,172 individuals under study, 926 individuals belonging to 799 twin pairs were found in one or both of these registers. After dividing the twin pairs by sex and zygosity, Christiansen found that the identical twins had a higher pairwise concordance rate than the fraternal twins for both male and female twin pairs (see Table 2.1). The male identical twins had a concordance rate of .35 compared to .13 for male fraternal twins. Thus, male identical twins were about two and a half times more likely to be concordant than male fraternal twins. For females, the relative difference in concordance rates between identical and fraternal twins was of about the same magnitude. Christiansen's results and those found in other studies (reviewed below) provide evidence that there is a genetic contribution to criminality (Christiansen 1977).

Weaknesses of Twin Studies

Like all empirical methods, the twin method has its weaknesses. One particularly important weakness involves the family environment. The twin method assumes that all twins share a common environment, but this assumption may not be correct in all cases (Christiansen 1977). For example, if the parents of identical twins dress their children in identical outfits, give them identical toys, and otherwise treat them as if they are supposed to be exactly the same more often than do the parents of fraternal twins, then it

TABLE 2.1 Results from the Denmark Twin Study¹

	Male	Male	Female	Female
	Identical Twins	Fraternal Twins	Identical Twins	Fraternal Twins
Number of Twin Pairs	325	611	328	593
Criminal Pairs ²	71	120	14	27
Concordant Pairs	25	15	3	2
Discordant Pairs	46	105	11	25
Concordance Rate (PwCR)	.35	.13	.21	.08

¹ Adapted with permission from Christiansen, Karl O. 1977. "A Preliminary Study of Criminality Among Twins." In Sarnoff A. Mednick and Karl O. Christiansen (eds.), *Biosocial Bases of Criminal Behavior*, pp. 89–108. New York: Gardner Press, Inc.

² Criminal pairs refers to pairs of twins in which at least one twin had a criminal record.

would not be surprising that the former act more alike than the latter. In this case, some of the similarity between identical twins would reflect contamination by the environment. This is called the equal environments assumption.

In order for the equal environments assumption to be violated, however, two things have to happen. First, MZ twins have to experience a more similar environment than DZ twins. Second, the similarity in the environment has to be related somehow to the phenotype of interest. For example, dressing two identical twins the same way when they are infants probably does not affect their criminal behavior later in life. So, that sort of similarity in environment can probably be safely ignored. On the other hand, if MZ twins tend to hang out with the same friends while DZ twins more often have different friendship groups, then the MZ twins would experience a more similar peer environment than DZ twins, and research suggests that is the case (Wright et al. 2008a). This environmental similarity might, indeed, be an important influence on their criminal behavior, because in regards to delinquency, peers matter (Warr 2002). In short, twin studies that do not take into account this source of environmental contamination may overestimate genetic contributions to a trait. There are statistical techniques to correct for environmental contamination, but they have generally not been used in twin studies of criminality (Wilson and Herrnstein 1985).

The Logic of Adoption Studies

As with twin studies, adoption studies involve comparisons between pairs of people and can be used to assess genetic influences on traits. In adoption studies, adopted children are compared to their biological and adoptive relatives (e.g., their parents and siblings). The basic question is simple: Are adopted children more likely to grow up resembling their biological relatives or their adoptive relatives? The extent to which adopted children grow up to resemble their biological relatives more than their adoptive relatives is evidence for genetic influences. The extent to which they resemble their adoptive relatives is evidence for environmental influences. For example, suppose a child is born to parents who consider themselves Democrats, but the child is adopted as a baby and raised by a family that holds conservative Republican political beliefs. If the child grows up and becomes a conservative Republican, this would be evidence that political preferences are not influenced by genetics. Rather, they are learned behaviors.

As an example of the logic of adoption studies, we will look at one of the largest and most well-known studies. It was conducted in Denmark and was based on non-familial adoptions that occurred between 1924 and 1947 (Mednick, Gabrielli, and Hutchings 1987). The original sample included 14,427 male and female adoptees and their biological and adoptive parents. After cases were excluded for missing data, the sample comprised 13,194

adoptees and over 10,000 parents. Criminal court convictions were used as the measure of criminal behavior.

To investigate the connection between the criminal behavior of parents and children, the researchers divided the male adoptees into four groups, depending on whether or not their biological or adoptive parents had been convicted. The rates of court convictions among adoptees were then calculated. Among male adoptees whose biological and adoptive parents had no court convictions, the conviction rate was 13.5 percent (see Table 2.2). This can be considered the base rate for court convictions in this population. If only the adoptive parents had been convicted, the conviction rate for the adopted boys was slightly higher, 14.7 percent. In contrast, in cases where a boy's biological parents had been convicted but the adoptive parents had not, the conviction rate was 20.0 percent. Among adoptees whose biological and adoptive parents both had been convicted, the conviction rate was the highest, 24.5 percent. These results have been interpreted as favoring a "partial genetic etiology," which means that criminal behavior may be at least partially heritable.

The investigators also examined the relationship between the degree of parental criminality and children's criminality. As the number of convictions of the biological parents increased, the likelihood that their sons would also have a conviction went up. Among sons of biological parents who had no convictions, 13 percent had convictions themselves. For sons who came from biological parents with three or more convictions, the rate nearly doubled to 25 percent.

Weaknesses of Adoption Studies

If we lived in a world run only for scientific purposes, adoption studies would be easy to design and carry out. Children would be randomly separated from their biological parents at birth and randomly placed with other parents. Only the scientists would know which children were being switched, and

TABLE 2.2 Results from the Danish Adoption Study: Percent of Sons Convicted¹

	Biological Parents Convicted	Biological Parents Not Convicted
Adoptive Parents Convicted	24.5 %	14.7 %
Adoptive Parents Not Convicted	20.0 %	13.5 %

¹ Adapted with permission from Mednick, Sarnoff A., William F. Jr. Gabrielli, and Barry Hutchings. 1987. "Genetic Factors in the Etiology of Criminal Behavior." In Sarnoff A. Mednick, Terrie E. Moffitt, and Susan A. Stack (eds.), *The Causes of Crime: New Biological Approaches*. Pp. 74-91. Cambridge: Cambridge University Press.

only they would know which children really belonged to which parents. The random assignment of children to parents would constitute a true randomized experimental design for investigating genetic influences.

Thankfully and of course properly, scientists do not run the world and adoptions are not conducted like scientific experiments. Children are adopted at different ages, and adoptive parents are not a random selection of parents. Adoption agencies try to match children to adoptive parents. Parents may behave differently toward children whom they adopt than they do toward children who are their true biological offspring. The emotional connection between parent and child may be strongly conditioned by whether their relationship is adoptive or biological. For all of these reasons, adoption studies are not controlled experiments. Like twin studies, they have inherent weaknesses.

One problem with adoption studies is that the analyses do not provide a fair comparison between genetic and environmental influences (Mednick et al. 1987). Simply knowing that an adoptive parent had been convicted is not a very good indicator of how criminogenic the adoptive home environment is. Adoption agencies do not simply hand children over to parents who are obviously criminal. They go to great lengths to find upstanding parents. In the Danish study, for example, agency rules required parents to be free of convictions for five years prior to adopting, and the adoptive parents had a lower rate of repeat convictions than the biological parents (Mednick et al. 1987). In statistical terms this means that there was probably little variation in home environments for the adoptees, making it difficult to identify environmental effects. In addition, biological mothers who are antisocial and who know that they are going to give their babies away may not take care of themselves or their babies during pregnancy. They may, for example, use drugs or alcohol excessively, smoke, not eat properly, and generally ignore prenatal care. All of these non-genetic factors are likely to have detrimental effects on how babies develop and make them more troublesome and antisocial later in life. In other words, they would look like their antisocial mothers. The similarity between mother and child, however, would not be the result of genetic influences. Rather, it would be caused by non-genetic factors, specifically a poor prenatal environment (Moffitt 2005b).

What We Have Learned from Twin and Adoption Studies

In a massive review of research, Moffitt (2005a) identified over 100 behavioral genetic studies focusing on the heritability of criminal, delinquent, and antisocial behaviors. These studies used a variety of different research designs, such as twins reared together, twins reared apart, family studies, and adoption studies. A variety of different methods were used to measure antisocial behavior, including official records (for example, arrests and court

convictions), self-reports, reports from parents and teachers, formal psychiatric diagnoses, and even some observational measures. The studies also varied substantially in regards to their geographic locations, historical time period, and the ages of the participants (from 19 months to 70 years). This diversity in methodology, measurement, sample design, and timing is encouraging. Although all of the studies identified by Moffitt (2005a) have methodological flaws, they do not all have the same flaws. As Moffitt (2005a, 57) notes, "each design's idiosyncratic flaws are offset by compensatory strengths of the other designs." Thus, to the extent that these different studies converge on a similar finding, we can have some confidence in the validity of that finding.

The studies do converge on one important finding that can be put in a single sentence: *The heritability of antisocial behavior appears to be approximately 50 percent* (Moffitt 2005a, 59). Not all of the studies find a value of .5 for h^2 of course. The estimates for h^2 vary from less than .1 up to .8, but they clearly tend to cluster around .5. This is an important finding, but we have to be clear on what it does and does not mean. For instance, saying that the heritability of antisocial behavior is .5 does not mean that 50 percent of antisocial acts are caused by genes, nor does it mean that the antisocial acts of an individual result half from his or her genetic makeup and half from the environment. Technically, saying that the heritability of antisocial behavior is 50 percent means that variation in genes in a population accounts for 50 percent of the variation in antisocial behavior in that population (not in individuals). In other words, the findings of behavioral genetic research imply that genetically based biological processes are involved somehow in the etiology of antisocial and criminal behavior. This finding also means that theories of antisocial behavior that include only environmental risk factors are at best incomplete and at worst misleading.

Although it is important to find that a tendency toward antisocial behavior is heritable, we must be careful not to misinterpret its significance. Evidence for heritability does not mean that nothing can be done to affect how people behave. Even though a trait or characteristic may be genetically influenced this does not mean that it is therefore immutable. To the contrary, environmentally based interventions can dramatically affect how genes are expressed. Recall the example given above involving PKU. Just because someone inherits the gene for PKU does not mean that they are automatically consigned to a life of retardation. How the gene is expressed depends crucially on environmental conditions. The same is likely to be true of the genes associated with antisocial behavior. In addition, the evidence for heritability tells us nothing about the genes that may be involved. Indeed, it does not even mean that we will be able to find the genes that are involved. Many complex phenotypes, such as intelligence, autism, and schizophrenia,

are heritable, but research at the molecular level has so far not been very successful in identifying the precise genes involved (Risch 2000). Finally, evidence that genetics are involved in the etiology of antisocial behavior does not mean that non-genetic factors are therefore unimportant (Moffitt 2005a). As we will show below, especially in regards to antisocial behavior, the environment plays an exceedingly important causal role.

Genes and the Environment

Up to this point, we have focused on the connection between genes and behavior without paying too much attention to the role of the environment in this process. But the environment is crucial, because the way in which genetic influences on behavior express themselves is always shaped by environmental conditions. Some of the most interesting and important findings produced by behavioral genetics involve the interaction between genes and environment. Indeed, one of the great advantages of behavioral genetic studies is that they provide the very best evidence regarding the strength of environmental effects on development and behavior (Walsh 2009).

Before we go further into the complex world of genes and the environment, we first must introduce a couple of new terms related to the concept of the environment. In their efforts to assess and separate genetic and environmental effects, behavioral geneticists distinguish between two types of environment: shared (or common) and unshared (or unique). The “shared environment” refers to events or conditions in a family that are shared equally by siblings and that are assumed to make siblings similar to one another. For example, if a family has two children, both of them will experience the same socio-economic status, parental education, and parental religious affiliation as they grow up. To the degree that these factors affect how children develop, we assume that they will affect the children equally and tend to make them similar to each other. The “unshared environment” refers to events or conditions that are unique to the individual. For example, in the family example used above, suppose the two children have different friends. The two children would then experience different friendship environments. Children in the same family can have many different idiosyncratic environmental experiences. One may be injured in an accident and have to spend months at home convalescing while the other is trying out new sports. They may have different teachers at school. Unless they are twins, one will be older than the other, and birth order creates a unique environment for each child. For a variety of reasons, parents often treat children differently. In short, even though siblings grow up in the same family, they don’t always experience the same environment inside or outside the home.

As with almost everything involving behavioral genetics, using the methods of behavioral genetics to estimate the strength of environmental effects can be very complicated mathematically. Yet, the basic logic behind the methods is relatively straightforward. In Box 2.2, a simplified explanation of the so-called ACE model is presented. The ACE model is used in twin studies to estimate what proportion of variation in a phenotype is heritable versus the proportions that are due to the shared and unshared environments, respectively.

Box 2.2 Estimating Genetic and Environmental Effects with the ACE Model

To understand the basic logic of the ACE model requires only an understanding of correlation and the concept of variance. The classic twin study assumes that in a large group or population there will be variation in many phenotypes (for example, antisocial behavior). This variation is assumed to result from three factors called, respectively, A (additive genetics), C (shared or common environment), and E (non-shared or unique environment).

Since monozygotic (MZ) twins raised in the same household share 100 percent of their genes (A) and the shared environment (C), any differences between them on a phenotype must be due to the unshared environment (E). Therefore, the correlation between MZ twins on a phenotype provides an estimate of $A + C$. Dizygotic twins share about 50 percent of their genes, which means that the correlation between DZ twins is an estimate of $\frac{1}{2}A + C$. In mathematical terms, then

$$r_{mz} = A + C$$

$$r_{dz} = \frac{1}{2}A + C$$

Once the correlation coefficients for the MZ and DZ twins have been determined, the values for the ACE model can be estimated.

To estimate A, we assume that the difference in the correlations between the MZ and DZ twins is entirely a result of halving their genetic similarity. So, the additive genetic effect (A) is twice the difference between the correlations.

$$A = 2(r_{mz} - r_{dz})$$

To estimate E, we assume that if the MZ correlation is not perfect, that is, if it does not equal 1, then that difference must be due to E, the non-shared environment (because MZ twins are assumed to have exactly the same genes and the same shared environment). Therefore,

$$E = 1 - r_{MZ}$$

Finally, the value for C can be estimated by subtracting A from the MZ correlation.

$$C = r_{MZ} - A$$

As a numerical example, suppose the correlation on a scale of antisocial behavior for 100 MZ twin pairs is .7 and for an equal number of DZ twin pairs the correlation is .45. Given these data, the values for the ACE model would be calculated as:

$$A = 2(.7 - .45) = 2(.25) = .5 \text{ (additive genetic effect)}$$

$$E = 1 - .7 = .3 \text{ (unshared environment)}$$

$$C = .7 - .5 = .2 \text{ (shared environment)}$$

As we will show below, it is now abundantly clear that the unshared environment, the unique experiences that people undergo as they pass through the life course, exerts an extremely important influence on how people develop. Indeed, strange though it may seem, it turns out that the unshared environment is more important than the shared environment in regards to almost all cognitive, psychological, and behavioral phenotypes (Wright et al. 2008a).

But there is one important exception and it involves antisocial behavior. According to Terrie Moffitt, the shared environment appears to account for about 20 percent of the variation in antisocial behavior (Moffitt 2005a; Moffitt 2005b; also Nuffield Council on Bioethics 2002). This means that differences between families in how children are raised influence the children's likelihood of behaving in an antisocial manner regardless of their genetic liability. In short, parents affect the antisocial behavior of their children.

If genes account for 50 percent of variation in antisocial behavior and the shared environment accounts for another 20 percent then that leaves approximately 30 percent for the unshared environment. (Technically, this

30 percent also includes measurement error and the 50 percent that is accounted for by genetics includes gene-environment interactions.) The unique or "person-specific" experiences that each of us undergoes as we grow up appear to exert a strong influence on our involvement in antisocial behavior. For example, two brothers in a family may have different friends, and the friendship group of one brother may be more delinquent than that of the other. This difference in exposure to delinquent peers would tend to make one brother more delinquent than the other. Children may experience any number of unique, non-shared incidents as they grow up, and a wealth of research now indicates that these unique experiences exert extremely important influences on development.

Just how the interaction of genes and environment works is an enormously complicated subject and not well understood. Despite the preliminary nature of much of what is known, however, several aspects of the gene-environment relationship deserve discussion because they may turn out to be vitally important for the life course approach to criminology. These aspects include the influence of environment on the heritability of traits and the power of individuals to shape their environment.

Heritability estimates for traits are not the same across populations, and they may fluctuate within a population as it experiences different environments (Walsh 2000; Rutter 2006). For example, numerous studies have shown that IQ scores are heritable. (We refer to "IQ scores" rather than simply "IQ" or "intelligence" to avoid getting bogged down in the complicated debate over what IQ is and whether IQ tests really measure intelligence (Gould 1981).) But the degree to which IQ scores are heritable varies across populations. Two studies found dramatic differences in the heritability of IQ scores, depending on the social class of the population under investigation. In one study of African-American twins, the heritability coefficient of IQ scores was estimated to be .34 among twins of low socioeconomic status (SES), but among African-American twins of high SES, the heritability coefficient was .72 (Scarr-Salapatak 1971). A study in Sweden found virtually identical heritability coefficients for low and high SES white twins (.30 and .70, respectively) (Fischbein 1980). So, do genes affect IQ scores? Yes. How much? Well, that depends.

The general point to be drawn from this example is that genetic effects are not stable across different environments. Genetic effects on a trait may be strong in one environment and weak in another. If a trait is strongly influenced by genetic factors in one environment, this does not preclude the possibility that we could create another environment in which the degree of influence would be different. In other words, by modifying the environment we can influence how genetic effects are expressed (Rutter 2006). The example used at the beginning of this chapter about PKU illustrates perfectly

how a modification in environment (diet, in this case) can prevent the expression of undesirable genetic effects.

