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PERSONALITY AND THE BIOSOCIAL MODEL OF ANTI-SOCIAL AND CRIMINAL BEHAVIOUR

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1. INTRODUCTION

In considering the causes of criminal and violent behaviour, we are dealing with two separate but interrelated factors. A crime is committed by a **person** in a certain **situation**; individual differences are responsible for the fact that in similar situations one person will commit the crime, another will not. Situations define not only the narrow circumstances of a particular crime, but the whole attitude of a given society to anti-social conduct, to the child's upbringing, discipline in school, judicial procedures, existing levels of punishment, certainty of detection, religious beliefs, prevalence of TV violence, and many more. We cannot explain the huge differences in anti-social conduct between Singapore and Washington, Switzerland and South Africa, Egypt and England in terms of general differences, or personality factors. Communist countries like Russia used to be relatively crime-free; after the overthrow of communism Russia is one of the most crime-ridden countries in the world.

Sudden changes like this cannot be explained in terms of genetic changes or criminal predisposition; the time factor makes any such explanation impossible. Social constitutions thus remain the major explanatory principles, but clearly such often-adduced causes as unemployment, poverty or income inequality have little evidential support. Periods of unemployment in the USA are characterized by **decreasing** crime rates (Lester, 1994). When unemployment was huge in Germany during the 1920s period of inflation, crime was minimal. Income inequality in the USA, using the Gini coefficient of income distribution, remained steady from 1961 to 1981, while crime rates increased linearly (Rutter, 1995). Poverty has decreased tremendously from the 1920s to the present day in England, but crime has increased geometrically. Clearly the constant reiteration of these shibboleths by politicians do not deserve scientific credence. It should be obvious that **social causes** (whatever they might be) can only act through their influence on people's minds, and hence produce psychological conditions favourable to antisocial conduct; purely sociological theories of crime are a **contradictio in adjecto**.

Fundamentally we may bring together the two sides (individual differences and social causes) in terms of what economists call the **marginal** customers. The price of a com-

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modity is not determined by those who would buy it whatever the price (within reason), not by those who could not afford it in any case, but by the marginal customer who would buy it at price X, but not at price X + 1. Let us postulate the concept of **criminal disposition**, determined partly by a person's heredity, partly by social and biological factors encountered during his upbringing, and their interaction. The predisposition is closely related to his personality (to be discussed, and documented presently), and determines the **probability** of his committing a crime, from very low (left of continuum) to very high (right of continuum); this probability is indicated by P in Fig. 1.

Consider now the application of this general theory to our marginal criminal, i.e. a person with a certain position on the predisposition continuum. The social ethos, as defined previously, will not affect people to the right of him; they are so strongly predisposed to crime that they will commit their crime regardless. It will not affect people to the left of him, they are not sufficiently predisposed to crime to commit a crime in any case. It is the marginal criminal who will be influenced by relatively slight changes in the social ethos. Large changes in this ethos, as in post-communist Russia, will of course shift the position of the marginal criminal to the left, rendering even people with rather low predisposition liable to commit crimes. Smaller but still noticeable shifts in diminishing permissiveness, such as happened recently in New York, will shift the position of the marginal criminal to the right, i.e. a higher degree of predisposition is required to indulge in criminal activity.

2. THE NATURE OF PERSONALITY

There is an enormous literature on personality, but for reasons given elsewhere (Eysenck & Eysenck, 1985; Eysenck, 1991) I shall concentrate on a system of personality descriptions anchored in a large nomological network (Garber & Strassberg, 1991) and presented in diagrammatic form in Fig. 2. The central place is given over to the ma-

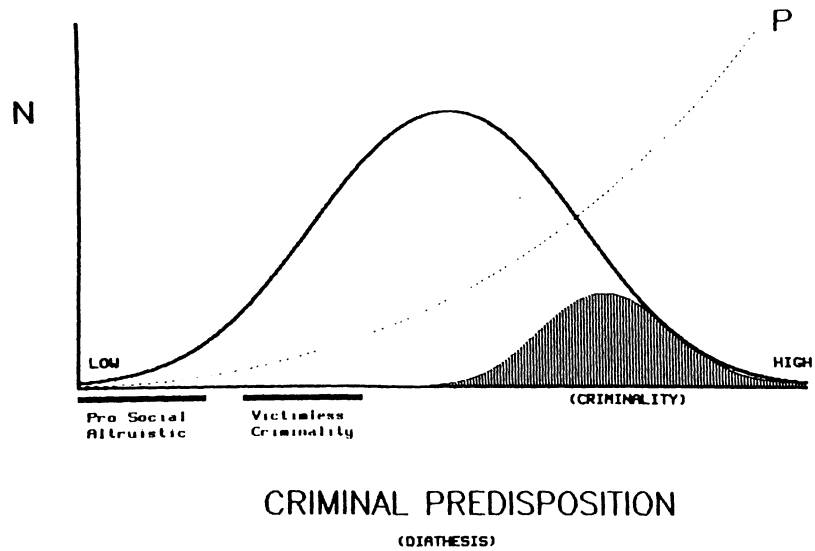

Figure 1. Diagrammatic representation of criminal predisposition. P = probability of becoming a criminal.

jor trait constellations, empirically established; these major dimensions of personality have been designated P (psychoticism), E (extraversion), and N (neuroticism), although other terms have been used by other authors. The causal sequence begins with **distal antecedents,** namely genetic determinants (DNA), and there is a large body of evidence supporting the view that a large part of the total phenotypic variance in personality is genetic (Eaves, Eysenck & Martin, 1989). But this information, although important, only leads to further questions. Hereditary information in the DNA is copied onto RNA by a complementation process; RNA in turn participates with certain intracellular structures to produce polypeptides, which compose proteins, which may be structural, transport, and catalytic (enzymes). Enzymes are of particular interest because they facilitate the chemical reaction of life. Thus clearly we must seek knowledge about the **proximal antecedents** of personality.

