

## H. J. Eysenck's Contributions to Behavior Genetics

J. PHILIPPE RUSHTON

*Department of Psychology, University of Western Ontario<sup>1</sup>*

In his autobiography *Rebel with a Cause*, Hans Eysenck situated himself firmly in the "London School" of psychology, defined by Charles Darwin's theory of evolution and its application to individual differences. Shortly after starting his own department (in 1950) Eysenck began work on the heritability of personality. His earliest study, published in 1951, found a strong genetic contribution to neuroticism, a discovery contrary to then prevailing opinion. Eysenck followed this up with a study of extraversion, and arrived at similar results. Later, Eysenck built up a several-hundred-pair Twin Register that was a boon to many researchers around the world (including this writer who published a behavior genetic analysis of altruism, empathy, and nurturance with Eysenck in 1986). Eysenck was certainly never afraid to propose theories about sensitive matters, including crime, sexuality, and race. Partly as a result of Eysenck, human behavioral genetics today is a well established discipline.

In his autobiography *Rebel with a Cause*, Hans Eysenck (1997, pp. 63-67) set out five principles he thought should govern the study of psychology as a scientific discipline. Although these seemed to him little more than commonsense, each was savagely attacked by what was often a majority of psychologists, and each led to large-scale theoretical battles. The first of Eysenck's principles was that human beings were *biosocial organisms*, whose conduct was determined by both genetic factors and by social factors. Eysenck thus situated himself firmly in the "London School" of psychology, which originated in Charles Darwin's theory

---

<sup>1</sup> London, Ontario, N6A 5C2, Canada

of evolution and advanced through Sir Francis Galton's applications to individual differences and through the psychometrics of Charles Spearman, Karl Pearson, and Sir Cyril Burt. Eysenck's four other principles: a mind-body continuum, reconciling correlational and experimental methods, abandoning distinctions between pure and applied psychology, and requiring proof for all assertions can likewise be seen as a program of unifying, rather than compartmentalizing, knowledge.

Shortly after Eysenck started his own department of psychology at the University of London's Institute of Psychiatry (in 1950), he studied the heritability of personality. One early analysis of 25 pairs of monozygotic (identical) and 25 pairs of dizygotic (fraternal) twins was published in 1951. This study, which uniquely combined factor analysis and behavioral genetics, revealed a strong genetic contribution to neuroticism, a discovery contrary to then prevailing opinion (Eysenck & Prell, 1951). In addition to the usual questionnaire measures, this early study included two measures of body sway taken while the subject stood with closed eyes which had high loadings on the neuroticism factor. In 1956, Eysenck followed this study up with one on extraversion finding a similar strong heritability, as he had earlier with neuroticism (Eysenck & Prell, 1956).

Eysenck advanced both the theory and practice of human behavioral genetics. Beginning in the 1960's, he recruited professional geneticists equipped with the most advanced methodologies of plant and animal genetics – John Jinks, David Fulker, and Lindon Eaves at the University of Birmingham – to analyze data on personality and IQ (e.g., Jinks & Fulker, 1970). Interestingly, many of these young British biometricians would soon emigrate to the United States, where they helped consolidate the behavior genetic tradition.

Following dozens of publications in major journals (e.g., Eaves & Eysenck, 1974, 1975; Martin et al., 1986), Eysenck's biometric collaboration culminated in his book *Genes, Culture and Personality* (Eaves, Eysenck & Martin, 1989). Here, genetic factors were firmly established as contributing something like 50 percent of the variance to a person's position along the three Eysenckian personality dimensions of Extraversion, Neuroticism, and Psychoticism. More sensationally, genes were found to contribute roughly 50% of the variance to a variety of social attitudes like prejudice, authoritarianism, religion, and conservatism. These findings of important genetic influence on attitudes and personality have been corroborated by other research designs including the adoption of twins raised apart, as in the famous University of Minnesota study by Thomas J. Bouchard and his colleagues (1990).

Eysenck never denied environmental factors of personality development. He and his colleagues were, in fact, among the very first to discover the remarkable (and counter-intuitive result) that the main source of environmental variance is *within* a family, (thus making twins and other siblings different from one another), rather than *between* families (making family members similar to each other [e.g., Eaves & Eysenck, 1975]). The environmental factors operating to

make family members different from one another include prenatal events, accidents during birth, illness, and the luck of having a good or a bad teacher. The shared environmental factors making siblings similar include sharing the same parents, the same home, the same food, the same schools, the same friends, and so on. But, as Eysenck and others have discovered, these between-family variables turn out to be relatively weak influences on long term personality.

