Epigenetic Rules in Moral Development: Distal-Proximal Approaches to Altruism and Aggression

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A time continum of levels of explanation is offered ranging from distal, evolutionary analyses, through trait and social learning perspectives, to proximate cognitive and situational accounts. While most research has been carried out from proximal perspectives, this paper considers data from each of the levels and concludes with a theory of moral development based on evolutionarily derived r/K reproductive strategies. When aggression is assessed using aggregate procedures, 1) consistent patterns of individual differences exist, forming part of a broad syndrome of moral behavior; 2) group differences in aggression emerge such that females < males, older < younger, and higher socioeconomic < lower socioeconomic; 3) individual differences are about 50% heritable; 4) epigenetic rules guide social development in one direction over alternatives; and 5) aggression is part of a constellation of reproductive attributes deeply embedded in evolutionary history

Key words: behavior genetics, law-abidingness, r/K reproductive strategies, sociobiology, trait theory

INTRODUCTION

Research on aggression and victimizing behavior is becoming broader in scope as researchers explore their relation to other aspects of cognitive and social functioning, as well as to biological and genetic factors. It seems increasingly clear that what we are dealing with is a broad continuum from prosocial to antisocial behavior, with individual differences linked at the behavioral level to criminality, intelligence, and sexuality, at the physiological level to neuroandrogenic functioning, and at the ultimate level to evolutionarily based reproductive strategies [Eron, 1987; Mednick et al., 1987; Olweus et al., 1986; Rushton, 1985; Wilson and Herrnstein, 1985; Zahn-Waxler et al., 1986]. In this article, I will outline a time continuum of levels of

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Fig. 1. The distal-proximal dimension and levels of explanation in social behavior. When explanations move from distal to proximal controversy does not ensue, whereas the converse is less true. Source: Rushton [1984].

explanation by which to organize disparate conceptual schemes and data sets, and I will review evidence on the predictive utility of the different perspectives.

Numerous errors and unnecessary debates have occurred as a result of confusing distal and proximal levels of reasoning (see Fig. 1). When explanations move from distal to proximal, controversy does not ensue. Evolutionary biologists do not find the heritability of traits problematic, trait theorists accept that dispositions are modified by later learning, and learning theorists believe that the products of early experiences interact with subsequent situations to produce emotional arousal and cognition. Resistance is more likely, however, as explanations move from proximal to distal. Thus, some phenomenologists mistrust the reduction that consciousness is partly the result of previous learning. Situationists and learning theorists do not always accept that people's choices and development may be guided by inherited traits. Often behavior geneticists ignore evolutionary history.

Behavior can be analyzed usefully from each of the levels. For example, situations can induce mood changes of happiness and anger that alter people's altruism and aggression [Rushton, 1980]. People can also be shown to differ, however, in average mood state [Epstein, 1979]. It is at this stage that conceptual problems occur, for some find it difficult to see how, if people alter their behavior with varying circumstances, they can be said to have enduring characteristics that reliably differentiate them from others. This crucial issue is worth considering in detail. On the continuum in Figure 1, let us take a distal step away from a situational analysis to a consideration of trait theory.

THE AGGRESSIVE PERSONALITY

Figure 2 presents hypothetical data in which people's aggression varies across situations. Relative to baseline, individuals A and B are nonaggressive while sitting in church, moderately aggressive while driving, and most aggressive while playing a sport. While playing cards, A increases and B decreases in aggression. Thus intraindividual, situational, and person \times situational variation is demonstrated. The essential point, however, is that average differences are also found with A generally being more aggressive than B. Depending on which situation is focused on, however, this observation could have been missed. The most stable and representative picture of A's and B's aggressiveness therefore is gained by using the *principle of aggregation* and taking an average, for in this way more idiosyncratic sources of variance are averaged out and any consistencies in the behavior will accumulate, leaving a clearer view of a person's central tendency [Rushton et al., 1983].



Fig. 2. Hypothetical data illustrating alternative models of person \times situation interaction. Averaging across situations shows person A to be generally more aggressive than person B, whereas averaging would have little effect on the data of individuals C and D.