To have a scientifically worth-while system we must formulate **theories** concerning the links between personality and such proximal antecedents as may be relevant. (Eysenck, 1967); such theories can be tested directly, by means of psychophysiological measures (Eysenck, 1994). They may also be tested by means of **proximal consequences,** i.e. laboratory studies of behaviour, such as conditioning, vigilance, memory, perception, etc. (Eysenck, 1981; Eysenck & Eysenck, 1985). It is the large body of experimental studies under this heading that presents the best evidence for the validity of the systems as presented.

Finally, and going well beyond the possibility of direct experimental laboratory testing, we have **distal consequences,** such as criminality (Eysenck & Gudjonsson, 1989), creativity (Eysenck, 1995), sexual behaviour (Eysenck, 1976), psychopathology (Eysenck, 1992a), marriage (Eysenck & Wakefield, 1981), etc. It is in making testable predictions mapping distal and proximal antecedents, as well as proximal consequences onto this field

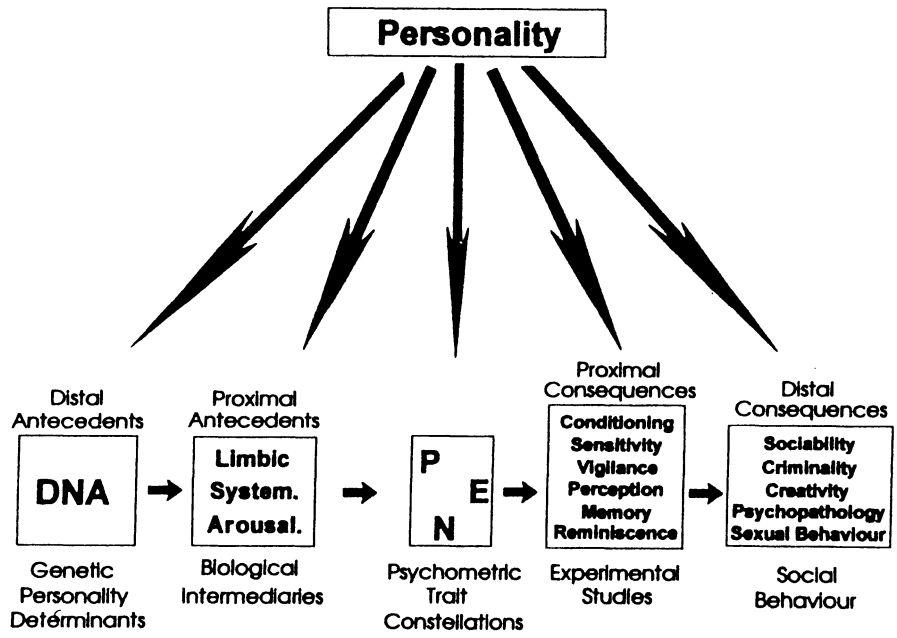

Figure 2. Causal picture of personality, from DNA to social behaviour.

of distal consequences, that the general personality theory proves its scientific and social usefulness, and in this chapter I shall try and document its applicability to the field of criminality and violence (Eysenck, 1977; Eysenck & Eysenck, 1971; Eysenck, Rust & Eysenck, 1977).

Leading into the documentation demonstrating the relationship between personality and criminal predisposition, I shall very briefly set down the general theory I put forward originally 35 years ago (Eysenck, 1980). I argued then that it was not meaningful to ask why people commit crimes; the real problem is that most people most of the time do not commit crimes or other antisocial acts although to do so would be to their immediate advantage. I suggested that they were prevented from doing so by their **conscience**, and I suggested that conscience was a **conditioned response** produced along Pavlovian lines, through innumerable positive and negative reinforcements of pro-social and anti-social acts respectively. This theory was amplified later on (Eysenck, 1977) and has found much empirical support (Eysenck & Gudjonsson, 1989; Raine, 1993). I linked it with personality through the postulation of a cortical **arousal** factor that promoted classical conditioning when high, and slowed it down when low. This was linked with the postulation that extraverts (and people high on psychoticism) had habitually **low** cortical arousal, and would hence condition poorly, and thus have trouble developing a proper conscience. This leads to the prediction that **P and E would be linked with antisocial and criminal conduct.** Emotional instability (N) seems likely to cause difficulties in making sensible and socially acceptable adjustments and through its strong autonomic reactions might lead to impulsive behaviour. This is a rather weak prediction, lacking the strong empirical support for the arousal-conditioning hypothesis.

Constitutionally low arousability may affect criminality **directly** as well as through making for poor conditionability. Essentially, a person with a low-arousal level seeks to increase this level by a variety of means, such as risk-taking, sensation-seeking, impulsive actions, socializing with many other people, drug abuse, multiplicity of sexual partners, etc. These activities are likely to lead such a person towards criminal activity, but not inevitably; risky sports activities may take the place of criminality in middle-and upper-class persons.