Eysenck, of course, was never afraid to propose theories about sensitive matters. One of these, dating back to the early 1950s and leading up to his landmark 1964 book, *Crime and Personality*, suggested that criminality resulted from a genetic disposition toward poor conditionability which tended to produce an under-socialized, under-conformist individual. This theory had an immense impact on many researchers, among them Gisli Gudjonsson, who co-authored the 1989 book *The Causes and Cures of Criminality* with Eysenck (Eysenck & Gudjonsson, 1989). It also influenced Adrian Raine (1993), who extended Eysenck's theory to work on brain imaging of the prefrontal lobes which, he suggested, are "underaroused" in murderers. These and subsequent reviews of research on the heritability of crime corroborated Eysenck's (1964) insight that crime and delinquency were substantially heritable.

Eysenck and his colleagues also extended heritability analyses to encompass sexual behavior. In his book *Sex and Personality* (1976) Eysenck reported a twin study (153 pairs of male twins and 399 female twin pairs) finding that in the case of men, sexual desire was about two-thirds heritable whereas cultural influences were more important for women. Subsequently, Martin, Eaves, and Eysenck (1977) demonstrated a genetic influence for age of first intercourse.

One of Eysenck's most important pragmatic achievements was to build up a register of several hundred pairs of twins at the Institute of Psychiatry. Dozens of researchers from around the world have used this register, including the present writer. The occasion for my first study was a 1983 sabbatical spent with Eysenck at the Institute of Psychiatry (Rushton, Fulker, Neale, Nias & Eysenck, 1986). We investigated individual differences in empathy, nurturance and altruism – partly because this was my own area of research – and partly because we thought that here, unlike some of the other attitudes and traits that had been studied, parents would be especially likely to exert strong socializing influence on their children. Thus, I predicted that heritabilities would be much lower than in those found for other traits, say about 30%, and the shared-family environmental component much higher, say about 50%. Yet, we found that the responses from 573 pairs of 19- to 60-year-old twins to our questionnaires only confirmed the results of so many other studies. As shown in Table 1, about 50% of the variance on each scale was associated with genetic effects, virtually 0% with the twin's common environment, and the remaining 50% with each twin's specific environment. When the estimates were corrected for unreliability of measurement, the genetic contribution increased to 60%.

Table 1: Variance Components for Altruism and Aggression Questionnaires from 573 Adult Twin Pairs

Trait	Additive genetic variance		Shared environmental variance		Non-shared environmental variance	
	%	(%)	%	(%)	%	(%)
Altruism	51	(60)	2	(2)	47	(38)
Empathy	51	(65)	0	(0)	49	(35)
Nurturance	43	(60)	1	(1)	56	(39)
Aggressiveness	39	(54)	0	(0)	61	(46)
Assertiveness	53	(69)	0	(0)	47	(31)

Note: Adapted from Rushton, Fulker, Neale, Nias, and Eysenck. (1986, p. 1195, Table 4). Copyright 1986 by the American Psychological Association. Reprinted with permission. Estimates in parentheses are corrected for unreliability of measurement.

In a follow-up study using the same Twin Register, I too corroborated Eysenck's hypotheses about the heritability of crime and misbehavior. I also found high heritabilities for *violent* behavior such as the destruction of property, fighting, carrying and using a weapon, and struggling with a police officer (Rushton, 1996), which previously had been disputed. These heritabilities were high for males (who are responsible for the overwhelming majority of violent crimes). However, I also found that environmental factors were predominant for women. The finding of a sex difference in the "genetic and environmental architecture" of violent behavior was especially interesting in light of Eysenck's finding, reported above, that sexual behavior in women too was more influenced by environmental factors. Taken together, these results suggest that women are more heavily socialized for sexuality and violence than are men.

### Animal research

Eysenck also broke new ground by suggesting that the major dimensions of personality should also be observable in non-human animals. In one study, rhesus monkeys were observed on a regular basis for two years (Chamove, Eysenck & Harlow, 1972). Ratings of their behaviors were then analyzed and three major factors extracted. Monkeys tended to be either aggressive (High Psychoticism), sociable (High Extraversion), or afraid (High Neuroticism). More recent work with chimpanzees has followed up Eysenck's initial ideas and examined sibling and other relationships to find that individual differences are heritable (Weiss & King, 1998).