It could be argued that the data of individuals C and D are more representative of reality. Here averaging would have little effect, and the appropriate level of analysis would more often be the situation or a person \times situation interaction [Campbell and Gibbs, 1986; Campbell et al., 1987]. In support, such theorists point to the alleged low level of cross-situational consistency in behavior. In a study of self-reported aggression, for example, Campbell et al. [1985] published a correlation of 0.19 as indicative of the degree of cross-situational consistency and cited a review by Mischel [1968] to the effect that the typical cross-situational consistency coefficients of .20 to .30 are too low to support the edifice of trait theory.

A major error of interpretation is involved in this analysis. The error is to focus on correlations between just two situations. The more accurate assessment of differences in central tendency is obtained from a number of measures. This methodological point applies equally to self-report items, judges' ratings, behavioral measures and physiological indices, whether assessed in situationally specific or generalized manners. For example, single items on IQ tests only correlate 0.15; subtests based on 4 to 6 items correlate 0.30 or 0.40; and batteries of items comprising verbal and performance subscales correlate 0.80. In a behavioral mode, Eaton [1983] assessed differences in activity level in 3 and 4 year olds using single vs. multiple actometers attached to the children's wrists as predictors, and parents' and teachers' ratings as criterion. Single actometers correlate 0.69.

Figure 3 presents data applying the principle of aggregation to an aggression questionnaire where correlations increase as a function of the number of items involved. Twenty-three items used by Rushton et al. [1986a] in a study of 573 pairs of twins included "Some people think I have a violent temper" and "I try not to give



Fig. 3. Relation between number of aggressive exemplars and degree of predictability. As shown, aggregated estimates provide increased utility. Source: Rushton and Erdle [1987a].

people a hard time." As the number of items being correlated increase from 1 to 7 to 11, the corresponding predictabilities increase from 0.10 to 0.44 to 0.54 [Rushton and Erdle, 1987a]. Clearly, if the goal is to predict aggressiveness, aggregated estimates provide increased utility. These data also imply that the model of interaction demonstrated by Person A and B in Figure 2 is more accurate than the one shown by Person C and D.

Individual differences in aggressiveness, when reliably assessed, are longitudinally stable and predictive of both antisocial and prosocial behavior. For example, Olweus [1979] reviewed data showing that assessments of aggression were as longitudinally stable as were measures of intelligence. Eron [1987] and Huesmann et al. [1984] report that individual differences at age 8 years correlated .46 with those at age 30, and that they predicted a syndrome of antisocial behavior including criminal convictions, traffic violations, child and spouse abuse, physical aggressiveness outside the family, poor educational and occupational status, and mental disorder. Moreover, the stability of aggression was found to exist across three generations, from grandparents to children to grandchildren. Several studies have also found negative relationships between prosocial and antisocial behavior [Eron, 1987; Eysenck, 1977; Rushton et al., 1986a]. Other data show that antisocial behavior is linked to the early onset of sexual intercourse [Jessor et al., 1983; Rowe et al., 1987]. Thus, a more extensive syndrome of behavior appears to exist than is typically considered.

GROUP DIFFERENCES IN PROSOCIAL AND ANTISOCIAL BEHAVIOR

A neglected topic in moral behavior is group differences (e.g., age, sex, socioeconomic). As with traits generally, the main empirical reason cited for negating such effects is the alleged low level of variance accounted for. A necessary prerequisite for adequately examining group differences, however, is reliable measurement, but since many studies fail to use aggregate procedures the results are often inadvertently biased in favor of the null hypothesis. If there is little reliable variance in dependent variables, it cannot be apportioned sizeably to independent variables. This point was illustrated by Rushton and Erdle [1987a] in a reanalysis of Rushton et al.'s [1986a] questionnaire data. Males had been found to be significantly more aggressive than females (and less nurturant and empathic), and aggressiveness had been found to decrease with age from 20 to 60 years, while components of altruism increased. Rushton and Erdle [1987a] showed that these observations would have been missed if the analyses had relied on single items, for the variance accounted for by sex differences increased from 1 to 3 to 8% as the number of questionnaire items increased from 1 to 5 to 23. Parallel results were found to occur when age and SES differences were examined. Combining age, sex, and SES in a multiple regression equation, again differentiating a 1- to 23-item scale, led the multiple R to increase from an average of 0.18 for single items to 0.39 for the 23 items.