In considering this theory, it is important to disregard criticisms suggesting that conditioning theories neglect **cognitive** factors. While this would be true of fundamentalist behaviouristic theories, such as those of Watson and Skinner, it totally misrepresents modern theories which inevitably include cognitive factors as vitally important elements (e.g. Mackintosh, 1974, 1984; Davey, 1983). This consideration goes back to Pavlov and his concerns with language as "the second signalling system", with Platenov (1959) as its main exponent. Cognitive changes are produced as easily, if not more so, by behavioural methods (e.g. exposure) as by purely cognitive manipulations.

3. PERSONALITY AND CRIMINAL PREDISPOSITION

I have surveyed a large body of evidence testing the prediction outlined in the previous section (Eysenck & Gudjonsson, 1989); many of these studies were carried out in cross-cultural experiments in many different countries. The general finding has been that P correlates positively in about every study with criminality and antisocial conduct; for children, youths and adults in pretty equal measure, and both for actual law-breaking leading to incarceration, and for self-confessed semi-criminal and anti-social activity. Neuroticism is more strongly associated with criminality and antisocial conduct in **adults**, while

extraversion appears to be more closely involved in **young** samples than incarcerated adults. This latter finding may be due in part to a tendency for prisoners to live a life that makes extraverted behaviour impossible, in part to prisoners understating their degree of extraversion (Eysenck & Gudjonsson, 1989). These correlations are all highly significant, but do they have a high enough effect size to have social significance? Correlations tend to be quite high on the whole. Looking at large-scale studies, giving reasonable stable coefficients, we may cite results reported by Jamison (1980) for 781 boys and 500 girls, correlating personality traits with the Allsop and Feldman (1976) ASB (antisocial behaviour scale). Correlates for the two sexes were .58 and .59 for P, .31 and .40 for E, and .10 and .09 for N. For L, the so-called Lie Scale, which is essentially a measure of conformity when conditions of testing do not encourage people to give an overly good account of themselves, correlations were -.56 and -.60. (L usually correlates negatively with P, which is not surprising!) (It is of interest, particularly in view of the stress on **violence** in this book, that Choynowski (1995) found a very strong association between L reversed (non-conformity) and aggression.)

Powell (1977) studied 381 boys and 427 girls, and found a similar correlation with personality, using the ASB scale. For senior boys and girls, the correlations were: P: .47 and 44; E: .26 and .17; N: .18 and .30; L: -.64 and -.56. For junior children, correlations were: P: .42 and .48; E: .04 and .10; N .09 and .17; L: -.48 and -.50. These of course are raw correlations; when corrected for attenuation, a correlate of .50 would become over .60. Combining the correlation into a multiple R, we get a value of over .70 or so (uncorrected). Thus personality predicts something like 50% of self-reported antisocial conduct in children, clearly indicating that personality is an important causal factor in antisocial conduct.

For adults in various studies we found similar results, with P always giving the highest correlations, or the largest difference between criminal and control groups. It might be expected that P would correlate more with violent than with non-violent crime, and Chico & Ferrando (1995) have put the matter to the test. The P score for 181 violent delinquents was 10.42 ± 3.79, while for non-violent delinquents it was 6.70 ± 3.01. This is a very significant difference, and indicates, taken together with the Mitchell et al. (1980) finding, that violent offenders are high P-low N as compared with non-violent offenders. This agrees with the usual finding that **maleness** may be related to violence; males as compared to females tend to show high P-low N levels. (Eysenck, 1995b). Given these relations, we would expect certain sex-related hormonal factors (e.g. testosterone to differentiate between violent and non-violent subjects. Ellis & Coontz (1990) have reviewed the evidence, which generally supports this view.

Bernson & Fairey (1984) added to the evidence linking violent crime with P in a study comparing 30 juvenile assaultive offenders with 30 juvenile property offenders. "Juveniles convicted of assaultive offences exhibited significantly higher psychoticism, extraversion, and neuroticism scores, and lower lie scores than those convicted of property offences" (p.527). In addition, Zuckerman's sensation-seeking scores were higher for assaultive offenders. (Sensation-seeking correlates quite highly with P and E - Eysenck, 1983).

I will not here enter further into this field, but will discuss briefly results achieved with the Eysenck Criminality Scale (C Scale)(Eysenck & Eysenck, 1975). The scale brought together items from all three personality scales (mainly P), and the resulting 34-item scale discriminated well between 934 criminals and 189 non-criminals, of similar age and social class. Scores were 9.01 ± 4.54 for non-criminals, and 15.57 ± 5.18 for criminals, with alpha reliability of .75 and .75, respectively. (Test-retest correlations were slightly higher). The difference is over one S.D., and of course a random non-criminal

sample will contain a fair number of unascertained criminals, which would lower the discrimination. A similar scale for children was also constructed, with an alpha reliability of .74. The scale correlated .71 with the ASB scale, suggesting good validity (Eysenck & Eysenck, 1975). Follow-up studies have not yet been done, but in view of a large literature showing considerable consistency of behaviour from child to adult with respect to antisocial behaviour (e.g. Olweus, 1984; Farrington , 1986; Staltin & Magnusson, 1989; Wolfgang, Thornberry & Figlio, 1987), it seems likely that the Junior C scale would correlate well with adult criminality. A study by Putsins (1982) shows that this expectation is not unreasonable.