Genetic and other biological effects on criminality also fluctuate across environments. Anthony Walsh (2000) theorizes that in environments where there are many opportunities for crime and where there is little social resistance to crime, genetic effects will be low. But in environments where there are few opportunities for crime and where there is strong social resistance, biological effects will appear to be stronger (Walsh 2000; Walsh 2009). For example, low tonic heart rate is a heritable trait thought to be associated with antisocial behavior and criminality. One study found that among high SES children, low tonic heart rate was a significant predictor of antisocial behavior, but among low SES children it was not (Venables 1987). Cognitive problems significantly predict violent delinquency in advantaged environments but not in disadvantaged ones (Walsh 2000). What these studies suggest is that in disadvantaged environments, environmental causes of crime may overwhelm genetic causes (Walsh 2000). In a neighborhood that is plagued with gangs, drugs, and street violence "good" kids will be exposed to many criminogenic experiences that may push them into delinquency even though they are not at risk biologically (Raine and Venables 1981; Wikstrom and Loeber 2000). Whereas in a neighborhood that is free of these problems, there are no criminogenic environmental forces pushing children who do not have a genetic predisposition toward antisocial behavior, but children who do have such a genetic predisposition will still be affected by that disposition and thus more likely to engage in delinquency than children who lack this predisposition.

Another aspect of the gene-environment relationship that deserves attention involves the power of individuals to shape their environment in ways that may influence how genes express themselves. In addition to responding to the environment in different ways, depending on their personalities and abilities, people shape and select their environments (Rutter 1996; Walsh 2000). By shaping the environment, we mean that individuals behave in ways that provoke certain responses from the environment, which then act back upon the individual, influencing his or her behavior and development in a feedback loop type of effect. For example, a child who is bad tempered and who has a lot of tantrums may provoke parents to use more coercive forms of discipline than would a child who is easygoing and even tempered. Sampson and Laub, for example, found that childhood temper tantrums and difficultness predicted the use of harsh and erratic discipline by both mothers and fathers (1993, 88–91).

A study of adopted children provides another illustration of how children may create their environments (O'Connor, Deater-Deckard, Fulker, Rutter, and Plomin 1998). In this study, the mothers of children who would

eventually be adopted were asked to self-report about their own antisocial behavior. After the children were born, they were classified as being either "at genetic risk" or "not at genetic risk" for antisocial behavior, according to the self-report data collected from their mothers. The children were then followed over a period of time in their adopted homes. From ages 7 to 12, the children who were rated as being at genetic risk for antisocial behavior received more negative parenting from their adoptive parents than did the children who were not at risk. Poor behavior from children appeared to evoke negative parenting. This example illustrates a pattern that is called an "evocative gene-environment interaction."

Individuals may also select their environments or engage in what is called "niche-picking" (Scarr and McCartney 1983). This pattern is formally known as an "active gene-environment correlation." Twin studies show that regardless of whether they are reared together or apart, identical twins often construct or end up in similar environments, and their environments are more similar than those of fraternal twins (Rowe 1994). This is not surprising. It makes sense that to the extent that people can control their lives, they will seek out environments in which they feel comfortable. Some people are "party animals." They like to get hammered and rowdy on weekends. Others are more introverted and would prefer to stay home and read a book. These individual preferences are driven by our genetic makeup, but as with all aspects of genetic expression, niche-picking is only influenced—not determined—by our genetic makeup.

The unavoidable reality of the gene-environment relationship raises complex and interrelated substantive and methodological issues for the life course perspective on crime. Substantively, it means that correlations between external environmental factors, such as employment or marital status, and criminality must always be interpreted with caution. Both cross-sectional and longitudinal correlations between environmental factors and measures of crime are likely to reflect processes of self-selection and should not be interpreted solely as causal connections. Based on their temperaments, talents, and traits, people will sort themselves into different jobs and relationships. Thus, these preexisting differences between people influence both their employment status and their involvement in crime. In order to avoid misinterpreting these sorts of correlations, it is essential to control for preexisting differences in temperament and behavioral dispositions between people (Moffitt 2005a).

The gene-environment relationship also means that we must be careful in how we interpret correlations over time between internal factors, such as temperament and antisocial behavior. We must be careful to avoid the ontogenetic fallacy because longitudinal correlations between temperament and antisocial behavior are always specific to particular environments. For

example, if we find in a sample of children from low-income families that temper tantrums at age 3 are strongly correlated with delinquency at age 15, we should not jump to the conclusion that some kids are just born bad and that the genetic factors that make children prone to temper tantrums will later cause them to develop into juvenile delinquents. If the same children had been born into high-income families, the correlation between early temper tantrums and later delinquency might well be very different. To avoid the ontogenetic fallacy, that is the mistake of assuming that development is the result of the natural unfolding of innate traits, longitudinal correlations between individual level traits and measures of antisocial behavior must be examined in a variety of different contexts and environments.

Molecular Genetics and Antisocial Behavior

Decades of behavioral genetic research involving hundreds of studies strongly indicate that there are genetic influences on the etiology of antisocial behavior (Moffitt 2005a). Although behavioral genetic research has convincingly demonstrated that genes matter, it does not tell us which of the some 25,000 protein coding genes that comprise the human genome are the important ones. Likewise, it does not tell how these particular genes link to biological differences between people that make some people more prone to antisocial behavior than others. Until fairly recently, this is where things had stood for some time. We knew that antisocial behavior was heritable, meaning it was genetically influenced, but we did not know exactly what it was that people inherited that made them different from one another in regards to antisocial behavior. The situation is changing now. Advances in the field of molecular genetics are beginning to reveal some tentative answers to the question of exactly what genetic differences are important. In this section of the chapter, we introduce the field of molecular genetics and review its major findings relevant to criminology.

Molecular geneticists study the structure and functioning of genes at the molecular level. One of the main objectives of molecular genetics is to identify specific genes or combinations of genes that are linked to specific phenotypes. Criminologists are interested in the genes or combinations of genes that are linked to phenotypes such as antisocial behavior, delinquency, and criminality.

Without going too far into the technical complexities of molecular genetics, we need to briefly address the types of genes that are important to us and to explain how variation in genes is linked to variation in phenotypes. Even though each of us has a unique genotype, the vast majority of genes in your body are exactly the same as everybody else's. These genes come only in a single version and most everybody inherits the same version. For

example, many genes do nothing but control very mundane functions of cells such as transporting chemicals from one part of the cell to another. These genes are pretty much the same not only in all humans but in all mammals and indeed throughout all living things. These are not the genes that are important for us. We are interested in genes that cause differences between people. The genetic differences between you and everybody else come about because of what are called *polymorphic* genes. Polymorphic genes are genes that come in different varieties. These different varieties are called *alleles*. For example, a polymorphic gene determines eye color, that is, there are different alleles of the gene that codes for eye color. Depending on which alleles you inherit from your mother and your father (you always inherit two alleles, one from each of your parents), you get blue eyes or brown eyes, or eyes of some other color. Although eye color represents a phenotype that is controlled by a single polymorphic gene, the phenotypes that we are interested in—self-control, antisocial behavior, and aggression to name a few—are not like this. They are not controlled by single genes. Rather, they result from combinations of genes working in tandem.

Genes can be linked to phenotypes in three different ways. First, in some cases, there is a direct link between a single gene and a particular phenotype such as a disease. For example, it is known that Huntington's chorea, a deadly disease that strikes in adulthood, is caused by a mutated version of a single gene (Ridley 1999; Nagin and Tremblay 2005; Rutter 2006). If you inherit the wrong version of this particular gene, you will eventually get Huntington's chorea. Second, the connection between gene and phenotype can be probabilistic rather than deterministic. For example, the phenotypes that criminologists are most interested in, such as low self-control and antisocial behavior, result from combinations of genes working in tandem. These are called polygenic phenotypes. In these cases, particular alleles of certain genes can be considered as risk factors. Inheriting a particular allele raises your risk of expressing a particular phenotype (Beaver 2009). Third, sometimes a gene can have multiple phenotypic effects. For example, the allele that causes PKU also causes hair to lighten and has a number of other effects on the body (Beaver 2009).

At present, most of the research on the molecular genetics of antisocial behavior has focused on genes associated with the production and regulation of neurotransmitters (Wright, Tibbetts, and Daigle 2008; Beaver 2009). Simplifying greatly, neurotransmitters are biochemicals in the brain that influence how the brain works. They allow cells in the brain to communicate with one another, thereby shaping how we think, learn, perceive and feel. Too much or too little of a particular neurotransmitter can make us feel one way rather than another, for example, anxious rather than relaxed. The level of a neurotransmitter is determined by both environmental and genetic factors.

For example, hearing that someone you love has passed away can cause neurotransmitter levels to rise or fall, depending, in part, on your genotype (Beaver 2009).

There are many different neurotransmitters, but so far only a few appear to be important for antisocial behavior. The important neurotransmitters appear to be those involved in the dopaminergic and serotonergic systems. These systems control the production, use, and disposal of two important neurotransmitters—dopamine and serotonin. A number of different genetic polymorphisms are involved in both systems.

Dopamine is a neurotransmitter that is part of the pleasure and reward systems in the brain. It is released when we undergo naturally rewarding experiences, such as eating, having sex, or drinking alcohol, but it can also be released in response to negative experiences. Some research suggests that aggression may also stimulate the release of dopamine. Exactly how dopamine works and exactly what it does are complex issues and the subject of ongoing research. Hence, our discussion here is necessarily incomplete, focusing mainly on how it is linked to various antisocial phenotypes.

Three polymorphic genes that are part of the dopaminergic system have received significant attention from researchers—DAT1, DRD2, and DRD4. As polymorphic genes, each by definition comes in several different allelic combinations, some of which are considered to be “risk” alleles. Research suggests that people who inherit these particular risk alleles are more likely than others to express certain antisocial phenotypes, such as attention deficit hyperactivity disorder (ADHD), alcoholism, conduct disorders, criminal behavior, violent delinquency, and substance abuse (Beaver 2009). It is important to note, however, that these risk alleles are at most only statistically associated with these phenotypes. For example, a recent study using the Add Health data found that males who carried particular alleles of the DAT1 and DRD2 genes displayed higher levels of serious and violent delinquency than males with other alleles (Guo, Roettger, and Shih 2007). However, as the researchers note, this statistical association does not mean that these particular alleles cause delinquency or violence. Indeed, an important issue for the field of molecular genetics is to identify the mechanisms that underlie the association between dopaminergic polymorphisms and antisocial behavior. As we will show below, the answer may lie in gene-environment interactions.

Another neurotransmitter that has been linked to antisocial behavior is serotonin. Among other functions, serotonin plays an important role in the regulation of mood and impulses. For example, imbalances in serotonin levels in the brain may influence mood in ways that lead to depression. Some research indicates that low serotonin levels are associated with aggressive and other types of antisocial behavior (Beaver 2009). One polymorphism that

influences serotonin levels, called 5-HTTLPR, has received a lot of attention from researchers. Findings indicate that individuals who carry what is called the "short" allele of 5-HTTLPR are more likely to display such symptoms as ADHD and conduct disorder syndrome (CD) as well as alcohol and drug abuse problems (Cadoret et al. 2003; Herman et al. 2003). In addition, a large-scale review of studies found a consistent and significant association between low serotonin levels and a number of antisocial and violent phenotypes (Moore, Scarpa, and Raine 2002). Intriguing as they are, however, we must be careful not to over-interpret these associations. It is not clear that the association between any particular gene and violence is causal, and the effects of single genes often are quite small. For example, variation in 5-HTTLPR appears to account for only about 5 percent of the variation in antisocial behavior (Retz et al. 2004).

Like behavioral genetics, molecular genetics research can also shed light on the importance of environmental factors and help us better understand how they work. For example, a study using the Dunedin data found an important gene-environment interaction between a gene called MAOA and child abuse (Caspi et al. 2002). MAOA, which is shorthand for monoamine oxidase A, is a polymorphic gene that is involved in the metabolism of neurotransmitters. Some alleles of MAOA, called "low activity alleles," are less efficient than others at metabolism, and this inefficiency can lead to imbalances in serotonin and dopamine levels.

Child abuse has long been linked to adolescent and adult antisocial behavior (Widom, Maxfield, and National Institute of Justice 2001). Children who are abused when they are young are much more likely to become abusers and violent themselves later in life. Yet, not all abused children become adolescent delinquents and adult criminals. Indeed, almost half of maltreated children somehow manage to emerge from childhood more or less intact (Widom 1989). Until recently, it was not at all clear why some children were able to survive abuse better than others (Vaske 2009).

Using the Dunedin data, Avshalom Caspi and his colleagues discovered that the MAOA gene plays an important role in mediating the effects of child abuse (Caspi et al. 2002b). Specifically, they found that children who experienced severe abuse while young and who carried the low activity MAOA allele scored significantly higher on a variety of measures of antisocial behavior than abused children who carried the high activity allele. For example, as Figure 2.1 shows, over 80 percent of the low MAOA activity children who experienced severe maltreatment displayed conduct disorders compared to about 40 percent of the high MAOA activity children who experienced similar abuse. Figure 2.1 also reveals two other important findings. First, by itself MAOA appears to have no effect on conduct disorders. Of the children who were not abused, nearly identical percentages displayed

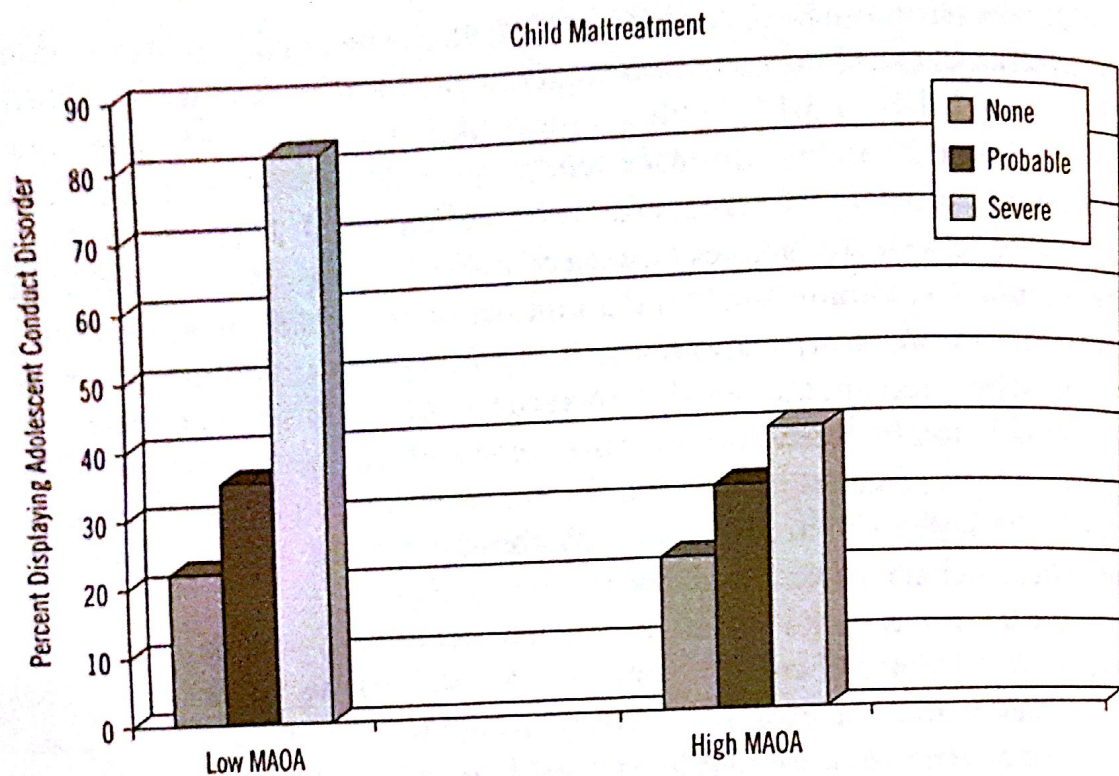


Figure 2.1 MAOA Activity, Childhood Maltreatment, and Adolescent Conduct Disorder

Source: Caspi, Avshalom, Joseph McClay, Terrie E. Moffitt, Jonathan Mill, Judy Martin, Ian W. Craig, Alan Taylor and Richie Poulton. 2002a. "Role of Genotype in the Cycle of Violence in Maltreated Children." *Science* 297:851–4.

conduct disorders regardless of whether they carried the low or high version of the MAOA gene. It is only in combination with abuse that variation in MAOA matters. Second, by itself abuse does matter. Children with the high activity allele who experience abuse are significantly more likely to have conduct disorders than their counterparts who are not abused. But the effects of abuse are greatly exacerbated if the abused child happens to carry the low activity allele of MAOA.

Taken together, behavioral and molecular genetics represent a new approach to understanding the connection between biology and crime. While it would be a mistake to think that our genes determine our behavior, it would also be a mistake to assume that they have no influence at all. We all know that people differ from one another. Some people are introverts. Some are extroverts. Some people are aggressive and bullying, while others are kind and considerate. Some people respond to provocations with their fists, while other people in the same situation simply turn the other cheek. What behavioral and molecular genetics research suggests is that these behavioral and temperamental differences between people are in part a function of their different genetic makeups. This does not mean that the external environment is irrelevant, but it does mean that the environment is not the sole determinant of how we behave as we go through life.

The Biological Bases of Delinquent Behavior: Brain Functioning

If our personalities and behavioral tendencies, including tendencies toward antisocial behavior, are at least partially controlled by genetic conditions present at birth, just how does this influence work? As the review of molecular genetics research suggests, one answer is that genetic conditions influence what are known as brain-functioning variables, that is, neurological and neurochemical conditions and processes in the brain (Ellis 1990). These neurological and neurochemical conditions shape how we behave, think, learn, perceive, and feel (Rowe 1990).

Some people learn more quickly and easily than others. They are born with psychological traits that equip them to achieve success in life relatively easily. Other people have difficulty learning or are born with personalities that make it difficult for them to conform to society's rules or to get along with others. These traits do not guarantee success or failure in life, but they do affect the odds. For example, all other things being equal, it is probably safe to assume that someone who is intelligent, persistent, and adaptable has a better chance of achieving success in life than someone who is unintelligent, impulsive, and intractable (Caspi, Elder, and Bem 1987). The latter individual is more likely to engage in behavior that will be defined by others as deviant or criminal than the former. To the extent that these traits are genetically based, biology is one source of influence on individual behavioral trajectories through the life course.