Research on sex differences often ignores the principle of aggregation. In a review of empathy, for example, Eisenberg and Lennon [1983] reported that the effect sizes favoring females were minimal or nonexistent on behavioral and physiological measures, moderate on specific self-ratings in specific situations, and most on self-report questionnaires. On the basis of this evidence, Eisenberg and Lennon concluded that the widespread belief in sex differences in empathy was probably due to the effects of stereotyping since the behavioral measures were the least susceptible and the selfreport measures were the the most susceptible to this type of influence. An alternative interpretation is that effect sizes depend on the amount of aggregated variability in the dependent variable. To test this hypothesis, Rushton and Erdle [1987b] examined the studies presented in Eisenberg and Lennon's [1983] review and found that for seven studies of reflexive crying a correlation of .69 (P < .05) resulted between the size of the effect favoring females and the total time possible to be measured in the dependent variable, and for 21 studies using questionnaires, a correlation of .73 (P <.001) occurred between the size of effect favoring females and the total number of units possible in the dependent variable. Thus, the greater is the variability in the dependent variable, the greater is the sex difference.

BEHAVIOR GENETIC STUDIES

Taking a further step or two in the distal direction of Figure 1, consider the genetic origin of individual differences in prosocial and antisocial behavior. According to American, Danish, and Swedish adoption studies, children who were adopted in infancy were at greater risk for criminal convictions if their biological parents had been so convicted than if their adoptive parents had been [Cadoret et al., 1975; Cloninger et al., 1982; Mednick et al., 1984]. In Mednick et al.'s [1984] study of 14,427 children separated from parents at birth, it was found that siblings and half-siblings adopted separately into different homes were concordant for convictions. Converging with this adoption work, twin studies of adults have found that identical twins were roughly twice as much alike in their criminal behavior as fraternal twins [Christiansen, 1970; Cloninger et al., 1978; Rowe, 1986]. In Rowe's [1986] analysis of twins reared together, the heritability of antisocial behavior was about 50%.

While critics have argued that the twin method is invalid for estimating heritability, detailed empirical work demonstrates the critiques to be of limited importance. For example, in cases where parents and twins misclassify zygosity, the degree of twin similarity on many traits is better predicted by true zygosity (defined by blood and fingerprint analysis) than by social definition [Scarr and Carter-Saltzman, 1979]. Moreover, Loehlin and Nichols [1976] showed that when measures of the differences

Trait	Additive genetic variance (%)	Common environmental variance	Specific environmental variance
Aggressiveness	39 (54) ^a	0 (0) ^a	61 (46) ^a
Assertiveness	53 (69) ^a	$0(0)^{a}$	47 (31) ^a
Altruism	51 (60) ^a	$2(2)^{a}$	47 (38) ^a
Empathy	51 (65) ^a	$0(0)^{a}$	49 (35) ^a
Nurturance	43 (60) ^a	1 (1) ^a	56 (39) ^a

TABLE I. Estimates of Variance Components and Estimates Corrected for Unreliability From a Biometrical Analysis of Aggressiveness, Assertiveness, Altruism, Empathy, and Nurturance Ouestionnaires From 573 Adult Twin Pairs*

*[After Rushton et al., 1986a]

^aEstimate corrected for unreliability of questionnaire.

that do exist in the treatment of twins are correlated with personality and other scores, there was no evidence that differences in treatment had any effect.

One of the less appreciated aspects of twin studies is the information they also provide about environmental effects. If the raw data are the between- and within-pair variances and covariances, then between-pair mean squares reflect both pair resemblances and pair differences, while the within-pair mean squares only reflect pair differences [Plomin et al., 1980]. The genetic models are fitted to these mean squares, and the total phenotypic variance can be partitioned into three sources: V(G), additive genetic effects; V(CE), common environmental influences that affect both twins equally; and V(SE), specific environmental influences that affect each twin individually. This latter is a residual term that comprises many sources, including measurement error and certain kinds of interaction between genotypes and environments. Thus, the total phenotypic variance is partitioned as V(G) + V(CE) + V(SE).

Using such a design with 573 adult identical and fraternal twin pairs, Rushton et al. [1986a] examined the cultural and genetic inheritance of individual differences in altruism and aggression. Components of these traits were measured by paper and pencil questionnaires in which the 1,146 respondents endorsed items measuring their self-reported aggressiveness, assertiveness, altruism, empathy and nurturance. Model-fitting estimation procedures revealed 50% of the variance on each scale to be associated with genetic effects, virtually 0% with the twin's common environment, and the remaining 50% with each twin's specific environment and/or error associated with the test. Correcting for the unreliability in the tests raised the heritabilities to 60% and reduced the specific environment variance to 40%. A summary of the results is presented in Table I. These data not only signify a strong association of genetic factors with the characteristics in question but also indicate a negligible influence of the twin's *shared* environment. Rather, the distinct experiences of the individual account for almost all the environmental variance.