Of some special interest are data concerning the **dual threshold** hypothesis. According to this quite general hypothesis, if you have two groups, say, men and women, who differ in their conduct with respect to a certain type of conduct, say criminality, which in turn is associated with a given trait, say P, then the difference between delinquents and non-delinquents on P should be **larger** for women than men (Eysenck & Gudjonsson, 1989). The reason of course is that men clearly have a stronger propensity (P) than women to indulge in this type of behaviour, so that women require a higher degree of P in order to indulge in the behaviours in question. Gudjonsson et al. (1991) showed that as usual prisoners had higher scores than non-prisoners, but that women prisoners had even **higher** P scores than male prisoners, while women non-prisoners had much lower P scores than men. This finding is fairly general (Eysenck & Gudjonsson, 1989).

The C-scale clearly differentiates criminal and non-criminal populations in England; does the effect obtain in cross-cultural studies? A large-scale study of this kind was undertaken in Zagreb (Croatia) by Sakic, Zuzul, Knezovic, Kulenovic & Zarevsky; unfortunately the war prevented publication, but they communicated the major results to me. (Some of these results have been published in a rather inaccessible form - Sakic, Knezovic & Zuzul, 1987). In the first study, a control group of 128 male subjects was compared with 101 prisoners convicted of violent crimes. C-scale scores were 10.1 ± 4.20 for the controls, 15.0 ± 5.66 for the property offenders, and 15.8 ± 5.13 for the violent offenders. There is no significant difference between the two kinds of offenders. In the second experiment, a control group of 128 males (the same as before) was compared with 205 prisoners who had committed physical assault, either mild (n=62), moderate (n=46), serious (n = 55), or very serious (n = 42); the last group was a recidivist group who had at least twice, on separate occasions, committed a serious physical assault. Ascending C scores were found in the four violent groups, in order 13.3 ± 5.5; 14.3 ± 5.3; 15.8 ± 5.6; and 18.3 ± 5.3 ($p < 0.0001$). More serious violent offences are linked with higher C scores.

In a third study, 976 male offenders were studies, with the total sample graded into 5 groups according to seriousness of crime as indexed by duration of sentence. Fig. 3 shows that all groups exceed the control score of 10.1 ± 4.20, with a linear increase in score according to seriousness of crime ($p < 0.0001$). Clearly C increases with seriousness of offence. Length of time spent in prison did not increase a prisoner's C score.

The C scale is of course not the only criminality scale; the Gough Socialization scale has also been used very widely (Gough, 1994). Unlike the C-scale, the So scale has no underlying theory and is purely inductive, choice of items being dictated entirely by successive administration to criminal and non-criminal samples. Like the C-scale, the So scale differentiates these groups at slightly above the 1 S.D. level, and has done so in a number of cross-cultural studies. The So scale correlates quite well with various stability-neuroticism scales, and negatively with scales related to psychoticism traits (egocentricity, aggression, impulsivity, negativism, sensation-seeking, but positively with agreeableness and conscientiousness). Backorowski & Newman (1985) found a correlation of -.54 be-

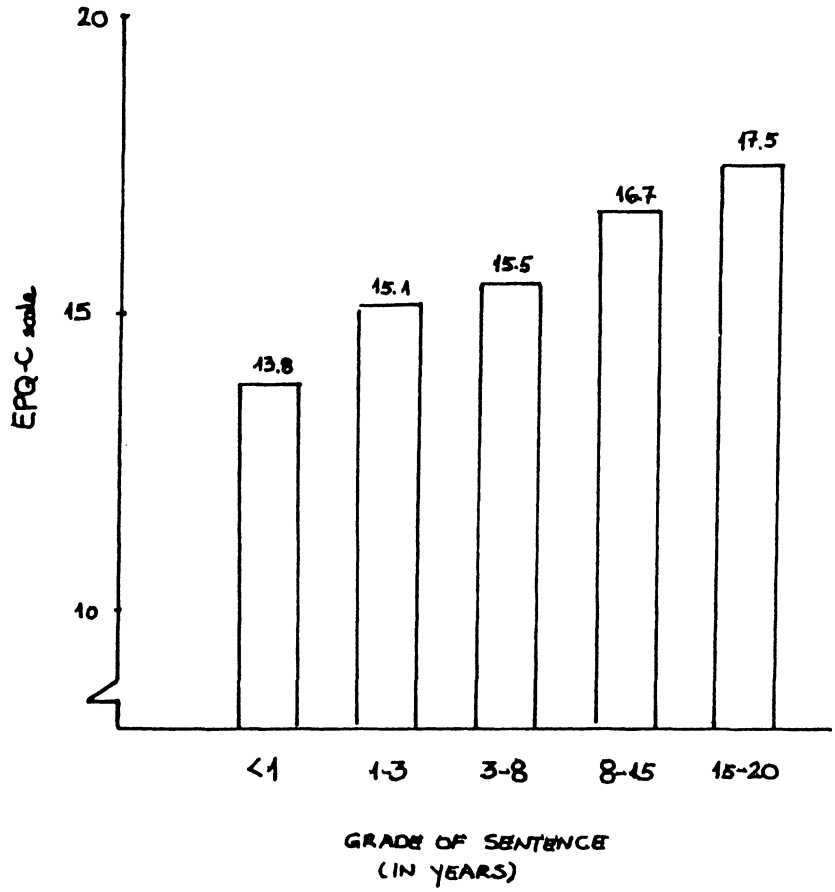

Figure 3. Scores on the EPQ-Criminality Scale for criminals graded according to severity of crime (length of sentence). (After Sakic et al., 1987).

tween So and P. Social status, as with the Eysenck scales, correlates negligibly with So. The So has heritabilities of around .40, with a possible epistatis component (Eysenck, 1995). There is a wealth of material in the almost 200 references cited by Gough (1994) that are relevant to our conclusions, and that should be considered for any final verdict.