Numerous studies have found that delinquents perform less well than non-delinquents on tests designed to measure neuropsychological processes (Buikhuisen 1987). As a group, delinquents appear less able than non-delinquents to comprehend and use conceptual material (Yeudall, Fromm-Auch, and Davies 1982). They also perform relatively poorly on tasks that require sequencing skills or perceptual organization (Pontius and Yudowitz 1980; Yeudall et al. 1982). Delinquents appear to have shorter attention spans, lesser powers of concentration, and worse memories than non-delinquents (Voorhees 1981; Yeudall et al. 1982). Finally, as a group, delinquents appear to do less well than non-delinquents in processing visual information (Slavin 1978). These findings coincide with tests showing that delinquents score significantly lower than non-delinquents on intelligence tests, especially in regard to verbal reasoning abilities (Wilson and Herrnstein 1985).

The observed neuropsychological differences between delinquents and non-delinquents involve particular areas of the brain, specifically the frontal and temporal lobes and a region known as the amygdala. These areas of the brain control certain functions related to thinking, perceiving, behavior and emotions that have potentially intriguing links to crime and delinquency.

For example, the frontal lobe is involved in regulating and initiating behavior. It plays an important role in how we formulate plans, assess

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consequences, learn from experience, and modify a course of action based on feedback from the environment (Buikhuisen 1987). The frontal lobe then is involved in all of what are called executive cognitive functions, such as "problem solving, abstract reasoning, concentration, spontaneity, speech production and direction of goal-oriented behavior" (Wright, Tibbetts, and Daigle 2008, 104). Persons who suffer frontal lobe deficits are less able than most to form plans and evaluate potential consequences. They are apt to act impulsively without having a clear idea of what the likely outcome of their actions will be, and they do not profit much from experience (Wright et al. 2009). Thus, frontal lobe deficits may encourage the sort of impulsive, poorly thought out crimes that are characteristic of many criminals (Shover 1996). In addition, some research suggests that people with frontal lobe deficits have difficulty interpreting the social cues that guide us through ordinary interpersonal interactions (Mah, Arnold, and Grafman 2004). They may misunderstand when others are joking or they may misperceive a neutral facial expression as a threatening one.

The temporal lobe of the brain is involved in the subjective consciousness, emotional life, and instinctive feelings of the individual. Structures in this area of the brain are responsible for hearing, auditory perception, and speech comprehension. One particularly important structure in the temporal lobe is the amygdala, which underlies emotions and feeling states. Some research suggests that delinquents may perceive and react to negatively emotionally charged stimuli differently than non-delinquents (Buikhuisen 1987). For example, delinquents may be less able to experience fear than non-delinquents and hence less likely to learn from experience and the threat of sanction. For a sanction threat to work, it must be capable of invoking a subjective feeling of fear and subsequently a desire to avoid the threatened consequence that causes fear. This is called avoidance learning, and it is fear-motivated behavior. Failure to experience fear means avoidance learning is unlikely to occur. This may explain why some individuals appear to be less responsive to punishment than others and why some delinquents continue to engage in troublesome behavior despite their having been caught and punished before.

In effect, both frontal and temporal lobe dysfunctions reduce the individual's ability to adapt to environmental contingencies. To adapt to one's environment requires the capacity to perceive, comprehend, recall, and process information accurately. It requires the capacity to experience emotions such as fear and to learn from those experiences. To the extent that these capacities are deficient in a person, that person is at a disadvantage in adapting successfully to his or her environment.

Non-Genetic Biological Effects

Not all biological effects are genetically based. By that, we mean that people can differ from one another biologically for reasons other than their different genetic makeups. For example, recent research shows that the brain is a work in progress for the first 20 or more years of life (Wallis and Dell 2004). How it develops and the functional capacities it attains are strongly affected by non-genetic factors, such as disease, injury, social experiences (Caspi et al. 2002) and exposure to environmental toxins such as lead (Wright et al. 2008b). Thus, individuals may have what we regard as cerebral dysfunctions or cognitive deficits for a variety of different reasons. Some may be genetic but others are environmentally based. These dysfunctions and deficits can be related to violent and antisocial behavior.

For example, prenatal and early childhood exposure to lead is associated with arrests later in life. In an important prospective study by Wright et al. (2008b), a sample of pregnant women was selected from prenatal clinics in Cincinnati, Ohio. The level of lead concentration in the women's blood was measured while they were pregnant and their children's lead blood level concentrations were measured regularly between birth and age 6. Roughly 20 years later, the researchers examined official criminal justice records in Ohio and ascertained the arrest records of the children in the study. They observed a substantial and statistically significant association between the level of exposure to lead before age 6 and arrests for violent offenses. Greater exposure to lead was followed by more arrests (Wright et al. 2008b).

Although Wright and his colleagues were not able to directly assess why the association between lead and arrests exists, one reasonable hypothesis is that exposure to lead affects intelligence and maybe other characteristics such as self-control or impulsiveness. Other research clearly documents that exposure to lead in early childhood affects brain functioning (Cecil et al. 2011). In the case of the unfortunate children in Cincinnati, then, it seems likely that they are indeed biologically different from their peers who were not exposed to lead, but these differences are not genetically based. Rather, they were environmentally caused.

Summary

In the early stages of life, children begin to develop ways of behaving and interacting with others that over time evolve into different trajectories through life. Both genetic endowments and family socialization experiences influence the direction of early trajectories, including trajectories in crime. Children born to parents who have criminal backgrounds are at greater risk of becoming criminals themselves than children born to parents without such backgrounds (Rowe and Farrington 1997). Evidence suggests that the

connection between the criminality of parents and that of their children is in part genetically based, and that it most likely operates through certain personality characteristics. That there are genetic components to crime and personality now appears beyond dispute. Indeed, it appears that variation in genes accounts for about 50 percent of variation in antisocial behavior. This does not mean, however, that certain people are simply born criminal and that therefore nothing can be done. Behavioral genetics tells us the strength of the correlation between genes and behavior as it is under today's environmental conditions. If the conditions change, so may the correlation. It remains to be determined how susceptible genetic influences are to treatment.

Main Points

- 1 There is substantial evidence that biologically based differences between people account for some of the variation in criminal involvement across populations.
- 2 Behavioral genetics is one source of evidence for biological effects on criminality. Behavioral genetics focuses on understanding genetic influences on human abilities, traits, and characteristics.
- 3 The two main research methodologies used by behavioral genetic researchers to investigate genetic effects on crime are the twin design and the adoption design.
- 4 The heritability of antisocial behavior appears to be about .50, meaning that approximately 50 percent of the variation in antisocial behavior in a population can be attributed to genetic variation among the members of the population.
- 5 Molecular genetics is the study of the link between specific genes and specific phenotypes or endophenotypes.
- 6 There is no such thing as a "crime gene." Genetic influences on crime involve combinations of multi-gene influences and gene/environment interactions.
- 7 At present, the most promising lines of molecular genetics research on antisocial behavior focus on genes that regulate the production and regulation of neurotransmitters, particularly those involved in the serotonergic and dopaminergic systems.
- 8 Not all biological effects on crime are genetically based. While they are developing in the womb or shortly after they are born, the development of children can be affected by a number of environmental conditions, including poor prenatal nutrition or health care, mother's use of drugs or alcohol, or exposure to environmental toxins, such as lead. These conditions can lead to developmental delays or dysfunctions in human infants.



Age, Crime, and Criminal Careers

Since it was first observed by the Belgium statistician Adolphe Quetelet in 1831, no other fact about crime has been as widely accepted as the relationship between age and crime. The relationship, observed at the aggregate level, reveals an increase and peak in crime during the late-teenaged years followed by a steady decline during early adulthood. This relationship serves as the fundamental basis for the study of criminal careers and crime over the life course. Even though the majority of criminologists accept the observed relationship, like many facts in criminology, there is widespread dispute about the interpretation of the age-crime relationship.

One of the more important developments in the evolution of the life-course perspective has been research on criminal careers. This section begins with an introduction to age, crime, and criminal careers by Blumstein and his colleagues, who define a criminal career as the longitudinal sequence of crimes committed by an individual offender. Embedded within the criminal career concept are four components: (a) participation, (b) frequency, (c) duration of the criminal career, and (d) seriousness. Their paper also outlines a number of policy implications that underlie the criminal career perspective.

Fortunately, there exists some healthy disagreement among criminologists about the value of the criminal career perspective and its interpretation of the age-crime relationship, and the nature of offending behavior over the life

course. In the second paper in this section, sociologists Michael Gottfredson and Travis Hirschi offer a serious challenge to mainstream thinking on criminal careers, age, and crime. In their comprehensive critique, Gottfredson and Hirschi challenge the criminal career perspective on its conceptual foundation, theoretical substance, methodological requirements, and ultimate policy prescriptions, concluding that the criminal career perspective is not adequately justified.

The papers in this section highlight some of the fundamental issues related to the nature of offending behavior. Having an appreciation of the current issues and debates surrounding age, crime, and criminal careers is crucial as one moves toward understanding criminal behavior over the life course.

SUGGESTED READINGS

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Introduction

Studying Criminal Careers

ALFRED BLUMSTEIN

JACQUELINE COHEN

JEFFREY ROTH

CHRISTY VISHER

THE CRIMINAL CAREERS CONCEPT

Although widely studied, crime is one of the most elusive subjects of social science research as well as a major public policy issue. It has been addressed by many scholars from a wide variety of disciplines; there has been extensive theorizing about its etiology; the public has consistently ranked crime as a serious problem; and there is intense public debate, even about facts, when considering alternative policies for dealing with crime. Yet, despite the importance of the issues and the amount of research, little definitive knowledge has been developed that could be applied to prevent crime or to develop efficient policies for reacting to crime. Over the past decade, however, some significant progress has been made, and much of that has focused on the "criminal career" paradigm.

A criminal career is the characterization of the longitudinal sequence of crimes committed by an individual offender. A previous National Research Council panel called for "research . . . directed at characterizing the patterns of individual criminal careers" (Blumstein, Cohen, & Nagin, 1978:78). This call was motivated in large part by the realization that crime is committed by individuals, even when they organize into groups, and that individuals are the focus of criminal justice decisions. Thus, a paradigm focusing attention on individuals might be most appropriate both for probing the causes of criminal behavior and for developing crime control policies intended to interrupt or modify criminal careers.

Much research on crime has been focused on aggregate crime rates, that is, crimes per capita in the general population. The criminal career approach partitions the aggregate rate into two primary components: participation, the distinction between those who commit crime and those who do not; and frequency, the rate of activity of active offenders. This partition is important

not only because the two components may be subject to very different influences, but also because different authorities have different levels of responsibility for control of the two components. In particular, education, social service, and mental health professionals all provide services that may reduce participation in crime, while controlling the rate of criminal activity is more central to the decisions of the criminal justice system. A decision on imprisonment, for example, often involves some concern for incapacitating a convicted offender, and so it is a matter of prime interest to estimate how many crimes in the community might be avoided by the removal of that offender.

In addition to the primary components of participation and frequency, two other dimensions that affect aggregate crime rates can be incorporated in the criminal career approach: duration, the length of an individual career (the time from first to last offense), and seriousness, which includes both the offenses committed and patterns of switching among offenses.

Separate consideration of participation, frequency, duration, and seriousness provides a finer resolution in the search for the factors associated with crime than do other common approaches. Traditional research on criminal behavior has often relied on aggregate arrest rates or recidivism statistics to develop or to test various causal models. These conventional measures of criminality, however, confound different aspects of individual offending patterns. For example, a drop in the aggregate crime rate may reflect a drop in the proportion of the population engaging in crime (level of participation), in the average number of crimes committed by active offenders in a given time (individual frequency), or in the average number of years over which offenders commit crimes (duration of activity). A causal factor could strongly affect one of these dimensions, but variation in the others might mask that relationship if the aggregate crime rate is used as the primary measure of crime. Thus, as in most research, when different factors affect different dimensions of a phenomenon of interest, it is extremely important to isolate those dimensions in order to assess the influence of any factor.

Different sets of "causes" may influence individuals' decisions to initiate criminal (or delinquent) activity, the frequency with which they commit crimes, the types of crimes committed, and their decisions to stop committing crimes. Attention to these separate dimensions of the criminal career can thus help to refine theories of criminal behavior, since some theoretical explanations may account for the initiation of deviant acts by teenagers, while very different theories may be more relevant to the termination of serious criminality by adults or to fluctuations in rates of offending during an active criminal career. Thus, basic knowledge about each component of individual criminal careers is fundamental for an understanding of how various factors and government policies may encourage or inhibit criminal activity.

For example, past research on the impact of unemployment on crime has resulted in inconsistent conclusions. However, the inconsistent results may be a consequence of the use of aggregate crime rates as the dependent variable. If the relationship between unemployment and criminal behavior were to be studied at the individual level, the effects might become more focused and

records are distorted by patterns in victims' willingness to report crimes to the police, by differential police attention to different crimes, and by police discretion in deciding which suspects to arrest, which arrests to record, and what charges to file. Arrest histories used in research may be incomplete because of failures to forward notations of all arrests or to include arrests recorded in jurisdictions other than the study site. Only recently has attention turned toward synthesis of criminal career data from both self-reports and official records.

Because of the limitations on the data from both sources, models are needed to convert the observed information into estimates of the principal dimensions of criminal careers. Such models have emerged only in the last decade, largely stimulated by the stochastic-process approach introduced by Avi-Itzhak and Shinnar (1973), which was followed several years later by empirical estimates of various career dimensions. Later, attention shifted to modeling the distributions of those dimensions and identifying their covariates (Chaiken & Chaiken, 1982a; Greenwood, 1982). This panel has contributed to that body by commissioning extensions of the modeling from the perspectives of economics (Flinn, Vol. II) and stochastic processes (Lehoczky, Vol. II).

CRIME CONTROL POLICIES

The criminal justice system's efforts to control crime take three forms: deterrence, rehabilitation, and incapacitation. Deterrence is the symbolic threat broadcast to actual and potential offenders by imposing punishment on identified offenders. Incapacitation is the removal of a convicted offender from the community, usually through imprisonment, to prevent the offenders from committing further crimes. Rehabilitation is the modification of an offender's criminal behavior. These efforts to control crime are carried out in conjunction with efforts to achieve other goals of the criminal justice system, such as imposing "deserved" punishment, enhancing public confidence in the justice system, and maintaining order in penal facilities.

Knowledge for Policy

Knowledge about criminal careers may be especially helpful in developing effective crime control policies. The appropriate response to crime will differ depending on whether the aggregate crime rate is the result of a small group of high-frequency offenders or a large group of offenders who commit

serious crimes. This differential raises questions about the validity of assuming that every arrest is properly associated with a crime and suggests using only those arrests that are followed by conviction. Two types of error are involved: using arrests as indicators of crimes probably involves some errors of commission because of false arrests; using only convictions is more likely to involve errors of omission. In adjudicating specific individuals, of course, the presumption of innocence makes the error of commission unacceptable. In assessing the relative validity of data for research purposes, however, there must be a relative weighing of these two types of error. Reports by criminal justice practitioners indicate that the errors of commission associated with using arrest records are far smaller than the errors of omission that would occur if only convictions were used.

crimes infrequently. In the former situation—low participation combined with high individual frequency—strategies of incapacitation or intensive supervision may well be effective and feasible. But if participation is high, incapacitating many offenders would be impractical, and other crime control strategies involving efforts to prevent participation would be more effective and feasible.

Distinguishing among the various dimensions of criminal careers may also serve to enhance the crime control potential of alternative strategies by more effectively targeting various crime control efforts. The effectiveness of incapacitation as a crime control strategy, for example, depends not only on how frequently offenders commit serious crimes, but also on the duration of an offender's career. From the perspective of incapacitation, prison capacity is used inefficiently if offenders are imprisoned beyond the time at which their criminal activity would have terminated if they were free on the street. Therefore, it is reasonable to ask whether "habitual-offender" laws, which mandate very long sentences, may result in incarceration of offenders well after they have ceased to be serious risk.

Effective policy strategies may also emerge from knowledge about individual offending patterns and the relationship of different attributes of offenders to the dimensions of their criminal careers. For example, early indicators of likely participation in criminal activity, such as educational difficulties or disruptive school behavior, suggest preventive strategies like preschool education of family-oriented treatment, which may reduce participation in crime. In contrast, career modification or rehabilitation strategies seek to terminate or reduce criminal activity through counseling, group therapy, job training, or similar programs. If heavy drinking and drug use are found disproportionately among high-rate offenders intervention strategies might focus on treatment for substance abuse. If frequent, serious offenders can be identified by using characteristics of the offense or the offender, the criminal justice system could use incapacitation strategies effectively.

Knowledge of the factors that are associated with variations in criminal careers can also be helpful in assessing existing policies and practices. For example, if a particular criminal justice system routinely imposes long sentences on offenders who commit serious crimes at a high rate, then it is already enhancing crime control by using incarceration to incapacitate offenders. But if incapacitation decisions implicitly invoke characteristics that are irrelevant to offenders' careers or use characteristics inappropriately—such as imposing long sentences on all young black offenders—then wider use of career knowledge could contribute to incapacitative effectiveness.

At the aggregate level, relationships between criminal careers and demographic variables can be used to forecast changes in crime volume or in the size and composition of prison populations arising from demographic changes in the general population. When combined with data on criminal justice system performance (e.g., arrest probabilities, judge's time required per case, conviction-to-arrest ratios, average time served per incarceration), criminal justice system resource requirements can also be projected. Knowledge of crime-specific offending frequencies and their correlates could also be used to

estimate the incapacitative crime-reduction effects of alternative incarceration policies. Thus, in a number of ways, knowledge of criminal careers and their correlates can refine the analysis of criminal justice policies.

Classification of Offenders

Selective treatment of offenders in the criminal justice system is one way to direct criminal justice discretion more effectively toward reducing the level of crime. Recent research findings have rekindled interest in basing selection explicitly on classifications derived from empirically demonstrated relationships between specific variables and criminal career dimensions, especially the frequency of serious criminal activity. In various ways, such information has long been used as a selection criterion: in formal ways in parole release decisions and in structuring prosecution priorities for "career criminal units" and more often informally in setting pretrial release conditions and sentencing. The recently discussed crime control strategy of "selective incapacitation" at sentencing (e.g., Greenwood, 1982) is based on selection rules defined explicitly in terms of frequency classifications. More generally, classification defined in terms of available, reliable, and legally usable information about offenders and their offenses could be used as one of the bases for selection at such criminal justice decision points as arrest, pretrial release, prosecution, sentencing, and parole.

