AN APPRAISAL OF CRIMINAL INSANITY: ITS GENETIC ASPECTS AND ENVIRONMENTAL INFLUENCES*

Abstract

It is currently impossible to assign major responsibility for criminal behaviour and those traits leading to criminal behaviour through either genetics or the environment since both appear to be involved. The criminal law provides a defense for people who as a result of their mental condition, should not be held responsible for what would otherwise be criminal conduct. The aim of this article to investigate the genetic, environmental and psychiatric aspects of criminal insanity and to determine the role of the mental health services in the disposal of the accused in criminal proceedings by the criminal justice system. Consequently, this paper will examine the various roles in which both genes and environmental factors influence criminal behavior. This paper further analyzes recent researches carried out to assign responsibility to the importance of genetics as compared with environmental influences and other aspects such as neurological damage to an individual, which makes them susceptible to criminal type behaviour. This article is concluded by saying that while there is currently no gene directly linked to criminality, there are genes that are responsible for such functions as aggressiveness and impulsiveness to some degree. Finally this paper recommends that major effort should currently be directed towards preventing brain damage and other neurological problems as well as dealing with families that are likely to be prone to producing children of anti-social, aggressive, and violent behaviour. In addition to the home setting, schools, society and the mass media can do much to prevent criminal demeanor as well as the preventive aspects through the police and the courts.

Keywords: Criminal Insanity, behavioral genetics, human psychology,

1. Introduction

It is almost certain that currently forensic psychology and psychiatry are unlikely to be able to rely on genetic aspects in defense of clients and their anti-social behaviour. Human behavioral genetics may enhance our understanding of human behaviour and yet have little relevance to assigning responsibility in the criminal law[1]. Behavioral genetics seeks to understand the contributory roles of genetics and the environment. Criminal insanity is understood as a mental defect or disease that makes it impossible for a defendant to understand their actions, or to understand that their actions are wrong. A defendant found to be criminally insane can assert an insanity defense.[2] When asserting an insanity defense, the defendant essentially admits to having committed the wrongful act, but claims that they are not culpable because of their mental defect.[3] Criminal behavior has always been a focus for psychologists due to the age old debate between nature and nurture. Is it the responsibility of an individual's genetic makeup that make them a criminal or is it the environment in which they are raised that determines their outcome? Research has been conducted regarding this debate which has resulted in a conclusion that both genes and environment do play a role in the criminality of an individual. This evidence has been generated from a number of twin, family, and adoption studies as well as laboratory experiments. Furthermore, the research has stated that it is more often an interaction between genes and the environment that predicts criminal behavior. Having a genetic predisposition for criminal behavior does not determine the actions of an individual, but if they are exposed to the right environment, then their chances are greater for engaging in criminal or anti-social behavior. Therefore, this paper will examine the different functions that genetics and the environment play in the criminal behavior of individuals. There is a vast amount of evidence that shows our criminal justice system is the new home for individuals with psychological problems. Although this may seem like a solution to some, it is creating a dilemma for our society. Once we label these individuals as criminals it creates a stigma for those who may suffer from psychological problems. Certain psychological problems have been shown to be heritable and if given the right circumstances, individuals with those genes could find themselves engaging in criminal activity. Therefore, should society look towards limiting the reproductive capabilities of individuals who suffer from certain psychological problems to better society? That same question was asked back in the late nineteenth and early twentieth centuries when the role of genetics in crime was widely accepted[4]. Prominent researchers believed that genes were fully responsible for criminal activity and that criminals could be identified by their physiological features. Along with this information and the idea of a eugenics movement during the same time period, it was not surprising to learn that acts of sterilization took place to rid society of criminals, idiots, imbeciles, and rapists'.[5] This period was therefore marked with inhumane treatment and the belief that genes were the sole reason behind criminal behavior. Not long after the practices of controlled breeding, there was evidence to support

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[1] L.F. Lowenstein (2004) The Genetic Aspect of Criminality, Journal of Human Behaviour in the Social Environment, 8:1, 63-78,DOI: 10.1300/J137v08n0104

[2] Legal Information Institute, Cornell Law School, Legal Encyclopedia May 2020.