Eysenck's main behavior genetic work with animals, however, focused on anxiety in rats. By breeding separate lines of fearful and non-fearful animals it was possible over several generations to obtain strains very different in appearance and behavior. This animal work continues today at the molecular level where the clinical implications are profound. If the same genes operate in highly emotional people as they do in animals, we may discover the means to understand (and alleviate) the anxiety that limits and even cripples many lives.

### Intelligence

Eysenck is especially well known for his work on the heritability of IQ although, as he states in his autobiography (1997, pp. 206-217), this is somewhat paradoxical, for he never actually did any original work on the genetics of IQ. He merely wrote about research conducted by others.

Eysenck's reviews of the literature on intelligence, however, were very influential. In *The Structure and Measurement of Intelligence* (Eysenck, 1979), Fulker and Eysenck (1979) examined a number of twin, sibling, and adoption studies and concluded that the best estimate of the heritability of intelligence was about 70 percent. In his autobiography, Eysenck (1997, p. 206) wryly noted the consistency of this estimate with one made decades earlier in the 1940s. Despite the unpopularity of the finding of high heritability for IQ in certain intellectual circles, and the vociferous political opposition it has generated over several decades, Eysenck concluded this had to be one of the best established facts in all of psychology! (See Jensen, 1998, for a recent review.)

### Race

Most controversially, Eysenck also joined the debate over whether the average Black-White IQ difference was at least partly genetic in origin. Ever since the time of mass testing in World War I, the bell curve for Blacks has been consistently 15 IQ points lower than that of Whites. When Arthur Jensen (1969) raised the genetic hypothesis in his famous *Harvard Educational Review* article, Eysenck (1971) entered the fray with his non-technical, popularly-written book *Race, Intelligence, and Education*. Simply by considering the genetic basis to race differences in IQ to be an open question made him a political pariah.

Eysenck had not always taken the view that genetic factors likely played a role in the Black-White IQ difference. In autobiographical accounts (e.g., Eysenck, 1993), he tells how, during the 1940s and 1950s, he had no difficulty in telling his students that there was no evidence for genetic differences in intelligence between racial groups, and that the differences that existed were due entirely to environmental pressures and the disadvantages imposed on Blacks by Whites. During the 1960s, however, he began to have doubts about the environmental

position. Eysenck (1993) has recorded that these doubts were strengthened especially after reading Jensen's (1969) account.

Four principal considerations led Eysenck to support the genetic hypothesis for race differences. First, the evidence showed that even after Black and White children were matched for the quality of their schooling, housing, and parental status and income, there still remained a 12 IQ point difference between them. In other words, all these social class variables taken together only accounted for 3 or 4 of the IQ points. Second, children of even middle-class Black parents averaged lower IQs than children of lower-class White parents. Thus, despite middle-class Black children having been raised in more advantaged environments than lower-class White children, they still performed at a lower average level. This suggested to Eysenck that genetic factors were operative through Galton's Law of Regression to the Mean. Third, other minorities even more deprived than Blacks, such as Native Americans, averaged higher on IQ tests than did Blacks. Finally, the kinds of IQ items that Blacks did best on were those most culturally influenced – like vocabulary and information rather than abstract reasoning – exactly opposite to the predictions from the anti-genetic perspective.

Characteristically, Eysenck reviewed other racial differences in behavior relevant to the nature/nurture question. Foremost among these were the findings of highly precocious sensory-motor development among African children. Most African babies, he wrote, who were put into a sitting position could keep their heads erect and their backs straight from the very first day of life. White babies typically required six to eight weeks to sustain these postures. To explain the findings, Eysenck cited the general law in biology according to which the more prolonged the infancy, the greater in general the cognitive complexity of the species. Eysenck also noted that Oriental babies were delayed in sensory-motor development relative to Whites. (See Rushton, 1995, for a recent review.)

Eysenck continued to write about race in the following years. In 1981, he debated in print with Leon Kamin, the arch-enemy of heritability analyses and race differences (Eysenck & Kamin, 1981). One underappreciated aspect of Eysenck's view on race and IQ is that vitamin/mineral supplements could alleviate some of the differences (Eysenck, 1991).