Selective treatment involves implicit or explicit use of classifications related to the frequency and duration of serious offending. Since those career dimensions cannot be directly observed for individuals in the context of high-volume criminal justice decision making, offender classifications are operationally defined in terms of other variables that are routinely measurable and that are correlated with the frequency, seriousness, or duration of the criminal career. Criminal justice processing on these classifications is, in turn, subject to statutory and constitutional constraints. Within these constraints, classification and selection rules involve articulating a balance between the competing objectives of protecting the community against harm by offenders and protecting the presumed offender from unjust treatment by the state.

Ethical Considerations

Invoking prediction-based classifications in criminal justice decisions raises a number of important ethical concerns. When, if ever, is it appropriate to invoke prediction of future criminal activity in criminal justice decisions? Is a difference in predicted future criminal activity a legitimate basis for imposing different sanctions for the same crime? What level of predictive accuracy is necessary to justify using predictions? What balance is appropriate between the harm done to offenders and that done to the community by different types of prediction errors? Should some effective predictor variables be explicitly ignored for ethical reasons?

These ethical concerns have a direct bearing on the policy uses of scientific knowledge about criminal careers.

Many of the ethical issues considered are matters of long-standing legal and philosophical debate. The resolution of some issues may rest on absolute principles, but more often it involves a balancing of competing ethical concerns. It is thus reasonable to anticipate that the principles governing the use of prediction-based classification rules as an aid to criminal justice decision makers will evolve, changing as public concerns about crime ebb and flow and as improved knowledge about individual criminal careers is developed.

DIMENSIONS OF CRIMINAL CAREERS

The panel's characterization of criminal careers partitions crime into four dimensions: one dimension describes the fraction of a population becoming offenders by virtue of participation in crime; three others describe active offenders in terms of the frequency, seriousness, and duration of their activity. The criminal career paradigm presumes that offending is not pervasive throughout a population, but is restricted to a subset of the population. This subset consists of active offenders—those who commit at least one crime during some observation period. It also presumes that the composition of active offenders varies over time as some criminal careers are initiated and others terminate.

Participation

The measurement of participation—the fraction of a population that is criminally active—depends on the scope of criminal acts considered and the length of observation periods.² Including minor infractions in the scope of crime types greatly increases the level of participation in offending in a population. Longer observation periods also increase participation measures, since more offenders who commit offenses only rarely will be included as will more offenders who are initiating or terminating their criminal activity. Conversely, restricting the criteria to focus only on serious offenses and using short observation periods will result in lower measures of current participation.

In any observation period, active offenders include both new offenders whose first offense occurs during the observation period and persisting offenders who began criminal activity in an earlier period and continue to be active during the observation period. Participation in any observation period thus depends on the number of individuals who become offenders and how long offenders remain active. The longer the duration of offending, the greater

²In the literature reviewed by the panel, the term "prevalence" is often used to refer to the current involvement of some portion of a sample in criminal activity, but occasionally to other measures of participation. The term "incidence" is usually used to refer to the per capita crime rate for the sample but occasionally to refer to individual frequency. In short, these terms have been used inconsistently by many researchers for decades. To avoid confusion, the panel adopted the vocabulary being introduced here. The relationship between the panel's framework and other individual and aggregate statistics on criminal behavior is discussed in the section, "Basic Definitions and Symbols."

the contribution of persisters to measured participation in successive observation periods.

Individual Frequency Rates, Seriousness, and Duration

Individual frequency rates—the number of crimes per year per active offender—vary substantially among offenders, with some having very high rates and others low rates of offending. For any individual, frequency rates may vary over time. Because they commit more crimes per unit of time, high-rate offenders contribute disproportionately to the total measured number of crimes.

Many different offense types may contribute to an individual's frequency rate. The scope of offending for individual offenders may vary from "specialists" (who engage predominantly in only one offense or a group of closely related offense types) to "generalists" (who engage in a wide variety of offense types). The degree of specialization may also vary across offense types, with some offense types committed predominantly by specialists and other types routinely committed by generalists. The mix of offense types committed by offenders may also vary over the course of their careers, with offenders becoming either more or less specialized, and with the mix of offense types escalating or de-escalating in seriousness.

The duration of criminal careers can also be expected to vary across individual offenders. It is likely that many criminal careers are very short, ending in the teenage years. However, some offenders continue to commit crimes into their 30s and even older ages. Thus, it is important to understand average *total* career length and the factors that distinguish offenders with long careers from offenders with short careers. But to understand the impact of decisions made about individual offenders, it is also extremely important to understand *residual* career length, the expected time remaining in an offender's criminal career at the time of the decision.

Basic Definitions and Symbols

To use these concepts to organize research results that have been developed in a variety of paradigms, the panel found it necessary to adopt consistent vocabulary and symbols for labeling the key dimensions that characterize individual criminal careers. This need arises from a confusion in the literature over specific terminology for individual and aggregate crime data. The confusion can be seen clearly, for example, in the variety of referents of the term "rate" in the literature: to a population (e.g., prevalence rate, the fraction of males ever participating in crime); to a time period (e.g., frequency rate, the individual's annual frequency of offending); or to both simultaneously (e.g., crime rate, the annual crime index per capita).³

³Crime itself is a heterogeneous phenomenon, and a variety of terminology has developed to distinguish more serious or less serious crimes. This report is primarily concerned with serious crimes, which are classified herein in several ways. Personal crimes

The symbols and definitions adopted by the panel are displayed in Table 3.1. Symbols in the second column describe the crime process, i.e., the actual offending process; symbols in the third column describe the arrest process from which much of the available information about the underlying crime process is derived.

We begin with the aggregate annual crime rate per capita (C) that is normally reported to the public in the press, and partition it into its component parts: one that focuses on the individual offender and his *individual offending frequency* measured in terms of crimes per year, λ , and another that describes the *current participation rate* of offenders in the population at any time (d). These three key variables are linked by the relationship $C = \lambda d$. Thus, for example, an aggregate crime rate of 1,000 crimes in a population based of 100,000 people could be a consequence of 10 criminals each committing an average of 100 crimes ($d = 10/100,000$, and $\lambda = 100$) or 100 criminals committing 10 crimes each ($d = 100/100,000$, and $\lambda = 10$). The two situations present different problems in the development of crime control strategies.

Much of the literature is not concerned with the current rate of participation in crime (d) but with the question of what fraction of a population has *ever* been involved in crime. This is simply the accumulation of new participants over time. We denote *cumulative participation* by the related symbol D .

Comparable symbols are defined for the arrest process, which is often the only source of information about individual criminal careers. The counterpart to the crime rate (C) is the number of *arrests* per capita per year, A . The average number of arrests experienced per year by active offenders is denoted by μ . The percent of a population that is arrested (or "busted") within some observation period is denoted by b . A relationship similar to that in the crime process exists for the arrest process, $A = \mu b$. Finally, as an analogue to the

encompass homicide, aggravated assault, and rape. Rape and homicide are relatively infrequent, and data are not usually reported separately by researchers for these crimes. The FBI includes these three crimes and robbery in their definition of *violent crimes*. *Safety crimes* include violent crimes and burglary. The five safety crimes plus larceny and auto theft are frequently referred to as *index crimes*, because they are included in the Part I crime index reported in the FBI's annual *Uniform Crime Reports*. In 1981, arson was added to the FBI's crime index; however, because reporting of arson was sporadic before that year, it is rarely included in the research reviewed here. *Property crimes* typically include burglary, larceny, and auto theft. In addition to the Part I index crimes, the FBI also uses the category of Part II crimes, which are recorded separately, are less often reported to police (e.g., white-collar crimes), are less serious (e.g., public order crimes), and include "victimless" crimes (e.g., prostitution, drug use). Some researchers also distinguish between a *felony* and a *misdemeanor*: the former is usually defined in statutes as any crime carrying a sentence length of at least 1 year. *Delinquency* has a less precise definition: it can refer to traditional youth crimes, such as truancy or underage drinking (sometimes called *status offenses* because they are only offenses as a result of the status, i.e., age, of the offender), or it can refer to any crime committed by someone under the age of majority.

Virtually all the research discussed in this report is on male offenders; hence, the pronoun "he" is used exclusively in referring to offenders.

Table 3.1 Glossary of Basic Symbols and Relationships

MEASURE	SYMBOL AND DEFINITION	
Measure Based on Crimes and Arrests	Crime Process	Arrest Process
Aggregate crime rate per capita per year	C Crimes per capita per year	A Arrests per capita per year
Individual frequency per active offender	λ Crimes per year per active offender	μ Arrests per year per active offender
Current participation rate	d Percent of a population committing a crime within a year ("doing")	b Percent of a population arrested for crimes within a year ("busted")
Cumulative participation rate	D Percent of a population ever committing a crime	B Percent of a population ever arrested
Aggregate crime rate per capita: frequency per active offender times participation rate	$C = \lambda d$	$A = \mu b$
Other Measures		
Arrest probability	q = Probability of arrest following a crime ($q = \mu/\lambda$)	
Career length	T = Total criminal career length	
Residual career length	T_R = Average time remaining in a criminal career	
Career dropout rate	δ = Fraction of a criminal population whose careers terminate during an observation period	

cumulative participation rate in crime, we denote the fraction of a population that is *ever* arrested as B .⁴

The arrest process can be viewed as a sampling from the crime process, since not all crimes result in arrest. This linkage is reflected in the "sampling probability" or the probability that a crime will result in an arrest, denoted by q . The two key individual rates, μ and λ , are thus linked through q by the relationship $\mu = \lambda q$. Thus, for example, if an offender commits 8 crimes per year and there is a 10 percent chance that commission of a crime will lead to an arrest, then the average arrest rate, μ should be $8(0.1)$ or 0.8 arrests per year.

The final principal construct for which we use symbols is the *total* criminal career length, T , denoting the number of years over which an offender is criminally active. In many cases, we are more interested in the *residual* career length, the number of *future* years a currently active offender is expected to remain active, and we denote this length by T_R . The fraction of careers that terminate during an observation period is denoted by the career dropout rate, δ .

Obviously, estimates of the criminal career dimensions represented by these symbols will vary by crime type, across different population groups, and

⁴Many studies use an alternative official-record indicator of an event, such as referral to juvenile court or conviction. For notational simplicity, we symbolize fractions involving all these events by B and b , but recognize in discussion the implications of these more stringent thresholds for empirical results.

in different settings. In the text of the report, we occasionally distinguish these different variations of the basic criminal career dimensions. The glossary presented in Table 3.1 should therefore be helpful as a continuing reference in reading that material.

Basic Model of a Criminal Career

The basic criminal career paradigm provides a framework for organizing knowledge about the dimensions that describe individual criminal behavior. It permits specifications or relationships among the dimensions and computation of statistics that describe offending in an observed sample, such as a cohort of individuals followed over time, a cross-section of active offenders arrested during some time interval, or matched control/experimental groups being studied to assess the impact of some intervention.

Figure 3.1 presents a highly simplified framework that introduces the essential concepts of the criminal career. The top of the figure represents a sequence of events during the criminal career of an active offender. On the line, the symbol \times denotes the times at which the offender committed crimes. Symbols of crimes for which the offender was arrested are circled, and the crimes for which the arrest led to conviction are enclosed in a square. The shaded area indicates a period when the offender was incarcerated following conviction. In theory, all incidents marked \times could be reported by the offender in a self-report survey, while only the circled ones could appear in an official arrest record.

A person initiates criminal activity at some time. That first offense may involve a conscious personal choice, it may follow from the development of a new set of associations developed, or it may be an inadvertent consequence of other changes in the individual's life. Once the offender has begun his criminal involvement, it continues for some period of time, perhaps increasing or decreasing in frequency. Finally, the person terminates his criminal career, possibly because of death, but more typically at a relatively young age, after which his probability of offending within any observation period is small enough to be ignored.

The minimum representation, which clearly omits many of the complexities of a real career, is represented in the lower portion of Figure 3.1. The offender is assumed to begin criminal activity at some "age of onset," a_0 , but his official record does not reflect onset until some later time, at the point of his first arrest. Once begun, the offender continues to commit crimes at a constant rate λ during any time that he is not incarcerated. The career ends when the last crime is committed, represented at age a_T in Figure 3.1.

The representation in Figure 3.1 invokes three primary elements of information: the frequency or mean individual crime rate, λ , the age at career initiation, and the duration of the criminal career, T . Each of these three dimensions of a career varies across offenders. This variation may be influenced by personal events associated with the individual or by broader forces such as sanction levels or other community characteristics.

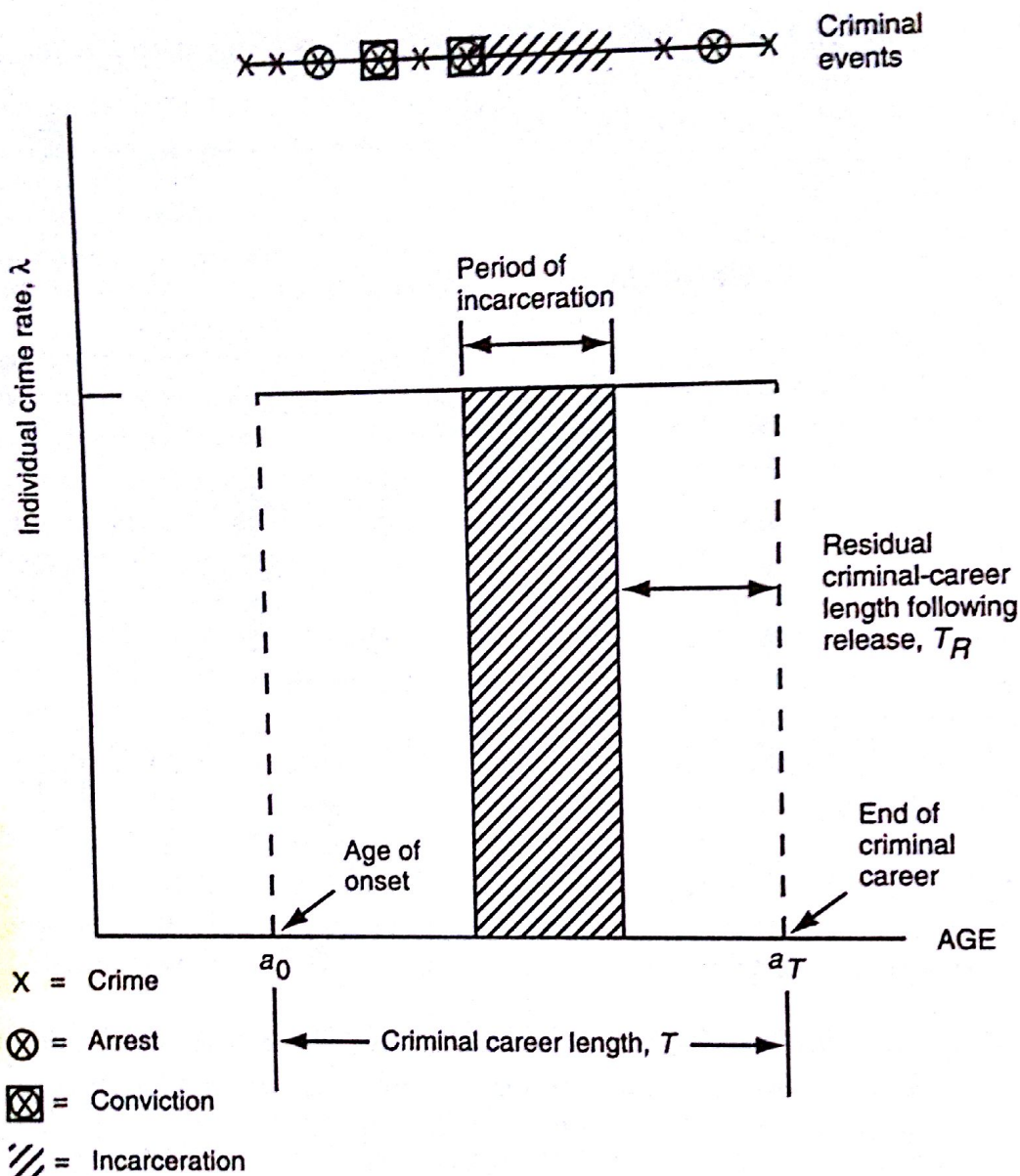


FIGURE 3.1 An individual criminal career

Extensions of the Basic Model

This simple representation can be extended to more richly describe a criminal career. Possibilities include a "start-up" time during which an offender's frequency increases, a decrease in frequency toward the end of a career, and sporadic spurts or intermittent recesses from criminal activity. If the intervals between spurts are much shorter than a typical sentence, the intermittent pattern may be ignored and the average λ used as a consideration in setting sentencing policy. But if the intervals of inactivity are long, then separate estimates are needed for high- and low-rate periods and for the duration of these periods, to adequately estimate average λ . In addition, spurts in activity make it difficult to obtain information from offenders for use in estimating average annual rates. Distinctions among different offense types can also be made, permitting attention to single offenses (e.g., "robbery careers") or to patterns of switching among offense types during a career. In this context, it is important to know whether offenders are more likely

to be "specialists" (who engage in only one or a small group of offenses) or "generalists" (who switch more widely among a range of offenses). Last, extensions of the basic model can address whether offending patterns typically "escalate" in the seriousness of successive events so that crimes later in the career are more serious, or whether they peak in seriousness in mid-career and then begin to decline in seriousness as a career nears its end.

USING THE CRIMINAL CAREER PARADIGM

Interpreting Aggregate Crime Rates

The criminal career paradigm adopted here represents a departure from analyses that have focused on aggregate measures, such as incidence rates of crimes per capita or arrests per capita. Applying to active offenders and nonoffenders alike in a population, these aggregate measures confound the combined contribution of the extent of participation and the frequency of offending by active offenders. Despite this confounding of different aspects of individual offending, variations in aggregate measures have served as the basis for much of the broadly accepted current knowledge on the causes and correlates of crime.

Perhaps the most widely accepted view of crime is that it varies substantially with age. While varying in absolute magnitude, aggregate population arrest rates display a very consistent pattern—increasing rapidly during the juvenile years to reach peak rates in the late teens and then steadily declining.⁵ Figure 3.2 illustrates this pattern for the FBI index offenses of robbery, aggravated assault, and burglary in 1983. Analyses of recidivism rates for identified offenders have also found a decline in criminal involvement for older offenders.⁶ The declines in offending observed in aggregate data and recidivism measures have been characterized as "maturing out of crime" and have been attributed to physiological and social changes with age that lead to gradual reductions in criminal involvement.