[3] *Kahler v. Kansas* Supreme court of Kansas (2020), 307 Kan; 374, 410 p 3d 105 affirmed.

[4] J. Joseph (2001). Is crime in the genes? A critical review of twin and adoption studies of criminality and antisocial behavior. *The Journal of Mind and Behavior, 22,* 179-218.

[5] J. Joseph (2001), p .182

the idea that the environment also played an important role in crime. Early family studies were conducted that showed a predisposition for criminal behavior as a result of inherited characteristics, but that an individual's characteristics and personality could still be modified by the environment.[6] Although these studies were void of high validity and reliability, it still raised the question of whether the environment can also influence individuals to act in a criminal manner. The debate between genetics and environment continues today with much more reliable research and data.

2. Definition and Measurement of Criminal Behaviour

Determining what constitutes criminal behavior can envelope a wide variety of activities and for that reason, researchers tend to focus on the wider context of antisocial behavior? Law in our society is defined by social and legal institutions, not in biology. Scientists and Researchers, who have investigated the genetic influences on criminal behavior, point out three different ways to define antisocial behavior. First is equating it with criminality and delinquency, which both involve engaging in criminal acts.[7] Criminality can lead to arrest, conviction, or incarceration for adults, while delinquency is related to juveniles committing unlawful acts.[8] Information can be collected using court and criminal records, as well as self-report surveys to analyze the influences that were present. Secondly, they advise individuals to define antisocial behavior is through criteria used to diagnose certain personality disorders. More specifically, they mean those personality disorders, such as Antisocial Personality Disorder, which is associated with an increased risk in criminal activity. A final measure suggested for defining antisocial behavior is by examining personality traits that may be influential in the criminal behavior of individuals. Traits such as aggressiveness and impulsivity are two traits that have been investigated the most.[9] Further details of disorders and personality traits associated with criminal behavior will be discussed later in the paper. With regards to determining the effects the environment plays in criminal behavior there are fewer resources available. Observational studies and reports submitted by parents are two sources, but not everyone agrees on the validity of information collected from these sources. Three additional sources of both genetic and environmental influences are twin, family, and adoption studies.[10]

It is important to recognize that the definition of criminal insanity can vary depending on the jurisdiction, meaning that one state may define insanity differently from another. For instance, some jurisdictions use the irresistible impulse test, where defendants essentially assert that their mental defect made it impossible to resist their impulses. Additionally, jurisdictions may follow the Model Penal Code which presents a distinct formulation of the insanity defense. Under this test, an individual is not liable for criminal offenses if, when he or she committed the crime or crimes, the individual suffered from a mental disease or defect that resulted in the individual lacking the substantial capacity to appreciate the wrongfulness of his or her actions or to conform his or her actions to requirements under the law. , or the more common 'M'Naghten rule.' Recently, the Supreme Court upheld Kansas's understanding of the criminal insanity defense, finding that due process does not require a state to adopt a criminal insanity test that considers whether the defendant recognized that their crime was *morally* wrong. In other words, due process not require that a court acquit a defendant who understood their actions, even if that defendant believed their actions were moral. See *Kahler v. Kansas*.[11]

3. Personality Trait and Disorders

Personality trait reflects people's characteristic patterns of thoughts, feelings and behaviours. Personality traits and disorders have recently become essential in the diagnosis of individuals with antisocial or criminal behavior. Based on the systematic review conducted to analyze the link between individual personality traits with criminal behavior, it was discovered that the individual personality traits that contribute towards criminality are (i) Psychopathy (ii) low self-control and (iii) difficult temperament.[12] In other words, greater consideration will be given to the dimension of personality as a notable risk factor of criminal behavior. These traits and disorders do not first become evident when an individual is an adult, rather these can be seen in children. For that reason it seems logical to discuss those personality disorders that first appear in childhood. Attention Deficit Hyperactivity Disorder (ADHD), Conduct Disorder (CD), and Oppositional Defiance Disorder (ODD) are three of the more

[6] *Ibid*

[7] K. Morley & W. Hall (2003). Is there a genetic susceptibility to engage in criminal acts? *Australian Institute of Criminology: Trends and Issues in Crime and Criminal Justice, 263,* 1-6.