4. TRAITS AS INDICATORS OF CRIMINAL PROPENSITY, AND DIFFERENCES BETWEEN VIOLENT AND NON-VIOLENT CRIMINALS

Personality appears to be organized in a hierarchical fashion, with intercorrelations between primary traits resulting in such higher-order factors as P, E and N (Eysenck, 1947). I have reviewed the relation between criminality and these higher-order factors, but much work has been done on primary traits, and while these behave pretty well as might be predicted from the findings related to higher-order factors, a rapid run through may be useful, particularly when a given trait differentiates between violent and property crimes.

One such study (Mitchell, Rogers, Cavanagh & Wasyliw (1980) was concerned with the Cattell **anxiety** factor, in a sample of 2,509 male adolescent offenders of 15.75 to 17.25 years. The more violent delinquents (both black and white) were significantly **less** anxious than the non-violent delinquents ($p < .006$). Whites were over-represented in the high anxiety group, blacks in the low anxiety group ($p < .006$). Whites ere over-represented in the high anxiety group, blacks in the low anxiety group ($p < .0005$). Violent crime was largely composed of murder, rape and battery. Wardell & Yendell (1980) also found violent recidivists less anxious than non-violent recidivists.

A variable correlating with impulsivity and sensation-seeking, and also differentiating between criminal and non-criminal groups is risk-taking, as indicated by Schwenkmetzger (1983), who also cites a number of German studies. Impulsiveness has also been found so to differentiate in Israeli delinquents (Rotenberg & Nachshon, 1979). Perception of risk was found, as expected, negatively related to P and antisocial behaviour by Jamison (1980) in normal children, and Stewart & Hemsley (1984) found risk-taking correlated with high P and criminality. Stimulation-seeking has been found in antisocial pre-adolescent children by Whitehill, Scott and De Myer-Gapin (1976). Aggressiveness was found correlated with extraversion and locus of control (reversed) by De Man and Green (1988).

A study by Hormuth et al. (1973) is of particular interest, because not only did the authors replicate the personality correlates on the FPI discussed below, but they demonstrated a significant difference between criminals and non-criminals on the factor of "impulse control", using a measured ability to control motor behaviour, thus getting away from purely verbal self-description.

A particularly interesting aspect of personality related particularly to violent crime is extent of personal space, i.e. the distance from other people that subjects find comfortable. Kinzel (1970); Booraem, Flowers, Bordner & Satterfield (1977) and McGurk, Davis & Greham (1981) have found evidence that this distance is greatest for violent criminals, less for property criminals, and least for "victimless" criminals, e.g. drug-takers. Eastwood (1985) failed to find any difference on a small sample of criminals; he gives a detailed discussion of previous work. Large personal space requirements are typical of high P scorers, and of persons of low intelligence; they are also found in psychopathological subjects who are not criminal. The precise relationships involved, and the possibility of interaction between causal factors, remain to be discovered.

A questionnaire widely used in Germany, the FPI (Fahrenberg Selg & Hampel, 1978) has been applied several times on criminals and controls (Steller & Hunze, 1984). Unfortunately the inventory does not contain a P scale, or a scale relevant to some of the traits it summarizes, but clear differences are observed for some 3,400 delinquents, as compared with controls, in nervousness, depression and emotional instability. "Increases on the secondary scale for Extraversion are also frequently ascertained, they are essentially due to increases on the primary scales for Aggression and Sociability." (p.87). Lossel & Westendorfer (1976) have reported data with the FPI which are essentially identical with the above, isolating aggressiveness, depression, excitement, dominance and neuroticism.

The "Big Five" have also been considered in relation to criminality (Heaven, 1996). Neuroticism was a significant correlate of criminality, as were agreeableness (reversed) and conscientiousness (reversed); these two scales can be regarded as primary factors in the psychoticism higher-order factor (Eysenck, 1991, 1992). Altogether, there is much support in these various studies for the P-E-N based C scale as a good measure of criminal propensity.

From the large literature a few further studies may be mentioned. Comparisons between criminals and controls have implicated delay of gratification (e.g. Pena and Luengo,

1993), anger/hostility and venturesomeness (e.g. Heaven, 1993). assertiveness and low conventionality, (e.g. Sirder, 1988), low self-control (e.g. Feldman, 1977), low self-esteem (e.g. Rice, 1992), lack of certainty (e.g. Rigby, Mak & Slee, 1989), locus of control (e.g. Shaw & Scott, 1991) and many others. It would go beyond the limits of this chapter to review all published studies, and I have endeavoured to concentrate on studies not dealt with in a previous survey (Eysenck & Gudjonsson, 1989). However, it may be useful to add to our account three indirect deductions from the main theory that P, E and N, and individual traits subsumed under their higher-order factor, are related to criminal activity, more strongly to violent than non-violent behaviour.