These analyses, however, do not tell the full story. The distinctive age patterns in aggregate measures may be due either to changes in participation or in individual frequency rates for active offenders. In the former case, the peak rates of criminal activity would result from growing participation in crime during the late teen years, followed by declining participation as increasing number of offenders end their criminal careers. In the latter case, peak rates would arise from variations in the intensity of offending by a fairly fixed group of active offenders, with individuals' frequency rates increasing during the juvenile years and then gradually declining with age.

⁵Historically, arrest rates peaked in an offender's early twenties. This pattern was observed as early as 1831 in France (Quetelet, 1984); recent reviews of this research can be found in Greenberg (1983), Hirschi and Gottfredson (1983), and Farrington (1986).

⁶See, for example, Glueck and Glueck (1937, 1940), Sellin (1958), and more recently, studies of differential success on parole release (e.g., Hoffman and Beck, 1980; Rhodes et al., 1982; Bureau of Justice Statistics, 1984c).

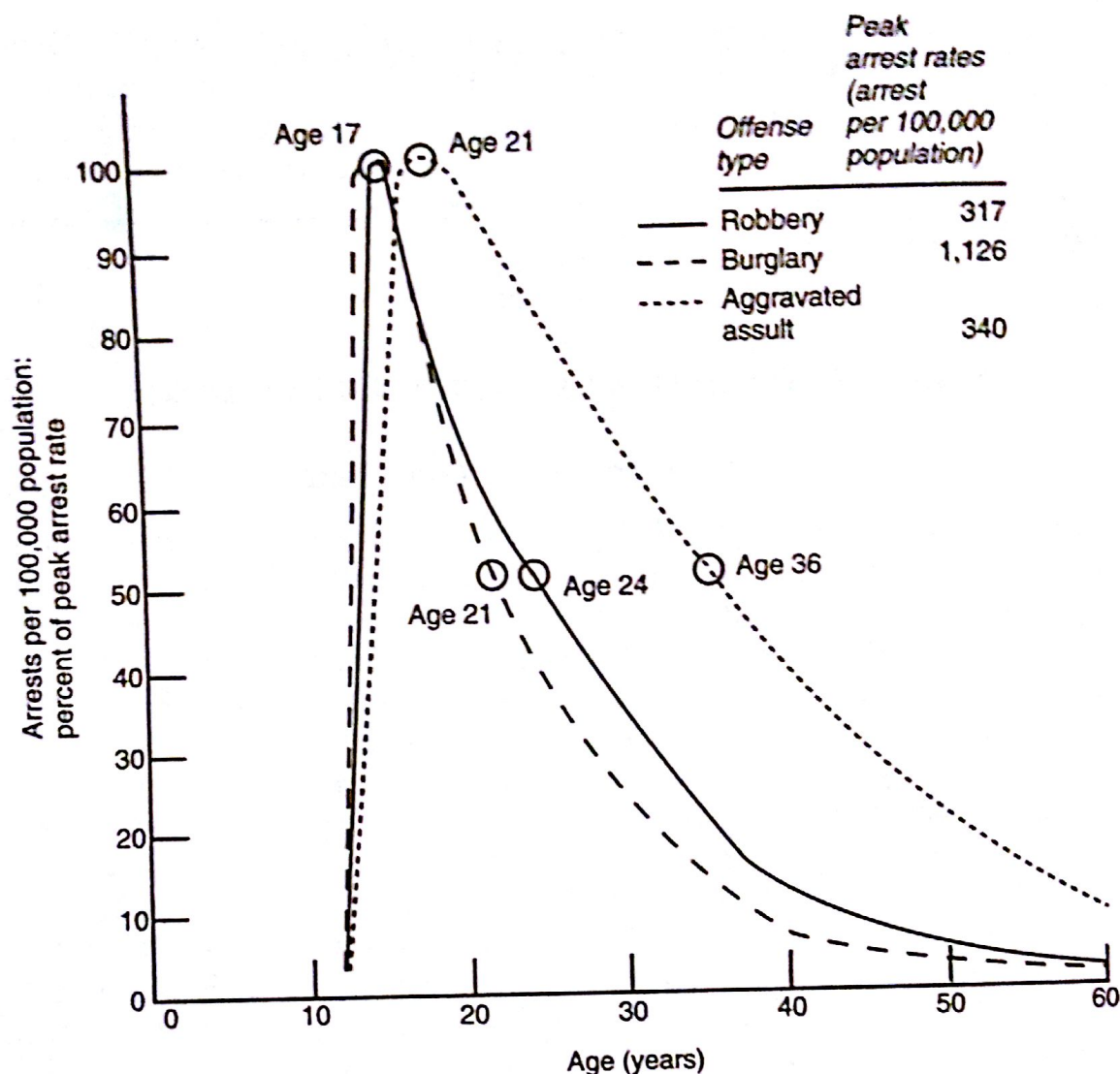


FIGURE 3.2 1983 U.S. age-specific arrest rates (arrests per 100,000 populations of each age). The curve for each offense type is displayed as a percentage of the peak arrest rate. The curves show the age at which the peak occurs (at 100 percent) and the age at which the rate falls to 50 percent of the peak rate.

Source: Federal Bureau of Investigation (1984).

Distinguishing between these alternative processes has both theoretical significance for understanding the causes of crime, as well as operational implications for efforts to control crime. From the theoretical perspective, the participation and frequency alternatives have implications for whether causes should be sought in broad social processes affecting the general population and people's movement into and out of criminal careers or in more isolated processes affecting only active offenders and their activity patterns. From a policy perspective, distinguishing between these alternatives has implications for the relative effectiveness of efforts to reduce peak levels of offending in the late teens by preventing participation by new offenders or by targeting intervention more narrowly at already active offenders.

Similar concerns about disentangling the relative contributions of participation, frequency, and duration emerge when considering other offender attributes. The sex of offenders is potentially an important factor in characterizing individual offending. Very large differences between males and females are observed both in aggregate arrest rates (see Table 3.2) and in recidivism rates (Bureau of Justice Statistics, 1984d), with substantially higher rates for males. Aggregate arrest rates also show large differences in levels of criminal activity between whites and blacks. As shown in Table 3.2, the differences between races increase as one focuses on more serious offense types, and have decreased in recent years. However, large differences between races are generally *not* found when recidivism rates for black and white offenders are compared (Wolfgang, Figlio, & Sellin, 1972:288–289; Blumstein & Graddy, 1982:283–284; Bureau of Justice Statistics, 1984d, Table 10). The differences in aggregate measures by sex and race reflect the combined contributions of differences in levels of participation in crime and differences in frequency for active offenders—distinct phenomena with very different policy implications.

Demographic Correlates of Criminal Careers

Demographic variables have received considerable attention, primarily because they are widely available in data on the general population, are easily observed by crime victims and police, and are routinely recorded for identification purposes in data from administrative and operational agencies. Data on dimensions of criminal careers are therefore widely available for different demographic subgroups defined in terms of age, sex, and race. The strong empirical associations observed between the demographic variables and aggregate arrest rates (see Table 3.2 and Figure 3.2, above) have generated substantial debate about the causes of subpopulation differences. But much ambiguity surrounds the underlying theoretical meaning of differences in criminal behavior between males and females (see Pollack, 1950; Adler, 1975; Nagel & Hagan, 1984), among racial and ethnic groups (e.g., Moynihan, 1965; Berger & Simon, 1974), and most recently, across age (Greenberg, 1983; Hirschi & Gottfredson, 1984; Greenberg, 1985; Wilson & Herrnstein, 1985; Farrington, 1986).

While demographic differences account for large portions of the variability in aggregate measures of criminal involvement, these differentials reflect relationships with other variables that are not yet well understood. For example, over the years, explanations offered for the differences between males and females have variously been biological differences, differences in moral training, differences in socialization experiences, and fewer criminal opportunities for girls because they are more closely supervised. These changes over time in interpretation of demographic differentials reflect the changing social contexts in which this research has been carried out.

Recently, Peterson and Hagan (1984) argued that criminal justice and research on differences between racial and ethnic groups should be viewed in an historical context. In the first half of this century, American research on

Table 3.2 U.S. Sex- and Race-Specific Arrest Rates in 1970 and 1980

Offense Type	ARRESTS PER 1,000 POPULATION				RATIOS ^a	
	MALES		FEMALES		MALE/FEMALE	
	1970	1980	1970	1980	1970	1980
Sex-Specific Arrest Rates						
All (except traffic)	76	81	12	14	6.3	5.6
All Index ^b	14	17	3	4	5.2	4.6
Property ^c	11	14	2	3	4.6	4.0
Violent ^d	2	3	0.2	0.3	8.0	8.3
Robbery	1	1	0.1	0.1	16.2	13.6
	WHITES		BLACKS		BLACK/WHITE	
Race-Specific Arrest Rates	1970	1980	1970	1980	1970	1980
All (except traffic)	35	40	107	97	3.1	2.4
All Index	6	8	28	29	4.7	3.7
Property	5	7	20	21	4.0	3.2
Violent	0.6	1	4	5	7.3	4.6
Robbery	0.2	0.3	3	3	15.4	10.3

Note: Rates are estimated from the number of reported arrests in 1980 (Federal Bureau of Investigation, 1981) and 1980 population figures (Bureau of the Census, 1983: Table 33). Similar data are available for adults and juveniles separately. Arrest rates for 1970 are estimated from the number of arrests reported in 1970 (Federal Bureau of Investigation, 1971) and 1970 population figures (Bureau of the Census, 1983: Table 33). To adjust for agencies not reporting to the FBI, reported arrests are increased by the ratio of total population available from the Bureau of the Census to the population covered by reporting agencies. This assumes that the arrest rates and population distribution in nonreporting agencies are similar to those available for reporting agencies.

^aThese ratios were computed before the arrest rates were rounded.

^bIndex rates include arrests for murder, rape, robbery, aggravated assault, burglary, larceny, and motor vehicle theft.

^cProperty rates include arrests for burglary, larceny, and motor vehicle theft.

^dViolent rates include arrests for murder, rape, and aggravated assault.

criminal behavior focused on the criminality of newly arrived ethnic groups, the Irish and Italian immigrants in large urban areas (e.g., Glueck & Glueck, 1940). Researchers associated high crime rates among urban ethnic groups with a vast array of social problems, including low-paying jobs, poor housing, and weak ties to the "dominant" culture. Slowly the emphasis in racial/ethnic studies of criminal behavior has shifted to comparisons of white and black Americans. This shift in attention probably reflects the changing demographic composition in large cities from a variety of ethnic minorities to blacks as the dominant minority and the most recent arrivals to large urban areas. Even more recently, other racial/ethnic groups—Hispanics and Southeast Asians—have begun to receive special attention (see Moore et al., 1978; Zatz, 1984; LaFree, 1985).

The panel did not attempt to resolve the theoretical debates concerning age, sex, and racial/ethnic differences in criminal behavior. Empirical relationships are reported because so much of the research results are presented in these terms, and because the differences are often large in bivariate comparisons, robust in multivariate analyses, and stable across a variety of geographical and temporal settings and data collection methods. However, by allowing for different causal structures for the initiation, persistence, and termination of offending, the partitioning of the aggregate differentials into separate career dimensions should facilitate better theoretical interpretation. As suggested above, one finding of research invoking the criminal career paradigm has been that the demographic differentials arise more from differences in criminal participation patterns, rather than in the frequency or duration of individual offending.

Incapacitation, Rehabilitation, and Deterrence

Analyses that partition the effects of sanction among participation, frequency, and duration may provide valuable insights for improving the effectiveness of alternative crime control strategies. To date, for example, evaluations of deterrent effects have relied almost exclusively on aggregate crime rates, and evaluations of rehabilitative interventions have relied primarily on recidivism rates. To the extent that participation, duration, and frequency are differentially affected by deterrence, rehabilitation, or incapacitation policies, important relationships may be obscured in aggregate measures. Analyses of the separate effects may provide valuable insights for improving the crime control effectiveness of deterrence and rehabilitation policies. Crime control effectiveness may be improved by targeting some strategies at reducing participation, very different ones at encouraging career termination among active offenders, and still others at reducing frequency among active offenders.

Incapacitation, which is usually achieved by incarcerating active offenders, is frequently presented in terms of the criminal career paradigm. In Figure 3.3, the shaded area indicating crimes prevented during the period of incarceration represents the "incapacitative effect." Crime control effects through incapacitation increase with the magnitude of individual frequency, with the length of incarceration, and with the expected duration of the criminal career. More specifically, higher frequency means more crimes averted for each unit of time incarcerated. And longer career duration means less likelihood of wasting incarceration on offenders who would have ended their careers during the time they were incarcerated and would therefore not be committing any additional crimes whether incarcerated or not.

The incapacitative effect actually achieved will depend on the effectiveness of the criminal justice system in identifying and incarcerating offenders, especially those with the highest rates of offending. The incapacitative effect is reduced if criminals are not arrested, if arrested criminals are not convicted, if convicted criminals are not incarcerated, if sentences are short, or if parole is early. The incapacitative effect is further reduced if the crimes of an incarcerated offender are replaced by crimes by other offenders. This might occur, for

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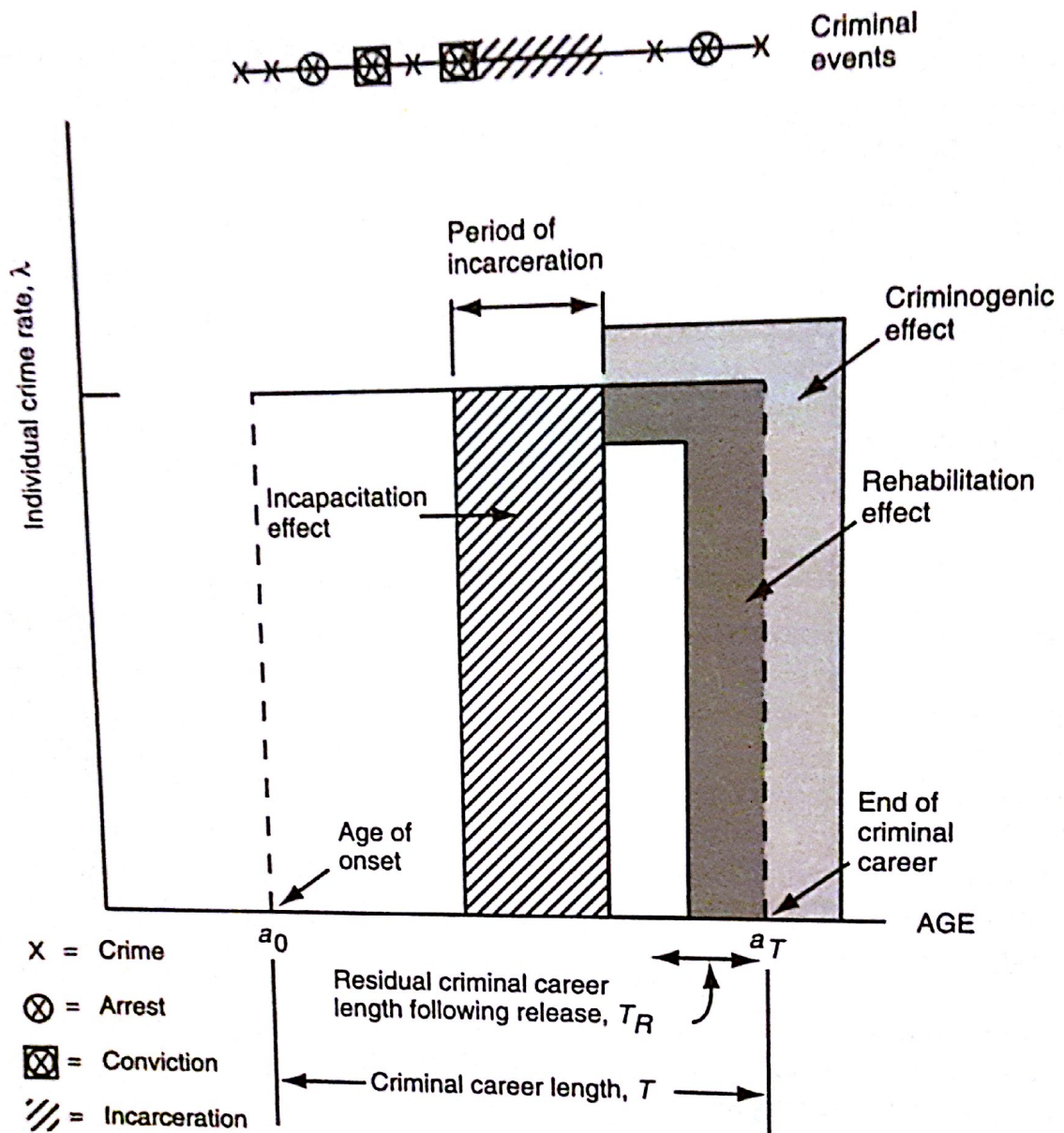


FIGURE 3.3 Incapacitation, rehabilitation, and criminogenic effects in an individual criminal career

example, if the offender is part of an organized illegal economic activity, like drug sales or burglaries organized by a fence; in this event, a replacement might simply be recruited from the available "labor market" to continue the crimes that would otherwise be committed by the incarcerated offender. If the offender is part of a crime-committing group, the remaining members of the group might continue their crimes, with or without recruiting a replacement. Group offending and its implications for crime control are addressed by Reiss (Volume II).

The criminal career construct discussed in this section is most directly related to incapacitation, with its fundamental objective of interrupting a criminal career, but it also relates directly to the other two modes of crime control used by the criminal justice system, rehabilitation and deterrence. In most evaluations of rehabilitation programs, effectiveness is measured in terms

of the recidivism rate. Recidivism is usually measured as the fraction of a release group that is rearrested, usually within an observation period of 1 to 5 years.⁷ If the offender depicted in Figure 3.3 received effective rehabilitative treatment in prison, its effect would be reflected as a change in his criminal career: as a reduction in his offending rate, as a shift to less serious crimes, or as a reduction in his career length. The crimes avoided by rehabilitation are depicted in Figure 3.3 by the dark gray area, "rehabilitation effect." These crimes are averted in addition to those averted through incapacitative effects during the period of imprisonment.