The discovery that common family environment plays a very limited role in social development (even for traits that parents are expected to socialize heavily such as aggression, altruism, and rule-following) runs counter to prevailing theories of personality development that assume that the important environmental variance is between families, not within. Yet the observation that the environmental factors that influence development are those that are specific to each sibling, rather than common, is robust, having been replicated using samples of four different types: twins reared together, twins reared apart, adoptive parents and their offspring, and adoptive siblings [Plomin and Daniels, 1987; Rowe, 1987]. Regardless of whether one considers the transmission of socially undesirable traits such as crime, obesity, and schizophrenia, or more normative personality charcteristics such as vocational interests and value systems, the evidence reveals that whereas genetic influences have an important role to play, the common family environment alone has little apparent effect.

These results are most readily grasped from the comparison of twins reared together and apart. They are also derived from the comparison of adoptive and biological siblings raised in the same family from infancy to adulthood, where the less related the siblings are, the increasingly divergent they grow with age. Following the lead of Bouchard [1984] and Rowe [1987], I provide in Table II a contrast of the world literature on adult identical twins reared apart for intelligence and personality with that for other relationships categories. The results converge in showing substantial genetic effects on the traits in question, and considerably weaker or nonexistent effects to common environment. That siblings raised apart for many years in complex environments grow to be significantly similar to each other on a variety of traits, and that their degree of similarity is predicted by the number of genes they share, implies the presence of genetically based stabilizing systems that channel development [Lumsden and Wilson, 1981; Rushton et al., 1986b; Scarr and McCartney, 1983].

EPIGENETIC RULES IN SOCIAL DEVELOPMENT

Genes do not cause behavior directly. They code for enzymes, which, under the influence of the environment, lay down tracts in the brains and nervous systems of individuals, thus differentially affecting people's minds and the choices they make about behavioral alternatives. In regard to aggression, for example, some people may inherit temperaments that dispose them to irritability, impulsivity, or a lack of conditionability [Eysenck, 1977; Rushton and Chrisjohn 1981]. There are many plausible routes from genes to behavior, and collectively these routes may be referred to as epigenetic rules.

Epigenetic rules are genetically based recipes by which individual development is guided in one direction over alternatives. Their operation is probably most apparent in embryology in which the construction of anatomical and physiological features occurs [Waddington, 1957]. To take a familiar example, the physical development from fertilized egg to neonate follows a preordained course in which development starts in the head region and works its way down the body. By the end of the 1st month, a brain and spinal cord become evident, and a heart has formed and begun to beat. By the end of the 8th week, the developing fetus has a face, arms, legs, basic trunk, and internal organs. By the 6th or 7th month, all major systems have been elaborated, and the fetus may survive if born prematurely. However, development continues, and the last months of pregnancy are important for the buildup of body fat, tissue, and antibodies and for the refinement of other systems.

The channeling of development requires that constant self-correcting adjustments occur until some targeted end-state is reached, as is illustrated in studies of "catch-up growth" following deficits caused by malnutrition or illness. Deprived children subsequently develop very rapidly to regain the growth trajectory they would have been on if the diversion had not occurred, following which growth slows down and development proceeds at the normal rate [Tanner, 1978]. Experimental examples of such corrective processes have been carried out on the growth of optic neurons in

	Intelli	gence	Personality		
	No. of pairs	Intraclass correlation	No. of pairs	Intraclass correlation	
Identical twins reared together	4,672ª	.86	5,000 ^{b,c}	.52	
Identical twins reared apart	65ª	.72	106 ^{c-e}	.54	
Fraternal twins reared together	5,546ª	.60	8,000 ^{b,c}	.23	
Fraternal twins reared apart	29 ^f	.47	20 ^c	.18	
Biological siblings reared together	26,473 ^a	.47	17 ^g	.20	
Biological siblings reared apart	203ª	.24	_	_	
Adoptive siblings reared together	369ª	.34	78 ^g	.07	

TABLE II.	World	Literature	e on Simil	larity in	Twins	Raised	Apart	Compared	With (Other
Relationshi	ip Cates	gories on I	ntelligenc	e and P	ersonal	lity				

^aBouchard and McGue [1981].