1. It is well known that antisocial and criminal activity increases, linearly with age from 12 or thereabouts to 17 or 18, and then steeply declines in a negatively accelerated curve to almost zero at the age of 50 (Moffitt, 1993). It would seem to follow that if personality factors P, E and N are **causally** related to antisocial conduct, such conduct should be associated with an **increase** in P, E and N scores from 10 to 17, and with a **decrease** from 18 onwards. For L scores the relationship should be inverted, decreasing with age up to 17, increasing from 18 onwards. Eysenck & Eysenck (1975) and Eysenck (1983) have shown that this is indeed so.
2. As psychoticism denotes a continuum from Altruism and conformity at one end to schizophrenia at the other, we would expect the observed correlation of P with criminality, especially violent criminality, to be manifested in a higher level of such criminality in schizophrenia. Of course the regression may be non-linear; actually psychotic individuals may be (a) segregated, (b) under drugs, or (c) incapacitated by their disease, and this may prevent them from carrying out assaultive attacks or other crimes. Bocker & Haefner (1973) found that schizophrenics were more likely, depressives less likely than normals to commit assaultive crimes, which agrees with the finding that N is lower in assaultive criminals than in criminals guilty of property crimes.
3. As already mentioned, the sex ratio of male offenders to female offenders is roughly 10 to 1, with female offenders often guilty of "victimless" crimes, such as prostitution; it is particularly in violent crimes that the disproportion is greatest. If violent crime is positively related to P, and negatively to N, this finding, as already noted, supports the general theory linking personality, on the one hand, and crime and violence, on the other, males scoring higher on P, females on N (Eysenck, 1995c). Direct proof, of this kind, constituting deductions from the general theory are always weaker in evidential value because of the weaknesses in relying on published figures and statistics; these are inevitably often questionable. But further experimentation along these lines may produce interesting and important evidence.

5. DISTANT AND PROXIMAL ANTECEDENTS

In terms of our model, as pictured in Fig. 2, we have so far dealt with the central place, i.e. the psychometric criminal predisposition factor diagrammed in Fig. 1. and have established (a) that such a factor exists, and (b) that it is related to higher-order factors P, E and N, and to primary traits associated with these superfactors. To be certain that the argument is rigorous, it needs to be shown that (a) criminality is stable over time, (b) that

criminality has a strong genetic basis, and (c) that we can identify proximal (biological) antecedents linking the genetic components with criminal predispositions. An attempt to do so will be made in this section.

(a) As the theme of this book is violent behaviour, I will start with a review of 16 studies by Olweus (1979). concentrating on aggressive reaction patterns in males. "The degree of stability that exists in the area of aggressiveness was found to be quite substantial; it was, in fact, not much lower than the stability typically found in the domain of intelligence testing marked by individual differences in habitual aggression level that manifest themselves early in life, certainly by the age of 3" (p.852). Olweus concluded that "(a) the degree of longitudinal consistency in aggressive behaviour patterns is much greater than has been maintained by proponents of a behavioural specificity position, and (b) important determinants of the observed longitudinal consistency are to be found in relatively stable individuals in differentiating reaction tendencies or motive systems (personality variables) within individuals" (p. 852).

The Philadelphia Cohort Study (Wolfgang, Thornberry & Figlio, 1987) similarly produced evidence of consistency of criminal conduct, mostly based on impulsivity. Statlin & Magnusson (1989) showed that early aggression led to later violent crimes and damage to public property. Farrington (1986) reviewed a number of studies also indicative of consistency. Olweus relates conduct problems to a combination of E and N, again noting consistency of behaviour. In a follow-up study, Klinteberg, Humble & Schalling (1992) also noted consistency. Taylor and Watt (1977) in a follow-up study of more than 6000 school children noted that future criminal activity was predictable in terms of more than 3 deviant items in their early behaviour on the frequency, the seriousness, and the types of later criminal offences.

Consistency in conduct implies predictability, and several studies have shown such predictability. In an early review, Loeber & Dishion (1983) showed that a child's conduct problems were among the most predictive variables for later criminality. Thus prediction in general is certainly possible and useful as far as criminal activity is concerned (Monahan, 1981; Morrison 1994).

Clearly there is **consistency of behaviour**, not mirrored in odd "dynamic" formulations so frequent in predictive circles. Mossman (1994), finds in his review that "past behaviour alone appears to be a better long term predictor of future behaviour than clinical judgments" (p.783).

(b) It would be inappropriate here to discuss in detail the evidence in favour of the great importance of genetic factors in criminality. The study of MZ and DZ concordance for criminality. The study of MZ and DZ concordance for criminality, and work on children, adopted at birth from criminal and non-criminal violent parents has left little doubt about the proposition that something like 50%-60% of total phenotypic variance in criminality is genetic, and this estimate is made without any correction for attenuation which would raise it significantly (Eysenck and Gudjonsson, 1989; Raine, 1993). Our model of criminal predisposition would lead us to expect genetic determination of **altruism**, as the opposite to criminality, and Rushton, Fulzer, Neale, Blizard and Eysenck (1984) and Rushton (1980; Rushton et al., 1986) have demonstrated that this is indeed so. (Broad heritability estimates for the five scales used were: Altruism (56%), empathy (68%), nurturance (70%), aggressiveness (72%), assertiveness (64%); correction for unreliability would increase these estimates.) These facts are important in ruling out of account the usual completely environmental theories of sociologists, and they are in line with the moderately high heritabilities of the relevant personality variables (Eaves, Eysenck &

Martin (1989), but they need complementation by hormonal and psychophysiological studies linking heredity and conduct. And of course they do not encourage absurd speculation about a "gene for crime".