However, incarceration can also be counterproductive, criminogenic, if it leads to increases in postrelease criminality. This effect could be reflected by an increase in frequency or career length, depicted by the dotted area labeled "criminogenic effect," in Figure 3.3, or by an increase in the seriousness of crimes committed.⁸ A criminogenic effect may result from an offender's enhanced identification as a "criminal," his learning new criminal techniques from fellow prisoners, or his strengthening ties to other offenders. The *net* rehabilitation effect is the rehabilitation effect less the criminogenic effect. No empirical comparison of these two effects has yet been carried out in the criminal career context. However, major reviews of evaluations of offender rehabilitation programs suggest that the net aggregate rehabilitation and criminogenic effect is small (Lipton, Martinson, & Wilks, 1975; Sechrest, White, & Brown, 1979).⁹

The third principal mode of crime control by the criminal justice system, in addition to incapacitation and rehabilitation, is deterrence. Deterrence is the crime-reduction effect achieved from the symbolic threat communicated to other offenders and to potential offenders by sanctions imposed on identified offenders.¹⁰ The most common mode for examining the deterrent effect has

⁷Recidivism is often also measured by reconviction or recommitment to an institution. Indeed, there is considerable debate over the "true" value of recidivism, which is unwarranted since measurement at these different stages will provide different numerical values, but usually not different relative values when all measure the same process (see Blumstein & Larson, 1971). This discussion focuses on arrest, but it applies equally to any other recidivism event.

⁸A special case of this effect would be a postponement of the offender's criminal career, so that the residual career length after release assumes the same value it had when incarceration began. Thus, the delay in the career is equal to the period of incarceration, and the crimes avoided through incapacitation are exactly offset by the same number of crimes committed after the career would otherwise have ended. If this effect occurs, incarceration would delay crimes, but not reduce their number.

⁹Sechrest, White, and Brown (1979: 34) caution that the poor quality of the evaluations, and the narrow range of options explored, militate against excessive pessimism concerning the potential of rehabilitation. But despite these qualifications, the failure of hundreds of evaluations to find demonstrable effects suggests that, given the current state of research methodology and correctional management, the net effect is fairly small.

¹⁰This effect is often characterized as "general deterrence" to distinguish it from "special deterrence," which refers to the effect of punishment on later behavior of the person punished. In this report special deterrence is considered an aspect of rehabilitation and the term deterrence refers to the broader crime-reduction effects achieved through general sanction policies.

been cross-sectional studies of jurisdictions with diverse sanction practices to examine the effect of aggregate crime rates of the sanction variation (controlling for other sources of variation in crime rate and in sanction policy). This research has yet to provide good estimates of the magnitude of deterrent effects (see Blumstein, Cohen, & Nagin, 1978). To determine the extent to which the deterrent effects of sanctions work by inhibiting career initiation, decreasing individual offending frequency, or encouraging career termination, it would be desirable for deterrence research to focus more specifically on the effect of community sanction levels on participation, and on the careers of active offenders.

SCOPE OF THE PANEL'S REPORT

The above discussion has presented the basic structural concepts involved in the criminal career paradigm. Aside from its intrinsic value, knowledge about the dimensions of criminal careers, their distribution in the population, and the factors that affect them, is important for a variety of policy uses:

- identifying variables associated with the most serious offenders (in terms of their criminal careers) so that such information may be used by decision makers, within legal and ethical constraints, to anticipate future criminal activity by an offender about whom they must make a processing decision;
- identifying variables that are widely but erroneously viewed as predictors of offenders' future criminal activity;
- improving identification of high-risk offenders and designing programs likely to be effective for them;
- better assessment of the magnitude of incapacitative effects under current or proposed imprisonment policies, possibly leading to more efficient use of limited prison space; and
- planning research programs that will build on existing knowledge and provide more effective policy directions over the next decade.

In its work, the panel focused primarily, though not exclusively, on criminal careers that involve robbery, burglary, and aggravated assault, including incidents leading to the victim's death. This decision was motivated by the scarcity of research on careers that involve only other offense types, by the priority given to those crimes by policy makers, and by the fear of those crimes expressed by the public (see, for example, Research and Forecasts, Inc., 1980). The following crime types were excluded from the panel's primary focus: arson, "white-collar" crime (e.g., embezzlement, securities fraud, mail fraud), and organized crime, for which neither extensive prior empirical research nor the requisite data exist; "victimless" crimes (e.g., prostitution, gambling, and drug use or possession); minor sex offenses and other deviant behaviors, for

which offenders are commonly diverted from criminal justice to mental health or community treatment agencies; minor property offenses; and status offenses (acts that are illegal only when committed by juveniles). Although these types of offenses were not of primary interest, the panel did review studies that related them to the major crime types considered by the panel. For example, the panel was particularly interested in the relationship of minor delinquent acts to later adult careers involving robbery, burglary, and aggravated assault.

The panel also focused primarily, though not exclusively, on research that involved individual-level data on criminal careers of large samples representing clearly defined populations. Examples include analyses of arrest histories of an urban birth cohort, self-reports of offending by high school students, self-reports of incarcerated offenders, and arrest histories of criminals who are active during some observation period. Overall, the research reviewed by the panel represents most of the literature that is relevant to the study of individual criminal careers.

Several categories of research literature that study criminal behavior using paradigms other than the criminal career as defined in this report were not systematically included. Biographical and autobiographical case studies of individual offenders are excluded because the subjects are not generally representative of specific offender populations. Most ecological studies (jurisdiction-level analyses) generally relate aggregate crime measures to community or jurisdictional characteristics and do not include information about dimensions of individual criminal careers. Most recidivism studies lack sufficient detail on the number and timing of postrelease arrests that would be necessary for estimating annual offending frequencies and termination rates; hence, many research reports and program evaluations that used recidivism as the only measure of criminal behavior were not reviewed. Finally the research reviewed is primarily based on U.S. samples; a few studies of British and Danish populations are also included. The panel limited its review almost exclusively to studies published in English.

While much of the panel's work—as with all research—is concerned with the eventual development of causal theory, the panel did not pursue any particular theoretical tradition. This approach reflects the panel's recognition that synthesizing the available statistical descriptions of criminal careers will contribute to many theoretical approaches. However, development and refinement of causal theory about criminal careers should evolve from much more intensive investigation of the various dimensions of criminal careers than the literature now contains. Ideally, this investigation should proceed with a mixture of ethnographic studies to generate detailed hypotheses, longitudinal studies to explore temporal sequences, and field experiments to rigorously test hypotheses.

In considering the effect of influences possibly associated with reducing crime, the criminal career approach—with its focus on individual offenders—naturally suggests various influences that operate at the individual level to prevent initiation of a career, reduce the frequency of offending, interrupt the career, or encourage termination of a career. Individual-level influences on careers (e.g., maturation, family influences) and planned interventions

grounded in knowledge about those influences (e.g., substance abuse treatment, incapacitation through incarceration) were reviewed by the panel. However, they are not the only ways in which individual careers are influenced. Individual criminal careers are also influenced in broader ways, such as through planned community-level interventions and uncontrolled events in the community (e.g., a factory shutdown). These other influences may operate through the social, economic, political, or environmental structure of the community in which individuals grow up or live, the social networks with which they become involved, or the deterrence effects generated by local sanctioning practices. Over time, all of these may change and therefore alter the nature of criminal careers. Therefore, their relationships to careers should be objects of future research. But because so little research is currently available that links these community-level effects to individual criminal careers, the panel did not address these broader relationships.

The True Value of Lambda Would Appear to be Zero

An Essay on Career Criminals,
Criminal Careers, Selective
Incapacitation, Cohort Studies,
and Related Topics*

MICHAEL GOTTFREDSON
TRAVIS HIRSCHI

ABSTRACT The idea of selective incapacitation and the distinction between prevalence and incidence (participation and lambda) justify the search for a group of offenders whose criminality does not decline with age and who may be identified solely on the basis of legally relevant variables. This paper questions such research, arguing that the decline in age with crime characterizes even the most active offenders, and that the distinction between incidence and prevalence does not deserve the theoretical, research, or policy attention it has been claimed to merit (Farrington, 1985, Blumstein & Graddy, 1981-1982). In doing so, it relies on research results widely accepted in criminology. Thus, the current focus of criminological research on the "career criminal," on selective incapacitation, and on longitudinal research remains unjustified.

On March 26, 1982, 14 leading members of the criminological community in the United States met in Washington, D.C., to discuss the future of criminal justice research in this country. The priority area for future research listed first by this panel was "criminal careers." The idea of the career criminal has become so ingrained in American criminological thinking that the panel apparently saw no inconsistency between its substantive emphasis on criminal careers and its procedural view that "no worthwhile research program can be centrally planned" (Wilson, 1982). Four years later, the criminal career notion so dominates discussion of criminal justice policy and so

controls expenditure of federal research funds that it may now be said that criminal justice research in this country is indeed centrally planned.

Nearly every federal agency concerned with research on crime, delinquency, or criminal justice assumes the existence of the career criminal and consequently limits research outside this tradition—if only on the grounds that such research is less likely to deliver results of policy significance.¹ The academic community also tends to adopt career criminal terminology: the language of criminology is now saturated with the vocabulary of this perspective—with terms like *lambda*, *prevalence* and *incidence*, *onset* and *desistance*, *chronicity* and *selective incapacitation*. Being derived from policy concerns, career criminal terminology sounds immediately policy-relevant to those in charge of the nation's research agencies, and the circle is closed. Academics supply the terms that justify the funds provided them. Although not unique to criminology, it is clear that such closed systems survive turnover in those political appointees who direct the expenditure of public funds (whatever their politics). Of course they do more than survive. The large sums spent on pursuit of these terms convince many that the terms have value (which they by now do). On and on, round and round it goes.

If such systems are to be questioned, the questioning must come from the academic community. As of now, this is not being done. Those who make policy about criminal justice research are being advised by leading scholars to continue to concentrate their attention and resources on the career criminal.² This paper seeks to introduce some small degree of tension into this otherwise complacent system. It criticizes the career criminal and derivative concepts, evaluates the research on which they are based, and examines the policy (selective incapacitation) stemming from them.

THE CAREER CRIMINAL

The idea of the career criminal goes back to before the turn of the century, when many Western nations formed special committees to advise government on methods for dealing with the habitual offender (Carbonell & Megargee, nd). Since then, it has been a staple of criminal justice research and policy.

¹According to James K. Stewart, Director of the National Institute of Justice, "Few issues facing criminal justice are more urgent than safeguarding the public from those who make a career of crime" (U.S. Department of Justice, 1983). According to Alfred S. Regnery, Administrator, Office of Juvenile Justice and Delinquency Prevention, "The main objective of our intervention strategies should be to incapacitate the small proportion of chronic, violent offenders" (Tracy, Wolfgang, & Figlio, 1985). In an announcement of research programs for fiscal 1986, the National Institute of Justice (U.S. Department of Justice, 1985) lists four areas relevant to crime causation: "crime control theory and policy," "offender classification and prediction of criminal behavior," "violent criminal behavior," and "design, detection, and crime." In all of these areas, the concepts critiqued in this paper can be fairly said to dominate the description of the agency's interests.

²For some example, the Attorney General's Task Force on Violent Crime (1981) told the Attorney General that as one of his first priorities he "should direct the National Institute of Justice and other branches of the Department of Justice to conduct research and development on federal and state career criminal programs."

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particularly among those concerned with the control of crime. Current enthusiasm for the idea is not, however, the cumulative result of improvements in knowledge resulting from a hundred years of research. Rather, it can be traced to rediscovery of the chronic offender by Wolfgang, Figlio, and Sellin (1972). Walker (1985: 39) illustrates the reaction of the criminal justice community to this discovery: "Their landmark study *Delinquency in a Birth Cohort* is the single most important piece of criminal justice research in the last 25 years and has become a major influence on crime control thinking." The major finding of this study of about 10,000 young men living in Philadelphia is said to be that 627 of them account for the bulk of the crime in the entire group. According to Walker, "since Wolfgang first identified them, those 627 juveniles have inspired the freshest and most important thinking in criminal justice. They are the career criminals." Today, Wolfgang's career criminals appear under a number of aliases in almost all federally funded theory and research on crime. They are habitual offenders, chronic offenders, high rate offenders, or even offenders involved in "a sustained pattern of illegal acts."

Despite persistent interest in career criminals dating back 100 years, little improvement in the definition of them can be observed. According to Gladstone, the chair of an 1895 British committee, the habitual criminal is characterized by "the wilful persistence in the deliberately acquired habit of crime" (Morris, 1951:34). Some 50 years later, Morris (1951:6) provided three elements to define the habitual criminal: "(a) criminal qualities inherent or latent in the mental constitution; (b) settled practice in crime; (c) public danger." Petersilia, author of important research on career criminals for the Rand Corporation, writes (1980, Abstract) "a criminal career may consist of a single, undiscovered, venial lapse or a high level of sustained involvement in serious crime." Finally, even the United States Government provides a definition. According to the U.S. Department of Justice (1983), the career criminal is "a person having a past record of multiple arrests or convictions for serious crimes, or an unusually large number of arrests or convictions for crimes of varying degrees of seriousness."

If the career criminal (or his criminal career) can be identified by a state of mind, by the quality of the acts he commits, by the number of acts he commits, or even by a single, private, excusable lapse, the fact remains that the term is meant to serve a purpose. It is meant to distinguish some kinds of criminals from others. (These others are also variously labelled. They are nonchronic offenders, occasional offenders, sporadic offenders, or nonserious offenders.) If career criminals can be identified, there must be at least two types of criminals. And if there are two, there may be more than two. The concept of career criminals is thus conducive to efforts to classify offenders into distinct groups and, eventually, to efforts to seek unique causes and policy prescriptions for each type. These residual types and the theoretical and practical problems they presuppose are nowadays usually forgotten the moment they are created (for good reason), and as a consequence the idea of the career criminal does not in itself suggest complexity or difficulty. On the contrary, it suggests simple, clear-thinking policy directed at the heart of the crime problem. Whatever else it

has come to mean, the idea of a career criminal suggests that some people pursue crime over an extended period of time, that the intention to pursue such activities may be determined in advance of their pursuit, and that the acts intended can be prevented by timely intervention by the state.

The theoretical and practical appeal of this idea is obvious. Sociologists who see crime as an alternate route to material success, economists who see crime as a form of employment, and psychologists and sociologists who see crime as a consequence of intense training in criminal values and techniques are likely to be comfortable with the notion of a career criminal. Their theories, after all, actually seek to explain such offenders. To the policy-oriented, the idea of a career criminal suggests the possibility of doing something to or for a small segment of the criminal population with notable reductions in crime rates. One currently popular policy option suggested by the career criminal notion is a sentencing strategy that seeks to imprison the career offender.

SELECTIVE INCAPACITATION

Selective incapacitation envisions identification of a small group of high-rate offenders early in their criminal careers in order to isolate them in such a way that they cannot pursue their criminal inclinations. Modern criminological research has held out the hope that such a dream may be realized, repeatedly telling us that the number of offenders responsible for the bulk of crime is remarkably small. In fact, the most frequently repeated finding of crime research is the Wolfgang disproportionality (about 6% commit more than half the crime). Wolfgang has not been alone in his pursuit of such disproportionality. Indeed, one might reasonably conclude that a competition exists among criminological researchers to maximize it. Thus, for example, Mednick (Mednick & Christiansen, 1977:1) reports that in a cohort he studied, "only 1% of the male population. . . accounts for *more than half of the offenses committed by the entire cohort*" (emphasis in original). Wilson and Herrnstein (1985:144) report that chronic offenders account for "as many as 75 percent of offenses" and also for "a disproportionately serious brand of crime." In fact, Cohen (1984) provides 13 additional estimates culled from recent research of the overinvolvement in crime of the active few.

Whatever the precise number of such inveterate criminals, they are sufficiently rare to be extremely attractive targets for crime control policy, suggesting as they do that with minimum effort and cost, maximum reduction in the crime rate may be achieved.

For such a dream to be realized, two conditions must obtain: First, selective incapacitation cannot simply duplicate existing criminal justice practices (which, after all, clearly involve highly selective processes). Second, those selected for incapacitation under proposed policies must be legally and socially eligible for such treatment.

As currently organized, the criminal justice system bases the decision to incapacitate offenders on the nature of their current offense and on the extent of their prior criminal record. Because the offender's prior record carries so much weight in the decision to incarcerate, those receiving prison sentences tend to be older than the average offender. For this reason, selective incapacitation envisions finding offender characteristics other than current offense and prior record predictive of subsequent criminal activity that can be legitimately employed in incarceration decisions. At the same time, selective incapacitation researchers recognize that utility and legitimacy are unlikely to come in a single package, that social predictors of crime provide a poor excuse for differential legal treatment. As a necessary consequence, researchers seek to base the incapacitation decision on characteristics of the criminal record not now considered by the criminal justice system. To do this, they must locate career criminals in the records of the criminal justice system. Such a search in the service of selective incapacitation has several ironies: it leads to an attempt to discover the very being whose discovery launched the search to begin with; it leads to an attempt to identify an obviously serious, dangerous offender whose character has gone unrecognized by criminal justice officials.

This point bears repeating until it is clear. Discovery of the career criminal by criminologists stimulated the idea of selective incapacitation. To implement the idea of selective incapacitation, one need only identify career criminals. Unfortunately, the career criminals who suggested the idea in the first place cannot be found when it comes time to implement the policy. Where did they go? What happened to them? It turns out that the particular career criminals identified in criminological research are no longer active and their replacements cannot be identified until they too are on the verge of "retirement." The 20-20 hindsight of career criminal research turns out to have been misleading. When asked to identify career criminals in advance of their criminal careers, the research community requests additional funding.

Still, the idea of imprisoning career criminals seems perfectly plausible. However, the idea has little merit. In fact, research has shown that the idea that "criminals" have "careers" is wrong. If crime represents a career, then it follows that it must have a beginning and an end, a determinable length, and a certain tendency or direction (for example, increasing skill, increasing seriousness, or increasing profitability). It follows further that those embarked on a criminal career may tend to specialize in certain crimes or to advance from one crime to another in predictable ways. These ideas survive as long as it takes to determine that the average burglar is about 16 and that he "advances" to robbery a few years later because burglary requires too much planning (for example, being at a particular place at a particular time). If there are lingering doubts about the veracity of the career criminal idea, the research literature should put them to rest. Consider the findings of Petersilia (1980): "the propensity to plan does not increase with age; it appears unlikely that the observed relation between declining arrests and age results from more skillful crimes by more seasoned criminals; the tendency to work alone becomes more pronounced as the career progresses; those who worked [at legitimate jobs] during their teens or early twenties . . .

had more police contacts and higher seriousness scores than those who were unemployed; few 'robbers' specialize in robbery."