^bFloderus-Myrhed et al. [1980].

^cTellegan et al. [in press].

^dShields [1962].

eNewman et al. [1937].

^fPedersen et al. [1985].

^gLoehlin et al. [1985].

young kittens. The visual cortex typically receives excitatory input from both eyes, but occluding one eye causes a compensatory growth to occur from the nondeprived eye. However, if the originally experienced eye is closed at the time that the deprived one is reopened there can be virtually total capture of neurons by the newly opened eye [Blakemore et al., 1978]. This reverse suturing paradigm implies that developmental processes are constantly involved in a match-to-model process with an inherent growth equation.

The canalization of growth processes can also be illustrated with findings from the newly emerging field of developmental behavioral genetics [Plomin, 1983, 1986]. Phenomena reflecting genetic timing mechanisms, for example, include the age of onset of puberty and menopause in which identical twins are highly concordant, whether reared apart or together [Bouchard, 1984]. Comparisons of twins also show that the genes influence the age of first sexual intercourse [Martin et al., 1977]. Another example is Huntington's chorea, a degenerative disorder of the central nervous system caused by a dominant gene. Age of onset varies from 5 to over 75 years, but family studies show that it is under genetic control. Chronogenetics also affects cognitive development as shown in a large sample of twins followed from age 3 months to 15 years in which the synchronies between lags and spurts in mental development were found to average about 0.90 for identical twins, but only about .50 for fraternal twins [Wilson, 1983].

Many additional data show that epigenetic rules guide psychological development, from sensory filtering through perception to feature evaluation to decision making [Lumsden and Wilson, 1981]. For example, while the brain perceives variation in luminance along a continuum, it divides color into categories, using language to do so. Many social scientists used to believe that the divisions into red, green, and so forth were arbitrary, but linguistic and cross-cultural studies have shown that they are in fact closely tied to natural color perception. The application of epigenetic rules to more complex social behavior has also been made. For example, canalized end-points appear to underlie the evolutionary function of smiling, attachment, and separation responses in infants [Freedman, 1974]. Similar interpretations can be made of the life-cycle stages documented to occur in ego development, morality and psychosocial functioning [Loevinger, 1987]. Epigenetically based physiological hypotheses can also be provided. Thus, androgens may underlie Rushton et al.'s [1986a] observations that altruism increases across the life span, while aggressiveness decreases, and that sex differences hold up consistently across time. Testosterone production is known to decrease with age and to differentiate the sexes in the predicted direction [Ellis, 1986a].

The idea of genetic canalization provides an explanation for the important finding. mentioned earlier, that common family environment has little impact on longer-term personality development. Such factors as social class, family religion, parental values, and child-rearing styles, for example, are not found to have a common effect on siblings [Plomin and Daniels, 1987; Rowe, 1987]. This implies that within the same upbringing environment, the more belligerent sibling observationally learns the items from the parents' aggressive repertoire, whereas the more nurturant sibling selects from the parents' altruistic responses. Thus, in an analysis of television effects, Rowe and Herstand [1986] found that although same-sex siblings resembled one another in their exposure to violent programs, it was the most aggressive sibling who 1) identified most with aggressive characters and 2) viewed the consequences of the aggression as positive. Within-family studies of delinquents find that both IQ and temperament distinguishes delinquent siblings from those who are nondelinquent [Hirschi and Hindelang, 1977; Rowe, 1986]. It is not difficult to imagine how intellectually and temperamentally different siblings might acquire alternate patterns of social responsibility.

That genotypes seek out maximally conducive environments is particularly well illustrated by findings that aggressive and altruistic individuals select similar others with whom to associate, both as friends and as marriage partners [Huesmann et al., 1984; Rowe and Osgoode, 1984; Rushton et al., 1984]. The epigenetic rules that bias people to choose each other on the basis of similarity may be particularly fine tuned, inclining individuals to assort most on the more genetically influenced of sets of homogeneous attributes. Positive correlations between estimates of assortment and genetic influence have been observed for a variety of anthropometric, cognitive, and personological characteristics [Rushton and Nicholson, 1988; Rushton and Russell, 1985]. In addition, a study by Rowe and Osgoode [1984] found a correlation of 0.56 between the delinquency of self and the delinquency of friends, which path analyses showed to be genetically influenced. That similarity between friends and spouses is partly genetic in origin has been confirmed using blood tests [Rushton, in press-a].