One interesting consequence of the broad heritability for criminality is that **criminality is dysgenic** because criminals tend to have more children than non-criminals. Lynn (1995) found in British parents that criminals had an average of 3.91 children, non-criminals had 2.21. "The result suggests that heredity for criminal behaviour is dysgenic, involving an increase in the genes underlying criminal behaviour in the population" (p.405).

It seems useful here to mention the promises held out for the future of genetic research in the study of personality and criminal behaviour by **molecular genetics.** These new techniques are beginning to revolutionize behavioural genetics because they allow us to identify **specific genes** that contribute to genetic variance in behaviour. Consider a study by Brunner, Nelen, Breakefield, Rogers and van Dorst (1993). They carried out genetic and metabolic studies on a large kindred in which several males were affected by a syndrome of borderline mental retardation and abnormal behaviour that included impulsive aggression; attempted rage, and arson. Disturbed mono-amine oxidase A was discovered, showing a complete and selective deficiency of enzymnatic activity of MAOA. In each of the five affected males, a point mutation was discovered in the eighth exon of the MAOA structural gene, which changes a glutamine to a termination codon. They conclude by saying that "isolated completed MAOA deficiency in this family is associated with a recognizable behavioural phenotype that includes disturbed regulation of impulsive aggression" (p.578).

This study was complemented by experiments on mice in which the gene encoding MAOA was damaged, so that no MAOA could be made. The mice in question were found to be more likely to bite their human handlers, and fight more vigorously with their fellow mice, all signs of greater impulsive aggressiveness. MAOA, of course, is in part responsible for the control of neurotransmitters such as dopamine, serotonin and nor-epinephrene, all of which are likely to play a part in regulating aggressive behaviour. It is interesting that in the Brunner et al.. (1993) study, carrier females were not detectable by enzymatic activity in cultural fibroblasts. Whether this is due to high antivity of the normal allele, incomplete X-inactivation, or other factor is unknown.

Also of interest is a study by Ebstein et al. (1996) into a gene postulated to underlie the trait of **novelty-seeking**, which is the name given by Cloninger (Cloninger, Svrakic & Przybeck, 1993) to **extraversion**; Harm avoidance (neuroticism), reward dependence (psychoticism) and persistence are his other three variables. Arguing that novelty seeking behaviours are related to dopamine, as shown in animal studies. Ebstein and his colleagues looked at a particular exonic polymorphism, the 7 repeat alleles in the locus for the D4 dopamine receptor gene (D4DR). The predicted association was indeed found in 124 unrelated Israeli subjects; no such association was discovered for the other three personality traits. Benjamin, using the Costa & McCrae (1992) NBO inventory, found the same exonic polymorphism to be related to extraversion (positively) and to conscientiousness (negatively). The specific facets mediating these associations were **warmth, excitement-seeking, positive emotions, and deliberation** (negatively). These are traits often found associated with criminal behaviour, and it will be interesting to carry out similar studies contrasting criminals with high-altruism subjects. Another interesting single gene association is that with severe alcoholism (Blum et al. 1991). Alcoholics and normals were studied for their allelic association with the D_2 dopamine receptor (D2DR) gene, utilizing peripheral lymphocytes as the DNA source. "The combined alcoholic group compared to the non-alcoholic group shared a significantly greater association with the A1 'allele of the D2DR gene" (p.409). This is relevant because of the

well-known association between alcoholism and crime, particularly violent crime; as Moir and Jessel point out, "all research points to the colossal influence of alcohol in virtually every brand of crime". (p.69). Finally, it is notable that psychoticism links significantly in the basal ganglia with dopamine 2 (Gray, Pickering & Gray, 1994). These associations deserve more detailed study.

The mediation between DNA and behaviour has been discussed in great detail by Zuckerman (1991) for personality, and for criminality by Raine (1993) in an academic and by Moir & Jessel (1995) in a popular book. Also of interest is a book by Masters and McGuire (1994) as "The Neurotransmitter Revolution", dealing more specifically with serotonin, social behaviour and the law. It cannot be the purpose of this chapter to summarize these extensive discussions, but a few important points may repay highlighting.

On the whole, MAO in low levels is associated with aggression, impulsivity, and novelty-seeking. **Dopamine** is related to aggressivity, **serotonin** to lack of aggressiveness. However, as Ginsburg (1994) has shown, differences in underlying genotypes are major modifying factors. "Where the effect on one genotype is to increase aggression, the effect on the other is to decrease it" (p.124). This research was done in mice, but it suggests complications as far as human research is concerned. In monkeys, there is a robust link between diminished serotonergic function and destructive aggression (Masters and McGuire, 1994). Clearly much remains to be discussed, particularly about the most relevant animal model for human conduct, and the conditions under which a given neurotransmitter functions in a particular manner.

Of particular interest is a recent study by Klinteberg (1995), concentrating on the development of antisocial behaviour in 82 male and 87 female subjects. Available were teacher ratings at age 13, self-ratings of normbreaking behaviours. Furthermore, in the male group, criminal offending was found to be related to adult psychopathy-related personality traits (high impulsiveness and monotony avoidance, and low socialization) and to an indicator of disturbances in the serotonergic transmitter system. The same personality pattern, even more accentuated, was characterizing the violent criminal offending male group. Among female subjects, criminal offenders were characterized by high cognitive-social anxiety (high psychasthenia), low guilt, and indications of low activity in serotonergic turnover. High normbreaking behaviours in adolescence were associated with adult impulsiveness, low socialization, and signs of low serotonergic activity in both the male and female subjects. Low MAO levels were also characteristic of offenders.