There is, then, virtually no evidence of offense specialization anywhere in the life cycle of ordinary offenders (rape and assault are intermixed with crimes for pecuniary profit); most offenses do not require any particular skill (doors are simply smashed open), knowledge (little training is required to snatch a purse), or even expectation of great gain ("hand over all your big bills," the career criminal says to the cabbie); there is no evidence of escalation of any sort as the offender moves from adolescence to adulthood; and the crimes that occur most frequently are the crimes most frequently committed by "career" criminals.

One way to save the career criminal in the face of the overwhelming evidence that his career starts at the bottom and proceeds nowhere is to suggest that somewhere there is a set of offenders whose careers are not described by these tendencies, a set of offenders who continue to commit large numbers of offenses over an extended period of time. This subset of offenders must, by definition, also deviate from the general tendency of crime to decline with age.

AGE AND CRIME

Incapacitation researchers realize that, in general, the commission of crime declines with age and that in order for incapacitation to achieve maximum effectiveness it must occur during the time that the incapacitated offender would be committing criminal acts at a high rate. The decline in crime with age is therefore a direct threat to incapacitation policy. It makes little sense to attempt to prevent crime by locking up people who would not be committing crimes were they free. The decline in crime with age also suggests that the optimal point of intervention for purposes of incapacitation is just prior to the age at which crime peaks—that is, 13 or 14. This too is a direct threat to incapacitation policy since it suggests lengthy incarceration of children in the interest of crime prevention.

There is a potential solution to these unfortunate problems: if the true career criminal starts late and maintains a high level of criminal activity during his adulthood, the impediment to incapacitation policy presented by the general decline in crime with age is removed. Awareness of this solution has led recent incapacitation research to focus attention on adults. Strange to tell, it is now claimed that research has revealed existence of such offenders: high rate, chronic, persistent, habitual adult offenders.

The authors have spent some time investigating the relation between age and crime (Hirschi & Gottfredson, 1983). This investigation led to the conclusion that the propensity to commit criminal acts reaches a peak in the middle to late teens and then declines rapidly throughout life (see, for example, Figure 4.1, which shows Uniform Crime Report arrest rates for 1983, by age). Further, this distribution is characteristic of the age-crime relation regardless of sex, race, country, time, or offense. Indeed, the persistence of

this relation across time and culture is phenomenal. As long as records have been kept, in all societies in which such records are available, it appears that crime is an activity highly concentrated among the young. These conclusions are controversial only insofar as they apply to other times and cultures. Current aggregate American age distributions of crime are not in serious dispute (Greenberg, 1985).

As is apparent from Figure 4.1, if the career criminal described by current incapacitation research exists, he is thoroughly disguised in arrest statistics for the general population. These statistics do not reveal a tendency for crime to level off at a high rate for any segment of the population. The issue thus turns directly on an empirical question: Is the age effect present in all segments of the population, including those now labelled "chronic offenders"?

Early research suggested that persons identified as offenders early in life were less likely to offend as they got older. In 1940, Glueck and Glueck reported the results of a long-term follow-up of 1,000 delinquents. The Gluecks recorded the offenses committed by the delinquents from the time they were 11 to the time they were 30. Being a true longitudinal study in which the same individuals are followed over time (the preferred research design of modern incapacitation researchers (Farrington, 1985), the Gluecks' study allows one to examine the age distributions of specific offenses. Some of these distributions are shown in Table 4.1.

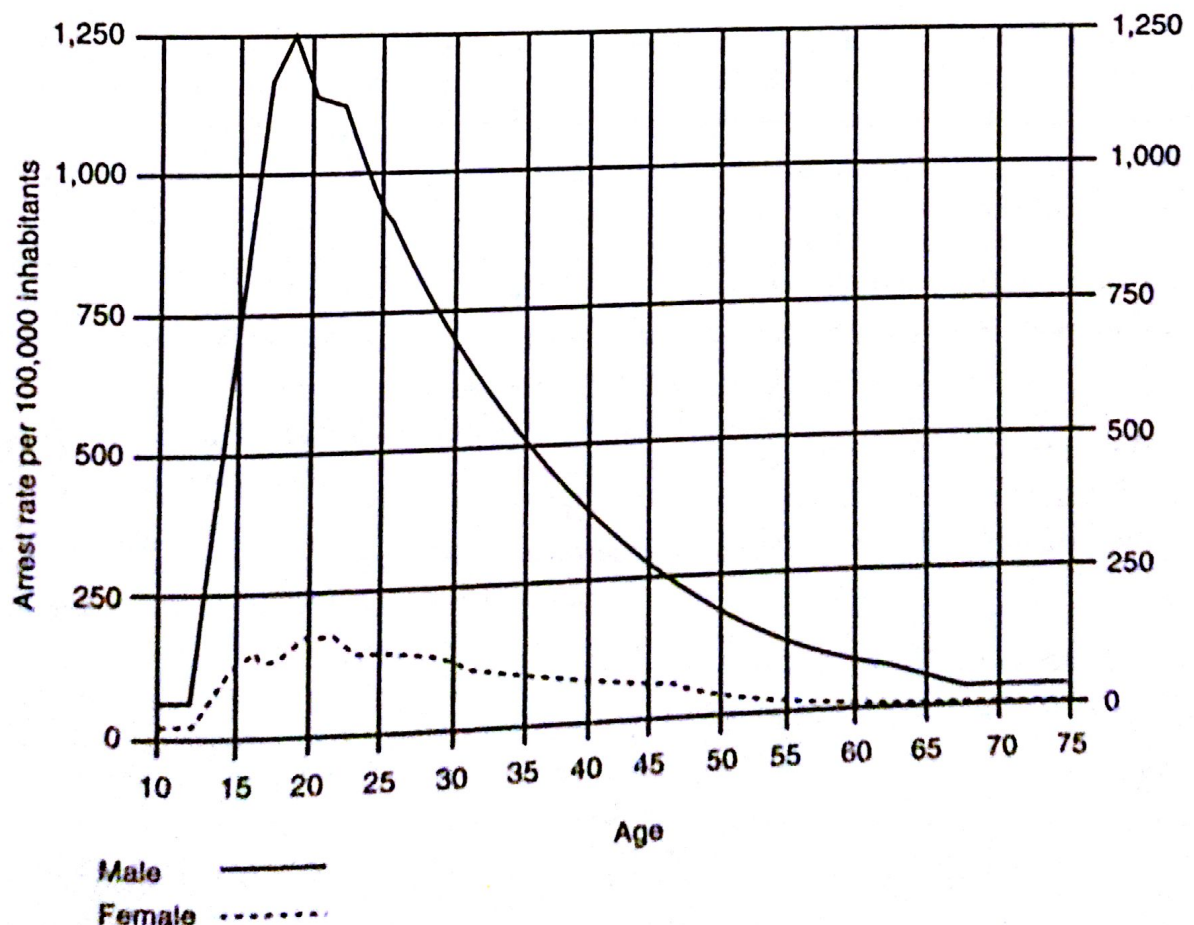


FIGURE 4.1 Age-crime relationship

Source: U.S. Department of Justice, 1985b: 346

Table 4.1 Number of Arrests by Age and Type of Offense, Glueck Longitudinal Study of 1,000 Delinquents

Crime	Age 11-15	16-20	21-25	26-30
Property	829	1,272	613	390
Disorderly Conduct	286	580	755	483
Violence	33	115	183	147
Drunkenness	0	242	724	922
Family and Children	0	14	40	71
All Other Arrests	185	496	232	182
Total Arrests	1,333	2,719	2,547	2,195

SOURCE: Glueck and Glueck, 1940: 310.

Nothing in the Gluecks' longitudinal arrest data gives comfort to the career criminal notion. The age distribution of specific crimes in their data looks very much like the age distribution in the cross-sectional data of the Uniform Crime Reports shown earlier. Crime as a whole peaks in late adolescence because the disproportionately frequent property offenses peak then. Violent offenses peak in the early 20s. Such crime as drunkenness and family and child abuse appear to increase throughout the 20s. This too is no surprise. All available data, whatever the research design producing them, show these distributions. (It seems unlikely that those interested in incapacitation have in mind control of drunkenness and intrafamily violence.) It is therefore apparent that even in a sample selected for the delinquency of its members, crime declines with age.

Other research well known to criminologists strongly suggests the same conclusion. For example, research on the effectiveness of treatment for highly delinquent youth, research that has produced controversial findings with respect to the effectiveness of treatment, has always shown that even these youths "mature out" of crime (Empey & Erickson, 1972; Murray & Cox, 1979). The hypothesis that always competes with the hypothesis that the treatment has worked is the hypothesis that the observed decline in delinquency is a consequence of age. Maturation reform is so pervasively observed, even among serious delinquents (career criminals?) that it is the dominant explanation of change in criminal activity during the teen years.

Undaunted by such seemingly definitive research, researchers in the selective incapacitation tradition claim to have found a group whose crime rate fails to decline with age. The most influential work of this type is by Blumstein and Cohen (1979), whose study of offenders in Washington, D.C., is widely taken to show that crime does not decline with age among career criminals when the data are properly analyzed. According to Greenberg (1985), the Blumstein and Cohen study shows that "what seem to be age effects disappear when cohorts are followed over time," and Blumstein (1982)

himself later summarizes his study as showing that "offenders who remain criminally active commit crimes at a fairly constant rate over age." Farrington (1985:33) is equally confident of these results:

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 20 to above 30. However, they explained away this decrease on two grounds. First of all, there were cohort effects confounded with age, since arrest rates were higher among those born more recently. Secondly, the calculations did not take account of time incarcerated, which affected the older offenders more than the younger ones. When Blumstein and Cohen allowed for both of 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. What varies is onset and termination, not crime rate.

If Greenberg's and Farrington's (and Wilson and Herrnstein's (1985:138-139)) assessments of the Blumstein and Cohen research are correct, it seems fair to say that there is merit in pursuing the selective incapacitation research agenda. If, on the other hand, the data amassed by criminologists outside the incapacitation tradition are to be believed, it seems fair to say that the career criminal research agenda should be abandoned, along with the criminal justice policy it suggests.

The Blumstein and Cohen study leads to conclusions contrary to established facts in criminology and does not justify rejection of these facts. If this is correct, pursuit of an empirical basis for a policy of selective incapacitation of career offenders is a waste of scarce research resources and diverts public attention from crime control policies of potential merit. The discussion therefore turns directly to the Blumstein and Cohen study.

BLUMSTEIN AND COHEN, 1979

Given their policy problem, Blumstein and Cohen first confront the age distribution of crime as it has been revealed by official statistics as long as they have been collected. How, they ask, could crime rates appear to decline with age year after year if in fact the rate with which individuals engage in crime does not decrease as they grow older? The solution adopted is to suggest that what is observed as an age effect in each yearly depiction of the crime rate by age is in fact a rising crime rate effect. Persons born recently have higher rates of crime at all ages than do persons born earlier. Therefore, at any given point in time, the mix of cohorts yields the illusion of an age effect.

This explanation would be plausible if the world were invented in 1975. In order for it to be true, however, every new cohort since crime statistics were invented would have to be substantially more criminal than its predecessors.

Put another way, the Blumstein and Cohen hypothesis could be true if the crime rate had risen steadily throughout the lives of the oldest cohort in the comparison. Since the age distribution of crime has been invariant for at least 100 years, the Blumstein and Cohen hypothesis requires a steady increase in the rate of crime for about 170 years. One need not go back so far to prove them wrong. One need only show that the crime rate actually declined during portions of this period or that the age distribution of crime has survived the much-publicized current decline in the crime rate. Both are easily shown. Figure 4.2 shows the age distribution of male robbers as revealed by the Uniform Crime Reports for 1970, 1974, and 1983. The robbery rate in 1970 was low (very low by current standards). The robbery rate in 1974 was near its historic high, a rate not equaled as long as these statistics have been reported. The robbery rate in 1983 was down from the peak in the middle to late 1970s. As Figure 4.2 shows, apart from differences in levels of crime, the age distributions in these three periods are virtually indistinguishable from each other, contrary to the requirements of Blumstein and Cohen's logic.

It is still possible, however, to confuse offenders whose pattern of offending is consistent with an age effect with "career criminals" whose pattern of offending is inconsistent with an age effect. An age distribution of crime does not require that rates of crime by age be identical for all persons in the population. It does not require that crime rates for individuals actually decline during periods in which crime rates for the population as a whole are declining.

Consider statistics on the performance of professional baseball players (statistics that in many respects parallel crime statistics). A problem of considerable interest in such statistics is the length of the career of the superstar—that is,

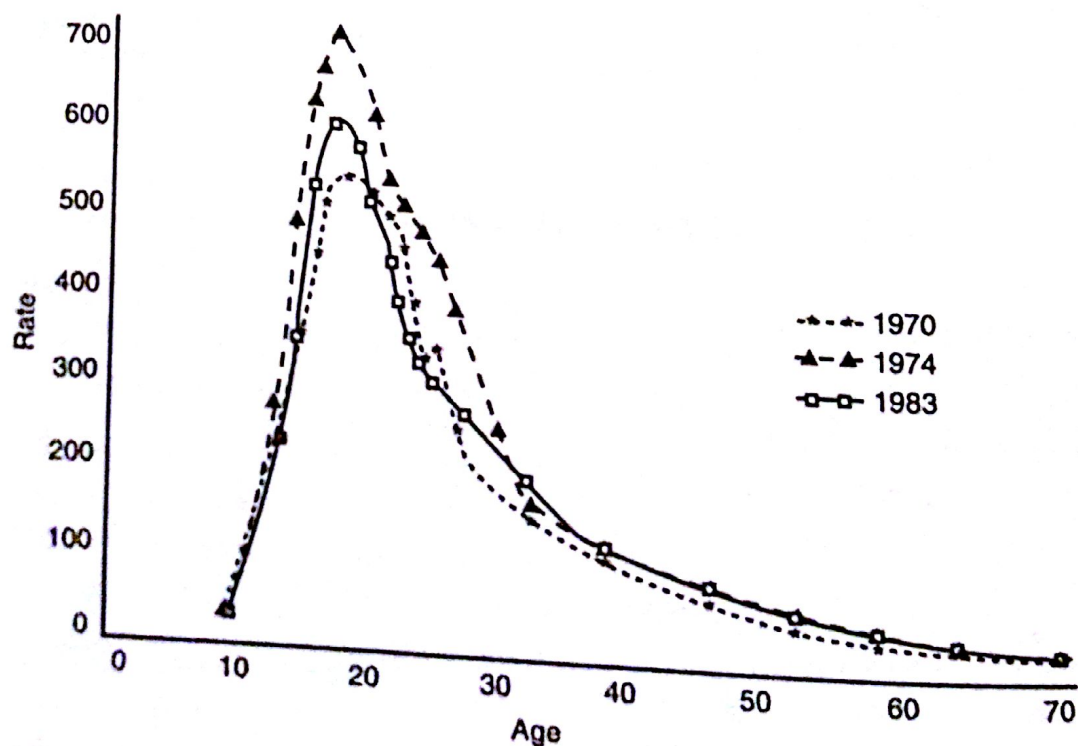


FIGURE 4.2 Number of robbery arrests per 100,000 males

until what age can superstars be expected to continue their excellence? One might conclude that age does not affect superstars to the same degree it affects ordinary players. After all, many superstars are still around and doing quite well at advanced ages (mid to late 30s). The data, however, show that (1) superstars have the same age curve as other ball players; and (2) at every age, superstars are better than other players at the same age (James, 1980). These facts leave an impression of unchanging performance over a restricted period of time because any player whose performance falls below the level acceptable for the major leagues is dropped from rosters regardless of prior record. The data also give the impression that the performance of superstars does not decline with age. But this is only because the performance of the superstar at advanced ages is well above that of ordinary young major league players. Mickey Mantle at 38 was better than Gene Michael at 28. Mickey Mantle at 38 was not, however, as good as Mickey Mantle at 28.

Applied to the crime rate, the baseball analogy suggests that crime may decline with age for several reasons: (1) some offenders so reduce the level of their criminal activity that they are no longer of interest to the criminal justice system; (2) some offenders continue a level of activity sufficient to be of interest to the criminal justice system, although this level is considerably below the level maintained during their peak years of activity; and (3) some offenders maintain a level of activity so high that they are removed from the game. In the criminal justice system as it now operates, superstars have the shortest rather than the longest careers.

Let us take these notions to an evaluation of the Blumstein and Cohen study: given their interest in discovering persistent offenders, Blumstein and Cohen's sample must be restricted to offenders somewhere between those who drop out because of insufficient activity and those who are forcefully removed because their level of activity is so high. Starting with the 5,338 offenders arrested for homicide, rape, robbery, aggravated assault, burglary, or auto theft in Washington, D.C., during 1973, Blumstein and Cohen proceed to the identification of offenders relevant to their concerns. Two additional criteria are applied to select their sample: (1) the offender must have turned 18 between 1963 and 1966, and (2) the offender's first reported adult arrest must have been at age 18, 19, or 20. Application of these criteria produced a sample of less than 200 offenders (Blumstein and Cohen do not report the exact number).