The potential of epigenetic rules to bias behavior and affect society may go well beyond ontogeny. Via cognitive phenotypes and group action, altruistic inclinations may be amplified into charities and hospitals, creative and educative dispositions into academies of learning, martial tempers into institutes of war, and delinquent tendencies into social disorder. The idea that genes have such extended effects beyond the body in which they reside, biasing individuals to the production of particular cultural systems, constitutes a central focus for current thinking in sociobiology [Dawkins, 1982; Lumsden and Wilson, 1981]. Within the constraints allowed by the total spectrum of cultural alternatives, people create environments maximally compatible with their genotypes [Rushton et al., 1986b].

EVOLUTION AND r/K REPRODUCTIVE STRATEGIES

The most distal levels of understanding (Fig. 1) derive from knowledge of the evolutionary process. This is where epigenetic rules originate, having previously been successful in the blind process of bringing about the replication of the genetic material that gave rise to them [Dawkins, 1986]. Information from this ultimate point of view can directly inform proximate data, as well as show the continuity between humans and other animal species [Ellis, 1986b; Wilson, 1975, 1986].

An evolutionary theory of human altruism, law abidingness, and aggression has been proposed in which these traits are seen as part of an r/K reproductive strategy involving a syndrome of correlated characteristics also including intelligence and longevity [Rushton, 1985; following Wilson, 1975]. K, a symbol from population biology, represents a type of reproductive strategy in which elaborate parental care is lavished on very few offspring, and is contrasted with an r-strategy involving maximum egg output and no parental care. As can be seen in Figure 4, oysters, producing 500 million eggs a year exemplify the r-strategy, while the great apes, producing only one infant every 5 or 6 years, exemplify the K-strategy.

Evidence from both comparative studies and selective breeding experiments on species ranging from dandelions to fish to mice to men, indicate that these reproductive strategies are correlated with other features of the organism's life history. Following Eisenberg [1981], Pianka [1970], Wilson [1975], and Rushton [1985], these are summarized in Table III. While each of the life-cycle traits might independently contribute to fitness, the important point is that they are expected to covary along a single axis both between and within species.

Individuals and species are, of course, only relatively r and K. Thus, rabbits are Kstrategists compared to fish but r-strategists compared to humans. Primates are all relatively K-strategists, and humans are the most K of all. Indeed, as depicted in Figure 5, the order primates display a natural scale going from lemur to macaque to gibbon to chimp to humans, in which there is a consistent trend toward K with progressive prolongation of gestation period and life phases [Lovejoy, 1981]. Note the proportionality of the four indicated phases. The postreproductive phase is restricted to humans. With each step in the natural scale, populations devote a greater proportion of their reproductive energy to subadult care, with increased investment in the survival of offspring. As a species, humans are at the K end of the continuum. What has been proposed, however, is that some people are genetically more K than others, and that K-behavior is associated with a constellation of attributes, all deeply embedded in evolutionary history [Rushton, 1985].



Fig. 4. The r/K continuum of reproductive strategies balancing egg production and parental care. Source: Johanson and Edey [1981].

r-strategist	K-strategist		
Family characteristics			
Large litter size	Small litter size		
Short spacing between births	Long spacing between births		
Many offspring	Few offspring		
High rate of infant mortality	Low rate of infant mortality		
Low degree of parental care	High degree of parental care		
Individual characteristics			
Rapid rate of maturation	Slow rate of maturation		
Early sexual reproduction	Delayed sexual reproduction		
Short life	Long life		
High reproductive effort	Low reproductive effort		
High energy utilization	Efficient energy utilization		
Low intelligence	High intelligence		
Population characteristics			
Opportunistic exploiters of environment	Consistent exploiters of environment		
Dispersing colonizers	Stable occupiers of habitat		
Variable population size	Stable population size		
Competition variable, often lax	Competition keen		
Social system characteristics			
Low degree of social organization	High degree of social organization		
Low amounts of altruism	High amounts of altruism		

TABLE III. Some Life History, Social Behavior, and Physiological Difference Between r- and K-Strategists [Following Pianka, 1970]



Fig. 5. Progressive prolongation of life phases and gestation in primates. Note the proportionality of the four indicated phases. The postreproductive phase is restricted to man. Source: Lovejoy [1981].