### A personal note

At this point, let me provide a more personal account. When Eysenck's book *Race, Intelligence, and Education* appeared in 1971, I was a graduate student at the London School of Economics. Two years later, Eysenck came to give us a lecture on "The Biological Basis of Intelligence." In 1973 the L.S.E. was (as now) one of the most radically left-wing universities in Britain. I was sitting with a friend in the eighth row. The entire first row was made up of Maoists proudly sporting red Mao-Tse Tung badges in their lapels. When Eysenck began to speak, these Maoists jumped forward in unison and physically attacked him.

Little did I know then, sitting horrified in the audience watching Hans Eysenck being attacked, that not 20 years later I would experience the same primal encounters. Although my early work focused on the social learning of generosity in 7- to 11-year-olds, I subsequently broadened my approach to altruism to include the sociobiological and behavioral genetic perspectives. As mentioned, I carried out two twin studies using Eysenck's Twin Register. I also reviewed the literature on race differences and proposed an evolutionary explanation for them (Rushton, 1995).

I would like to conclude on this note of personal appreciation for I often think of myself as a second-generation Hans Eysenck Ph.D. I did my Ph.D. in social psychology at the London School of Economics under Hilde Himmelweit and Hilde had received her Ph.D. with Hans at the Institute of Psychiatry. So, I think that makes me a sort of intellectual grandson of Hans. I am certainly very proud of that connection.

Hans Eysenck was a charismatic leader. Max Weber defined a charismatic leader as one who was able to transcend the boundaries of conventional thinking to achieve a sense of union with forces larger than himself and to carry forward others by a clear sense of conviction. Through his writing and through his example, Hans Eysenck was such a charismatic leader. He completely altered the way researchers look at the world. Unlike most charismatic leaders, Eysenck's vision had nothing to do with religion, or mysticism, or politics. It was about science. He seemed to see just so much more clearly than anyone else that there *was* an objective reality in human affairs and that *nothing* existed that was incapable of being measured. When the future giants of psychology see further, it will be because they will have stood on the shoulders of H. J. Eysenck.

## References

- Bouchard, T. T. Jr., Lykken, D. T., McGue, M., Segal, N. L., & Tellegen, A. (1990) Sources of human psychological differences: The Minnesota study of twins reared apart. *Science*, 250, 223-228.
- Chamove, A. S., Eysenck, H. J., & Harlow, H. F. (1972) Personality in monkeys: Factor analysis of rhesus social behavior. *Quarterly Journal of Experimental Psychology*, 24, 496-504.
- Eaves, L. J., & Eysenck, H. J. (1974) Genetics and the development of social attitudes. *Nature*, 249, 288-289.
- Eaves, L. J., & Eysenck, H. J. (1975) The nature of extraversion: A genetical analysis. *Journal of Personality and Social Psychology*, 32, 102-112.
- Eaves, L. J., Eysenck, H. J., & Martin, N. G. (1989) *Genes, Culture and Personality*. London: Academic.

- Eysenck, H. J. (1964) *Crime and Personality*. (1st ed.). London: Methuen.
- Eysenck, H. J. (1971) *Race, Intelligence and Education*. London: Maurice Temple Smith.
- Eysenck, H. J. (1976) *Sex and Personality*. London: Open Books.
- Eysenck, H. J. (1979) *The Structure and Measurement of Intelligence*. New York: Springer-Verlag.
- Eysenck, H. J. (1991) Race and intelligence: An alternative hypothesis. *Mankind Quarterly*, 32, 133-136.
- Eysenck, H. J. (1993) Introduction: Science and racism. In R. Pearson *Race, Intelligence, and Bias in Academe*. Washington, DC: Scott-Townsend.
- Eysenck, H. J. (1997) *Rebel with a Cause: The Autobiography of Hans Eysenck*. New Brunswick, NJ: Transaction.
- Eysenck, H. J., & Gudjonsson, G. H. (1989) *The Causes and Cures of Criminality*. New York: Plenum.
- Eysenck, H. J., & Kamin, L. (1981) *The Intelligence Controversy*. New York: Wiley.
- Eysenck, H. J., & Prell, D. B. (1951) The inheritance of neuroticism. *Journal of Mental Science*, 97, 441-465.
- Eysenck, H. J., & Prell, D. B. (1956) The inheritance of introversion-extraversion. *Acta Psychologica*, 12, 95-110.
- Fulker, D. W. & Eysenck, H. J. (1979) Nature and nurture. In H. J. Eysenck *The Structure and Measurement of Intelligence*. New York: Springer-Verlag.
- Jensen, A. R. (1969) How much can we boost IQ and scholastic achievement? *Harvard Educational Review*, 39, 1-123.
- Jensen, A. R. (1998) *The g Factor*. Westport, CT: Praeger.
- Jinks, J. L., & Fulker, D. W. (1970) Comparison of the biometrical genetical, MAVA, and classical approaches to the analysis of human behavior. *Psychological Bulletin*, 73, 311-348.
- Martin, N. G., Eaves, L. J., & Eysenck, H. J. (1977) Genetical, environmental, and personality factors influencing the age of first sexual intercourse in twins. *Journal of Biosocial Science*, 9, 91-97.
- Martin, N. G., Eaves, L. J., Heath, A. C., Jardine, R., Feingold, L. M., & Eysenck, H. J. (1986) The transmission of social attitudes. *Proceedings of the National Academy of Sciences of the U.S.A.*, 83, 4365-4368.
- Raine, A. (1993) *The Psychopathology of Crime*. San Diego, CA: Academic.
- Rushton, J. P. (1995) *Race, Evolution, and Behavior*. New Brunswick, NJ: Transaction.
- Rushton, J. P. (1996) Self-report delinquency and violence in adult twins. *Psychiatric Genetics*, 6, 87-89.