[8] S. H. Rhee, & I. D. Waldman, (2002). Genetic and environmental influences on antisocial behavior: A meta-analysis of twin and adoption studies. *Psychological Bulletin, 128,* 490-529.

[9] K. Morley & W. Hall (2003). Is there a genetic susceptibility to engage in criminal acts? *Australian Institute of Criminology: Trends and Issues in Crime and Criminal Justice, 263,* 1-6

[10] J. Tehrani & S. Mednick (2000) Genetic factors and criminal behavior. *Federal Probation, 64,* 24-28.

[11] *Kahler v. Kansas* Supreme Court of Kansas (2020), 307 Kan; 374, 410 p 3d 105 affirmed

[12] N. K. Tharshini, F. Ibrahim & ors. The link between individual Personality Traits and Criminality. A Systematic Review. *Int. J. Environ. Res. Public Health* 2021, 18,8663. https://doi.org/10.3390/ijerph18168663

prominent disorders that have been shown to have a relationship with later adult behavior.[13] Oppositional Defiance Disorder is characterized by argumentativeness, noncompliance, and irritability, which can be found in early childhood. When a child with ODD grows older, the characteristics of their behavior also change and more often for the worse. They start to lie and steal, engage in vandalism, substance abuse, and show aggression towards peers.[14] Frequently ODD is the first disorder that is identified in children and if sustained can lead to the diagnosis of Conduct Disorder. It is important to note however that not all children who are diagnosed with Oppositional Defiance Disorder will develop Conduct Disorder. Attention Deficit Hyperactivity Disorder is associated with hyperactivity-impulsivity and the inability to keep attention focused on one thing.[15] S. Holmes state that, impulse control dysfunction and the presence of hyperactivity and inattention are the most highly related predisposing factors for presentation of antisocial behavior'[16]. They also point to the fact that children diagnosed with ADHD have the inability to analyze and anticipate consequences or learn from their past behavior. Children with this disorder are at risk of developing ODD and CD, unless the child is only diagnosed with Attention Deficit Disorder (ADD), in which case their chances of developing ODD or CD are limited. The future for some children is made worse when ADHD and CD are co-occurring because they will be more likely to continue their antisocial tendencies into adulthood. Conduct Disorder is characterized with an individual's violation of societal rules and norms. As the tendencies or behaviors of those children who are diagnosed with ODD or ADHD worsen and become more prevalent, the next logical diagnosis is Conduct Disorder.[17] What is even more significant is the fact that ODD, ADHD, and CD are risk factors for developing Antisocial Personality Disorder (ASPD). This disorder can only be diagnosed when an individual is over the age of eighteen and at which point an individual shows persistent disregard for the rights of others. Antisocial Personality Disorder has been shown to be associated with an increased risk of criminal activity. Therefore, it is of great importance that these early childhood disorders are correctly diagnosed and effectively treated to prevent future problems. Another critical aspect that must be examined regarding antisocial or criminal behavior is the personality characteristics of individuals. Two of the most cited personality traits that can be shown to have an association with antisocial or criminal behavior are impulsivity and aggression. S. Holmes stated that antisocial behavior between the ages of nine and fifteen can be correlated strongly with impulsivity and that aggression in early childhood can predict antisocial acts and delinquency. One statistic shows that between seventy and ninety percent of violent offenders had been highly aggressive as young children.[18] These personality traits have, in some research, been shown to be heritable.

4. Criminal Behavior and Personality Disorders

Certain studies have demonstrated a genetic link between ADHD, CD, and ODD and criminality.[19] However, there are possible alternate explanations for a greater rate of criminality for those who have suffered from these disorders that the paper failed to mention. It has been shown that people evoke certain responses from their environment. It is plausible that children suffering from these disorders are treated in a different manner than normal children due to the responses that they evoke, and it is because of these environmental differences that they are more prone to criminal behavior. Say a child suffering from ADHD is having problems in school, they may be placed in a remedial class in which there is a greater rate of delinquency. This would be a very important environment difference that could contribute greatly to future criminality. Other children may also socialize less with children with these disorders, which could plausible lead to anti-social behavior. While it is possible that in some cases the relationship between these disorders and criminality is not direct byproduct of genes, but rather as a byproduct of the same environment. There have been studies on ADHD in relation to a multitude of environmental factors, including everything from nutrition to environmental toxins. In addition to ADHD, CD, and ODD, other disorders have shown to influence criminality as well. Studies have shown that there is a higher occurrence of disorders such as schizophrenia, major depressive disorder, bipolar disorder, just to name a few. It is possible that having these personality disorders gives one a greater predisposition toward criminal behavior. A Swedish study found that the occurrence of major mental disorders in prisoners to be 5%, as well as a 20% occurrence of personality disorders.[20] Other studies have given different values for the occurrence, but in most cases the research agrees that there is a much higher incidence of these mental disorders in those who commit crimes.