Testosterone is an obvious candidate for a proximal antecedent role in view of the large sex differences in criminality. A detailed summary of the literature leaves little doubt that one of the effects of exposing the hunan brain to high (male-typical) levels of androgens is to increase the probability of behaviour patterns that lead to criminality (Ellis & Coontz, 1990). Aggression in particular is associated with high plasma testosterone (e.g. Ehrenkranz, Bliss, Sheard, 1974; Dabbs et al., 1984, 1988); Olweus, Mattson, Schalling & Loew, 1980). Impulsiveness, P, E and N usually correlate positively with plasma testosterone, but usually not above .2; there is high daily variability in plasma testosterone so that the mean of a number of measures should be used to obtain an aggregate measure. It is of interest that at three different age levels, black men obtained higher serum testosterone levels than white men (all were male Vietnam era veterans). Whether this is relevant to the higher criminality levels of black men is not clear, nor why there should be such a difference (Ellis & Nyborg, 1992).

Finally, a brief discussion of autonomic measures may be appropriate. Arousal forms a central part of the theory of criminality, and arousal can be measured by autonomic indicators. Of particular interest are two studies by Raine, Venables & Williams

(1990a, b) in which they studied autonomic activity change at age 15 as a predictor of criminality at age 24. Arousal was specifically lower in 15-year-olds who were later identified as criminals at age 24; this was true of a number of different studies. The same authors found increased attentional processing characteristics in predicting inter criminality, using EEG and contingent negative variation measures; this may link up with psychoticism through the low latent inhibition activity of high P scorers (Lubow, 1989). Raine (1993) has given an excellent summary of the evidence, leaving little doubt about the tendency for criminality to be linked with low arousal.

The Eysenck theory centres on low arousal leading to poor Pavlovian conditioning and hence to lack of conscience and anti-social behaviour. I have noted that the evidence favours low arousal in criminals; how about poor conditioning? Hare (1978) reported on 14 such studies, and Raine (1993) summarized results from 5 further studies. With two dubious exceptions, all of these studies gave results in accordance with prediction. One study explicitly investigated Eysenck's (1977) prediction that children who were highly conditionable and who had antisocial parents would become "negatively socialized" into their parents' antisocial habits, whereas children who conditioned poorly would paradoxically avoid becoming antisocial. Raine and Venables (1981) successfully demonstrated that this was indeed so. The only study to relate the Gough So scale to conditioning found low scorers less responsive to verbal reinforcements (Sarbin, Allen & Rutherford, 1969).

Avoidance learning, too, is associated with (high) arousal, and may indeed be considered a form of conditioning; Raine (1993) has reviewed the literature and shown that criminals tend to show **poor** avoidance learning. They are also very sensitive to rewards, a behaviour linked with extraversion (Gray, 1982, 1987); thus failure to condition may be only in response to **negative** reinforcement. Other psychophysiological consequences of low arousal have been reviewed by Raine (1993); they tend to follow the lines of prediction in showing criminals to have **low arousal** patterns.

It may be noted that when we look at the four major interactive biosocial theories of delinquency and crime listed by Raine, Brennan & Farrington in their introductory chapter, those by Mednick (1977) and Buikhuisen (1988 clearly are included in the Eysenck (1977) formulation, as involving poor conditioning. They concentrate on one aspect of the conditioning process, namely **avoidance learning**, but this is only one aspect of a more complete picture which also includes the effects of positive reinforcement. Moffitt's (1993) theory adds perinatal complications, but is not otherwise incompatible with a low arousal-poor conditioning theory. There seems to be here the beginnings of a paradigm, so long missing in this field.

Moffitt lists poor nutrition as one of the social environment effects that might interact with biological causes. There is some evidence on this point that concerns the main subject of this book, namely violent behaviour. Schoenthaler (1991) has reviewed the studies which suggested very strongly that violence in prison could be reduced by some 40% by micro-nutrient supplementation. None of these studies was without flaws, but the wide-reaching agreement should not be disregarded. The most recent study puts the matter beyond reasonable doubt. A triple-blind, randomized, controlled study among 402 male prisoners aged 18 to 25 years in California showed a statistically significant change in serious rule violation (largely violence towards warders and fellow prisoners). Two formulae (100% and 300% RDA) were tried, and as with IQ studies, the 100% was the more successful, giving a rule violation decrease of 41%, as compared with 16% among the 300% RDA group. Among the placebo group, there was a slight (20%) rise during the same period. Looking at the difference between micro-nutrient and placebo, these were -61% and -36%, respectively. As expected, improvement was observed in those prisoners

who had the most vitamin and mineral status as assessed by blood analysis. Clearly it is possible to modify violent conduct by means of micro-nutritional supplementation, and it would seem an urgent need to repeat the experiment with school children in deprived areas to assess the effect of such supplementation on school behaviour and antisocial conduct generally (Eysenck & Eysenck, 1991).

I would conclude that **personality is a concept that is an essential feature of any acceptable theory of criminality and antisocial behaviour.** Personality provides a taxonomy of human behaviour that includes antisocial, aggressive, violent and generally criminal behaviour, and relates to genetic and biological variables. Only by reference to the wider perspective offered by attention to the major dimensions of personality can we hope to understand the causes of criminality.

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