It is difficult to determine what population this sample represents. Presumably, it was selected to allow study of chronic offenders. It was widely represented as doing so (Wilson & Herrnstein, 1985:138). As indicated, such offenders are unlikely to be available to the sampling procedure employed by Blumstein and Cohen. Nonetheless, Blumstein and Cohen report good luck in finding a group of serious offenders among whom the rate of offending does not decline with age. "The results . . . strongly suggest that the previously observed effects of a decline in arrest rates with age . . . could well be artifacts." To understand the magnitude of this achievement, the reader should consult Figure 4.3, the age distribution of the full 1973 population of arrestees in Washington, D.C., as reported by Blumstein, Cohen, and Hsieh

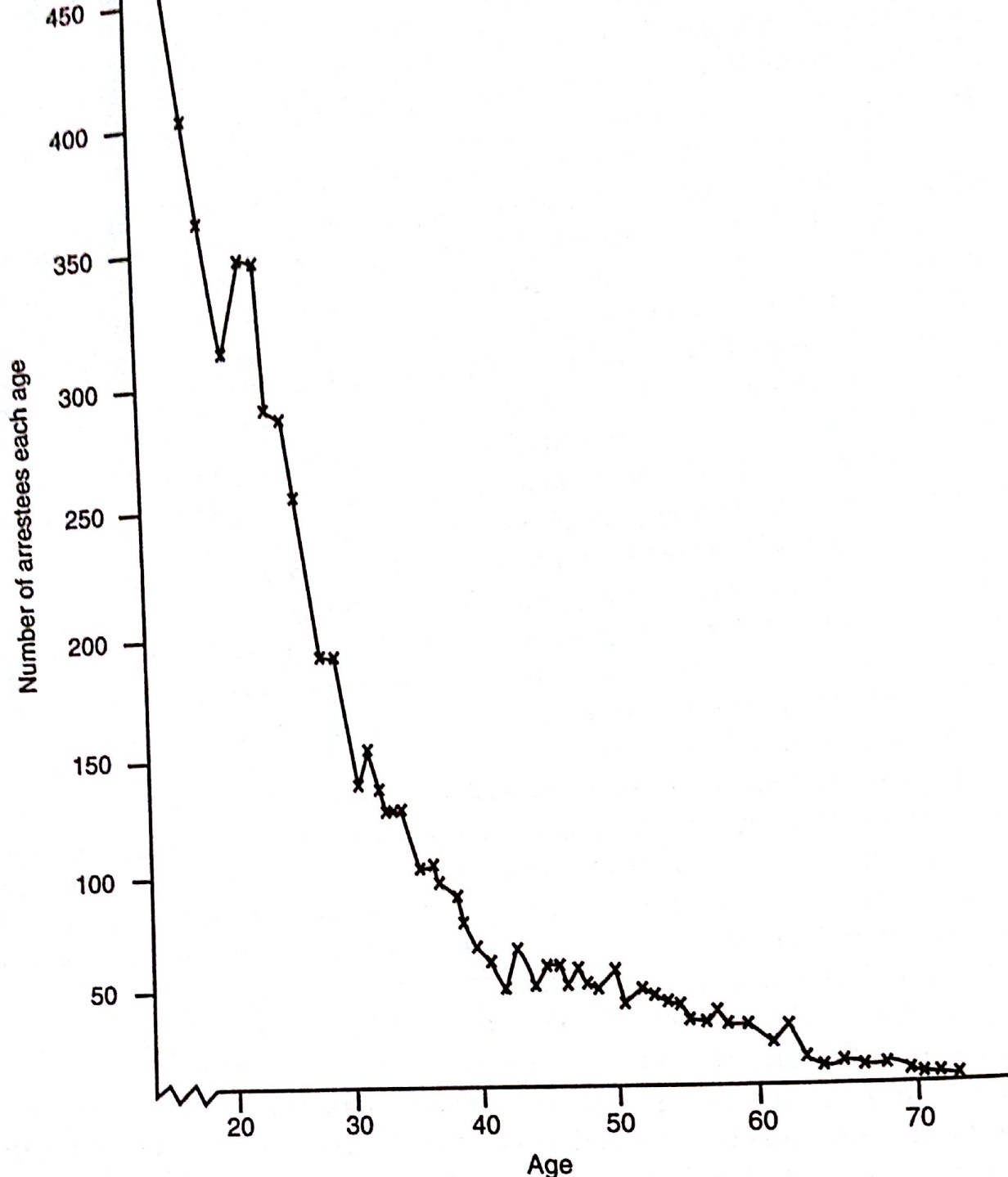


FIGURE 4.3 Age distribution of "criterion" adult arrestees in Washington, D.C. during 1973^a

^a"Criterion" arrestees include those adults arrested during 1973 for the index offenses of homicide, rape, robbery, aggravated assault, burglary, and auto theft (that is, arrestees for all index offenses other than larceny).

Source: Blumstein et al., 1982: 14.

(1982). How could a sample constructed from this population fail to reflect the overwhelming tendency of crime to decline with age in the parent population? To find the answer, one must come to grips with the implications of the Blumstein and Cohen sampling procedure. It turns out that the age effect

apparent in Blumstein and Cohen's data is not an artifact. On the contrary, the conclusions of the Blumstein and Cohen study are themselves an artifact of their research procedures.

Recall that Blumstein and Cohen included offenders in their sample only if they had an arrest in 1973 and also had an arrest at age 18, 19, or 20, some time prior to 1973. Also recall that the question of interest is what the career criminal scientists have dubbed "lambda," the "average yearly individual arrest rate." (This figure, when precisely known, allows precise estimation of the savings in crime gained by a year of imprisonment.) In this case, lambda would be the average yearly arrest rate between 1966 and 1972 for persons between 21 and 27 arrested in 1973 and at least once subsequent to 1965. It is, for the "active individual criminals" identified by Blumstein and Cohen, .27, about one arrest every four years.

So, Blumstein and Cohen identify offenders arrested at two points in time, and they calculate the extent of their activity in the interim. This is identical to identifying ballplayers employed by the major leagues at two points in time and asking whether they were involved in professional baseball in the interim. It is neither very surprising nor very useful to learn that persons selected on the basis of predetermined characteristics actually possess those characteristics. Unfortunately, the utility of incapacitation depends on the ability to lock people up before they commit the offense defining them as persistent, and it is much more difficult to predict the occurrence of offenses than it is to count them after they have been committed. But for the moment, what is of interest is the significance of the Blumstein and Cohen data for their conclusion that crime does not decline with age among active offenders.

Consider the chances that an offender will be included with his cohort in the Blumstein and Cohen study: For the offender who turned 18, 19, or 20 in 1963 and was arrested in that year, it would be necessary that he be arrested again ten years later in order to be included. Ten years is, in arrest terms, a very long time. Only high-rate offenders would be expected to achieve this feat. However, recall the requirement that to be included in the sample the offender must have been arrested in 1973. What kind of long-term offender would still be on the street after such a lengthy period? Three kinds come to mind. The first is the undoubtedly mythical offender whose intelligence and sophistication make him a worthy adversary for the crime fighters of American fiction and public policy. Skilled in avoiding detection and presumably unlikely to be involved in robbery, aggravated assault, or narcotics, this sophisticated career criminal is by definition beyond the reach of meaningful selective incapacitation strategies. The second is a strangely sporadic or low-rate occasional offender whose arrests are sufficiently dispersed over time to reduce the likelihood of imprisonment (again, a curious although apparently frequent target of incapacitation researchers and "repeat offender" projects). The third is a high-rate offender who may have served a good deal of time in prison during the period in question but who happens to be free in 1973—that is, an offender already largely incapacitated under

existing policy. Blumstein and Cohen do not attempt to count or describe their offenders in these terms, preferring to treat them as equally plausible targets of rational crime control policy.

Such lack of attention to the composition of the sample may have stemmed from the statistical difficulties involved in breaking an already small sample into subgroups. But such decomposition is required if one is to judge the policy significance of this research. It will be recalled that the life blood of selective incapacitation is the minute fraction of the offender population said to be responsible for the bulk (50% to 75%?) of criminal activity. Presumably Blumstein and Cohen have isolated the population of interest. But have they?

The group does appear to be small, representing less than 4% of those arrested in 1973. The group does not appear to be unusually active or chronic, however, at least in comparison to other adult offenders in the population from which Blumstein and Cohen drew their sample. In fact, a calculation shows that their 4% of offenders accounts for 4% of the arrests (hardly a group of "high-frequency, serious offenders" (Wilson & Herrnstein, 1985:138). In other words, a Washington arrestee selected at random would be as "active" or "chronic" as the arrestees so closely scrutinized by Blumstein and Cohen.

Farrington (1985) and Greenberg (1985) say that Blumstein and Cohen have uncovered a group of offenders whose criminal activity does not decline with age, thus providing potential targets for incapacitation policies and a justification for continuing research on the career criminal. They argue that the apparent decline in crime with age disappears when Blumstein and Cohen applies controls for cohort. Farrington (1985) argues further that part of the apparent age effect in the Blumstein and Cohen study was accounted for by differences in time incarcerated.

Neither of these points about the Blumstein and Cohen analysis is correct. Close examination of the Blumstein-Cohen data reveal that controls for cohort or time served were unnecessary because the Blumstein and Cohen sample was selected in such a manner that there was no correlation between age and crime from the beginning. Given the initial zero relation, control for cohort is hard to justify on statistical grounds (and there is certainly no substantive reason for such a control—any random variable would show the same result). Given the obvious connection between time served and frequency of criminal activity, the lack of a time-served effect gives additional reason for concern about the adequacy of the sample (and the effectiveness of an incapacitation policy). In any event, it is misleading to control for irrelevant variables and then suggest that such controls account for observed results. By doing so, Blumstein and Cohen imply that they know why age is related to crime—that it is an artifact of cross-sectional data and current incarceration practices—when in fact their research says nothing about this question and is incapable of saying anything about it. Making more of an issue that might seem by now settled, the discussion turns to a distinction much publicized in the career criminal literature, the distinction between incidence and prevalence.

CAREER CRIMINALS OR CRIMINAL CAREERS?

If crime declines with age because low-rate, amateur, or occasional offenders offend only during the teen years and then drop out, while high-rate, professional, or chronic offenders start early and stay late, then it may be true (as many incapacitation researchers argue) that the greatest effect of imprisonment would be between ages 30 and 40 rather than at the peak age of offenses. Farrington (1985, Abstract) states this possibility as established fact: "Age-crime curves for individuals do not resemble the aggregate curve, since incidence does not change consistently between onset and termination." Farrington thus asserts what Blumstein and Cohen attempted to show, that differences in age-specific crime rates stem from changes in the number of active offenders rather than from changes in the frequency of offending among offenders. As has been seen, Blumstein and Cohen's methodology is not capable of supporting this assertion, especially in the face of good evidence to the contrary. What other evidence bears on Farrington's assertion?

Some evidence is provided by the longitudinal study of London youth by Farrington and his colleagues (Farrington, 1983). Portions of the data, along with the calculations of the authors of this paper, are reproduced as Table 4.2. The reader will note that the number of persons convicted of crimes is highest at age 17, that the number of convictions is highest at age 17, and that both persons convicted and convictions decline from this point. The similarity between offender and offense counts suggests that they are connected by a multiplier that remains reasonably constant throughout the 15 years the cohort is followed. This multiplier is one type of incidence rate for the sample, what some scholars refer to as "lambda." This incidence rate uses the number of offenders during a given time period as the denominator. (A more useful incidence rate uses the number of individuals in the population (offenders plus nonoffenders) as the denominator. The numerator in both cases is the number of offenses during the period.) Simple arithmetic reveals that the average annual lambda in the Farrington data is 1.294 (the total number of convictions divided by the total number of different persons convicted each year). Inspection of annual lambdas leads directly to the conclusion that lambda is invariant over the 15-year period of the study.³ Because lambda is a constant over the period of the study, several things follow: (1) lambda, as one measure of the incidence of crime, does not vary by age; persons committing crimes at age 28 on the average commit as many crimes as those who commit crimes at age 10; (2) lambda can be calculated in the absence of expensive, time-consuming longitudinal research; and (3) lambda, as a measure of the

³An additional five years of follow-up data are available in draft form (Farrington, Gallagher, Morley, Ledger, & West, 1985). These new data, as predicted, would not alter the argument presented here. For example, in adding the five additional years of data, the average lambda changes from 1.294 to 1.288.

Table 4.2 Convictions at Each Age

Age	No. of First Convictions	No. of Different Persons Convicted	No. of Convictions	No. of Recidivists Convicted	Lambda
10	6	6	7	0	1.17
11	6	8	10	2	1.25
12	8	12	14	4	1.17
13	15	21	27	6	1.29
14	19	34	44	15	1.29
15	17	33	43	16	1.30
16	13	32	47	19	1.47
17	19	47	63	28	1.34
18	8	41	50	33	1.22
19	8	38	47	30	1.24
20	9	29	41	20	1.41
21	2	18	20	16	1.11
22	3	25	35	22	1.40
23	2	11	11	9	1.00
Total	136	367	475		$\bar{X} = 1.294$

SOURCE: Modified from Farrington (1983). Columns 4 and 5 were calculated by the authors of this paper.

incidence of crime, is, as defined, without theoretical or policy significance.⁴ (Blumstein and Graddy (1981-1982) show that lambda is similarly insignificant with respect to race differences in offending—that is, that although race differences in prevalence are large, white offenders are as likely to recidivate as black offenders. This of course does not mean that black-white differences on the usual measure of incidence are without interest.)

⁴In the criminal careers literature, lambda is defined as the rate of offending by "active" offenders. The question is, given that one is a criminal, how many criminal acts does one commit during a specified period of time? This definition of "incidence" has implications not typically acknowledged by users of the term. It implies, for example, that the important questions for theory and policy have to do with how offenders vary among themselves, rather than with how offenders differ from nonoffenders. The vacuity of this kind of thinking about crime cannot be overestimated. No other area of scientific inquiry would accept the logic of this approach. What, this approach would ask, is the impact of interest rate increases on saving among those with savings accounts? (Rather than, what is the impact of interest rate increases on saving in general?) What, it would ask, distinguishes blacks who have had at least one heart attack from whites who have had at least one heart attack? (Rather than, what are the causes of heart attacks—and do they differ between blacks and whites?) The heart attack rate may be decomposed into at least two elements. For any given time period, there will be the proportion of people in a group who have had heart attacks (prevalence); there will be the number of heart attacks suffered by members of the group (incidence); and there will be the number of heart attacks suffered by those who had at least one heart attack during the period. The last named statistic (called lambda) connects the first two. It appears to have no other possible significance.

Having dispensed with lambda, the discussion can return to the career criminal. Taking into account age at first conviction in the Farrington data (column 1), we calculate that the number of "career criminals" (those with prior convictions) is highest at age 18, where 33 of the 41 persons convicted had been convicted previously. Apparently, the age distribution of career criminality is identical to the age distribution of noncareer criminality in Farrington's as in the Gluecks' data, and the assertion by Farrington is contrary to his own evidence. There is more contrary evidence.

When high-rate imprisoned offenders are asked for retrospective accounts of their criminal behavior, they report engaging in fewer crimes as they grow older.⁵ For example, researchers for the Rand Corporation surveying a small group of California inmates found that "the overall amount of crime during [the reference period] declines linearly as a function of the respondent's age" (Peterson, Braiker, & Polich, 1980:49-50). Confronted once again by an age distribution contrary to the career criminal notion, incapacitation researchers invent a new strategy: "[The Rand researchers] using self-reported crime note that total crime rates for individuals tend to decrease with age of the offender. This decrease with age, however, is apparently associated with a decline in the number of different crime types committed by older offenders. Controlling for crime type [yet another lambda], older offenders report committing crimes at about the same rate as younger offenders" (Blumstein et al., 1982:8). In other words, Blumstein et al. tell us that offenders indeed commit fewer homicides, rapes, robberies, aggravated assaults, burglaries, and auto thefts as they age. He also tells us, however, that old rapists commit as many rapes as young rapists, that old robbers commit as many robberies as young robbers, that old burglars . . . etc. All of which means only that if one commits many crimes one is likely to commit many different crimes (criminal offenders, recall, do not specialize) and that if one commits few offenses one cannot commit many different kinds of offenses. This shows that older criminals do indeed slow down, a finding that comes as no surprise and a finding contrary to, rather than supportive of, a policy of selective incapacitation.

⁵Another property of lambda is that it depends heavily on the method of crime measurement. With self-report measures, lambda will vary in magnitude and meaning depending on the cutting point between offenders and nonoffenders. With self-report measures, one can ask: what is lambda for those committing more than 100 offenses during the specified reference period, or what is lambda for those committing at least one offense every day? Although precise numerical answers to these questions are possible, it is not clear what purpose they would serve.

Lambdas computed from official data are of course constrained in ways self-report (or victimization) data are not. For example, felony conviction is the official criterion, whereas self-report measures are apparently of little

CONCLUSIONS

The heavy emphasis on the career criminal has paid little in the way of practical dividends and has limited thinking about crime to the repetition of pretentious slogans. Federal research policy has been captured by the career criminal notion. The favorite research design consistent with this idea requires following large numbers of people over long periods of time. In other words, the favorite design requires large outlays of funds concentrated on a small number of research institutions. This research policy therefore presupposes considerable confidence in the validity of the ideas being pursued, and considerable lack of confidence in alternative perspectives.

The evidence is clear that the career criminal idea is not sufficiently substantial to command more than a small portion of the time and effort of the criminal justice practitioner or academic community. Is there a policy-relevant alternative to the career criminal notion? Since the Enlightenment, many reasonable people have argued that the state exists in part to prevent crime. In a liberal society, the state prevents crime at least as much through the use of legal penalties as through the imprisonment or rehabilitation of criminals (Van den Haag, 1982). The theories of crime implicit in this strategy tend to reject the notion of a career criminal, not because they reject the idea that the criminal propensity is lodged in a small segment of the population, but because they accept the idea that the criminal propensity is lodged in the great bulk of the population. Whether advanced by economists (the rational choice theory) or by sociologists (social control theory), these explanations of crime share the view that crime occurs naturally in the absence of restraint. Crime, then, is merely natural, unskilled, unrestrained activity, activity carried on without regard to ordinary social or long-range consequences. The person committing criminal acts is thus a person relatively free of concern for the consequences of his acts, a person free to follow the impulse of the moment.

In this view (Hirschi & Gottfredson, 1986), one defining feature of the offender is a short-term orientation, a tendency to pursue immediate pleasure whatever its implications for the future. Another feature of the offender is what Short and Strodtbeck (1965) call social disability, a tendency to experience difficulty in managing the ordinary tasks of life. Such an offender is incapable of pursuing a career in the usual meaning of the term. When he is captured late in his "career" (whether by ordinary enforcement practices or by special repeat offender or career criminal units), it will tend to be for mundane public-order offenses more suggestive of failure than success, more suggestive of self-incapacitation than the need for public intervention. Nothing reviewed in this paper suggests discovery of any fact about crime or criminals contrary to this alternative perspective. Until such facts are discovered, the citizen would be well advised to continue to bolt the door despite the incapacitation of the wicked few.

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