[13] S. Holmes, J. Slaughter, & J. Kashani, (2001). Risk factors in childhood that lead to the development of conduct disorder and antisocial personality disorder. *Child Psychiatry and Human Development, 31,* 183-193.
[14] Op cit.
[15] K. Morley & W. Hall (2003). Is there a genetic susceptibility to engage in criminal acts? *Australian Institute of Criminology: Trends and Issues in Crime and Criminal Justice, 263,* 1-6
[16] S. Holmes (2001) p. 184
[17] *Ibid*
[18] R. J. Larsen., & D. M. Buss (2005). *Personality psychology: Domains of knowledge about human nature* (2nded.). New York: McGraw Hill.
[19]C. T. Jeffrey Rochester Institute of Technology (2005)
[20] K. Rasmussen, O. Storsaeter, & S. Levander (1999). Personality disorders, psychopath, and crime in a Norwegian prison population. *International Journal of Law and Psychiatry, 22,* 91-97.

5. Criminality is a Product of Genes and Environment

In considering the roles of genetics and environment on criminal behavior, or any behavior for that matter, the best explanation is that there is a complex interaction between one's inherited traits and the environment in which he or she lives.[21] Although the idea of environmental influences seems rather intuitive, regardless of knowledge regarding heredity and biological factors, it is surprising that some may have considered criminal behavior to be solely a result of genetics. It is proposed that the debate of nature versus nurture now is not whether genetics or environment influence behavior, but how complex the interaction between these factors is. Despite the relative lack of reliability and validity in twin, adoption, and family studies, they still provide valuable insight into the roles of heredity and environment in criminal behavior. However, it seems that most studies of this kind focus on the role of heredity in influencing behavior. It would be interesting to see whether any studies with adopted children have examined the role of environment in criminal behavior. Most adoption studies examine the correlation between criminality in the biological parents of adopted children, but what about the correlation between the children and their adopted parents who are crucial to their environment? The influence of neurochemicals on criminal and antisocial behavior is indicative of a genetic component to such behaviors.[22] However, a more definite explanation of neurochemical influences is that they reflect the complex interactions between genetics and environment. There is evidence that the expression of genes is influenced by a wide variety of environmental factors. Therefore, it is very possible that disorders relating to such chemicals as serotonin and dopamine could be caused by stressful environmental situations. If environment affects the regulation of gene expression and, in turn, the activity of neurotransmitters that modulate behavior, this kind of interaction may be a significant factor in the development of criminal and antisocial behavior.[23] While it is true that adults have more control of their environment than children, it isn't true that children are necessarily affected more by environment and adults are influenced more by heredity. Inherited traits provide the foundation by which people are able to learn and respond to their environment. An adult's personality is the combination of traits and learned behavior patterns that have been established throughout childhood. Thus, although it is true that adults have more control over their current environment, however it is believed that they are still heavily influenced by both their current environment and by past exposure to environmental factors.[24] The social learning theory is a good way to explain the influence of environment on antisocial behavior in children, and does not necessarily have to oppose the notion of genetic influence on behavior as well. Rather, it should be considered part of a larger theory or model that could describe how environment and genetics interact. Eysenck's general arousal theory, which suggests such an interaction, could be modified to encompass the social learning theory, providing a more complete model to explain how upbringing and inherited traits interact to influence criminal behavior.[25] Overall, Genetics and environmental factors are so intertwined, that it seems impossible to separate them in explaining how people are caused to engage in criminal acts. Also, it is important for society as a whole to take responsibility in preventing the advent of criminal and antisocial behavior in children via programs to provide children with healthy, enriching environments.[26] A eugenic approach to preventing antisocial behavior is immoral and impinges on human rights, but taking an active approach to ensure positive environmental influences would be appropriate.