- Rushton, J. P., Fulker, D. W., Neale, M. C., Nias, D. K. B., & Eysenck, H. J. (1986) Altruism and aggression: The heritability of individual differences. *Journal of Personality and Social Psychology*, 50, 1192-1198.
- Weiss, A., & King, J. E. (1998, June) *The heritability of personality factors in zoo chimpanzees Pan troglodytes*. Paper presented at the meeting of the Behavior Genetics Association, Stockholm, Sweden.

## Doprinos H. J. Ajzenka bihejvioralnoj genetici

J. FILIP RAŠTON

U svojoj autobiografiji "Buntovnik s razlogom", Hans Ajzenk je sebe jasno smestio u "Londonsku školu" psihologije, definisanu Darvinovom teorijom evolucije i njenom primenom na individualne razlike. Ubrzo po osnivanju svog odeljenja (1950) Ajzenk je počeo rad na naslednosti ličnosti. U najranijoj studiji, objavljenoj 1951, našao je snažan genetski doprinos neuroticizmu, što je bilo suprotno tada preovlađujućem mišljenju. Nastavljajući sa istraživanjem ekstraverzije, Ajzenk je došao do sličnih rezultata. Kasnije je sačinio registar nekoliko stotina parova blizanaca, koji je bio blagodat mnogim istraživačima širom sveta (uključujući ovog autora koji je sa Ajzenkom 1986. objavio bihejvioralno-genetičku analizu altruizma, empatije i pružanja potpore). Ajzenk se svakako nikad nije plašio da iznese teorije o osetljivim temama, kao što su kriminal, seksualnost i rasna pitanja. Delom i kao rezultat Ajzenkovog rada, humana bihejvioralna genetika danas je dobro utemeljena disciplina.

## Вклад Х. Айзенка в бихевиоральную генетику

Ј. ФИЛИП РАШТОН

В своей биографии "Бунтовщик с причиной" Ханс Айзенк поместил себя в "Лондонскую школу" психологии, определенную теорией эволюции Дарвина и ее применением к индивидуальным особенностям личности. Вскоре после основания своего отделения (1950), Айзенк начал исследования наследственности личности. В самой ранней работе, опубликованной в 1951 году, он высказал мнение, противоположное принятым до этого времени взглядам, о большой роли генетики в нейротизме. Продолжая исследование экстраверсии, Айзенк пришел к подобному выводу. Впоследствии Айзенк составил регистр, насчитывавший несколько сотен пар близнецов, которым пользовались

многие исследователи во всем мире (включая автора настоящей работы, опубликовавшего вместе с Айзенком в 1986 году бихевиорально-генетический анализ альтруизма, эмпатии и поддержки). Айзенк никогда не боялся сообщить свои теории о таких чутких вопросах, как криминал, сексуальность, вопросы о расах. Благодаря отчасти и результатам исследований Айзенка, гуманная бихевиоральная генетика в наши дни является хорошо обоснованной дисциплиной.