Generalizing from the animal literature to human differences, the more K the family, the greater should be the spacing between births, the fewer the number of offspring, the lower the rate of infant mortality, the more stable the family system, and the better developed the parental care. The more K the person, the larger should be the period of gestation, the higher the birthweight, the more delayed the onset of sexual activity, the older the age at first reproduction, the longer the life, the more physiologically efficient the use of energy, the higher the intelligence, the more social-rule-following the behavior, and the greater the altruism. Thus, diverse organismic characteristics, not otherwise relatable, are presumed to covary along a single dimension.

Consideration of the evidence provides support for the K-perspective. As a necessary preliminary, many indices of K have been found to be heritable. Including some mentioned earlier, these are family size and structure [Bulmer, 1970]; the age of onset of puberty and menopause [Bouchard, 1984]; the rate of growth from 3 months to 15 years in height and mental development [Wilson, 1983]; the strength of the sex drive and its relation to age of first intercourse, intercourse frequency, and total number of partners [Eysenck, 1976; Martin et al., 1977]; energetic efficiency and obesity [Stunkard et al., 1986]; the onset of degenerative diseases associated with aging [Omen, 1977]; longevity [Hrubec et al., 1984]; and such personality traits as altruism and aggression [Rushton et al., 1986a], intelligence [Bouchard and McGue, 1981], law abidingness [Mednick et al., 1984], social attitudes [Martin et al., 1986], and temperament [Buss and Plomin, 1984].

Studies also find the predicted covariation among the K-attributes. Rushton [in press-b] contrasted the characteristics of the mothers of dizygotic twins who, because they produce more than one egg at a time can be considered to represent the r-strategy, with the mothers of singletons representing the K-strategy. As expected, the former were found to have a lower age of menarche, a shorter menstrual cycle, a higher number of marriages, a higher rate of coitus, a greater fecundity, more wasted pregnancies, an earlier menopause, and an earlier mortality.

Individual differences in moral behavior including aggressiveness can be linked to the r/K dimension in several ways. First, altruistic behavior, as shown in Table III, has been identified by evolutionary biologists as a characteristic of K-selected species. Victimizing behavior, whether criminal or not, can be conceptualized as the opposite of altruism. Of equal interest, however, is the identification in Table III of K-selected species as being higher in social organization than r-selected species. With humans, stable social organization depends on individuals adhering to rules, as does much human altruism [Rushton, 1980]. Aggression and crime, on the other hand, show similarity in that social rules are broken and others are harmed.

Aggression may be related in additional ways to the r/K dimension. Wilson [1975], for example, distinguishes between *scramble* and *contest competition*, in which in the r-strategy, each time a scarce resource such as food materializes, individuals compete anew in a scrambling manner, whereas in the K-strategy, individuals first compete to establish a dominance hierarchy and then, each time, take their share of the resources based on the established social order. Establishing a stable social order is obviously a necessity for good functioning in a complex civilization.

In an empirical test of some of these ideas, Ellis [1987] contrasted the characteristics of those low in social-rule-following (criminals) with matched controls, and found them to have shorter gestation periods (more premature births), a more rapid development to sexual functioning, a greater copulatory rate outside of bonded relationships and a preference for such, less stable bonding, a lower parental investment in offspring (as evidenced by higher rates of child abandonment, neglect, and abuse), and a shorter life expectancy. Thus, preliminary evidence for the r/K perspective on altruism and aggression has been provided.

CONCLUDING REMARKS

While much research in moral behavior is carried out from a proximate perspective, it has been shown that distal levels of analysis also have predictive utility. There may be some reluctance, however, to accept "reductionistic" positions implying that cognition, choice, and learning are influenced by genetic processes. A preference for proximate reasoning, however, ought not to exclude alternatives. While wariness of distal interpretation may be due in part to concern about extreme reductionism, another reason is lack of knowledge. It is rare for cognitive social learning theorists to expose themselves to behavior genetics, for humanistic phenomenologists to immerse themselves in psychometrics, or for trait theorists to pursue behaviorism. Many researchers are devoted to an exclusive orientation. Increasingly powerful behavior genetic methodologies, however, are becoming available with which to test different weightings for the components in Figure 1 [Plomin et al., 1980; Plomin, 1986]. It is to be hoped that more levels will be used in the future, for the distal "morality of the gene" is necessarily mediated via the proximal mechanisms of social learning, cognition, and situational behavior.

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