6. The Inter-relationship between Genetic and Environmental Factors in Criminal Behaviour

There are theories, however, concerning genetic and environmental influences, which seem to suggest an interaction between the two and one such theory is the general arousal theory of criminality. Personality psychologist Eysenck created a model based on three factors known as psychoticism, extraversion, and neuroticism, or what is referred to as the PEN model.[27] Psychoticism was associated with the traits of aggressive, impersonal, impulsive, cold, antisocial, and un-empathetic. Extraversion was correlated with the traits of sociable, lively, active, sensation-seeking, carefree, dominant, and assertive. Finally, neuroticism was associated with anxious, depressed, low self-esteem, irrational, moody, emotional, and tense.[28] Through research and surveys, *Eysenck* found that these three factors could be used as predictors of criminal behavior. He believed this to be especially true of the psychoticism factor and that measuring it could predict the difference between criminals and non-criminals. Extraversion was a better predictor for young individuals, while neuroticism was a better predictor for older individuals. An important point about these factors and the personality traits associated with them is that

[21]Larsen, R. J., & Buss, D. M. (2005). *Personality psychology: Domains of knowledge about human nature* (2nd ed.). New York: McGraw Hill.

[22]M. Jones. *Criminal Behaviour, those affected, other causes and beyond.* Rochester Institute of Technology

[23] H. J. Eysenck, (1996). *Personality and crime: Where do we stand?* Psychology, Crime, & Law, *2,* 143-152.

[24] Ibid

[25] H. J. Eysenck, (1982). *Personality, genetics, and behavior.* New York: Praeger.

[26] F. Elliot, (2000). A neurological perspective of violent behavior. In D. H. Fishbein (Ed.), The science, treatment, and prevention of antisocial behaviors: Application to the criminal justice system (pp. 19-1 to 19-21). Kingston, NJ: Civic Research Institute

[27]Eysenck, H. J. 'Personality and crime: Where do we stand'? *Psychology, Crime, & Law,* (1996). *2,* 143-152.

[28] *Ibid*

most of them have already been found to be heritable.[29] Understanding *Eysenck's* original model is critical to assessing the general arousal theory of criminality, which suggests an interaction between factors. Research has shown that criminality is strongly correlated with low arousal levels in the brain. Characteristics related to low arousal levels include lack of interest, sleepiness, lack of attention, and loss of vigilance. *Eysenck* believed that these characteristics were similar to the personality factor of extraversion. Individuals with low arousal levels and those who are extraverts need to seek out stimulation because they do not have enough already in their brains. Therefore, the premise of the general arousal theory of criminality is that individuals inherit a nervous system that is unresponsive to low levels of stimulation and as a consequence, these individuals have to seek out the proper stimulation to increase their arousal. Under this theory, the proper stimulation includes high-risk activities associated with antisocial behavior, which consists of sexual promiscuity, substance abuse, and crime.[30] A significant fact that must be pointed out though is that not every individual with low arousal levels or those who are extraverts will seek those high risk activities just mentioned. It takes the right environment and personality to create an individual with antisocial or criminal tendencies and that is why this theory can be considered to take into account both factors of genetic and environmental influences.

Environmental Influence on Criminal Behaviour

Thus far it has been established through research and various studies that genetics do influence criminal or antisocial behavior. Researchers agree on the point that genes influence personality traits and disorders, such as the ones just mentioned. However, researchers also agree that there is an environmental component that needs to be examined. The family environment is critical to the upbringing of a child and if problems exist then the child is most likely to suffer the consequences. We have seen the problems associated with a child who is diagnosed with ADHD and how that can influence antisocial or criminal behavior. In relation to that, some researchers have claimed that it is the family environment that influences the hyperactivity of children.[31] The researchers in this article specifically identify family risk factors as poverty, education, parenting practices, and family structure. Prior research on the relationship between family environment and child behavior characterizes a child's well-being with a positive and caring parent child relationship, a stimulating home environment, and consistent disciplinary techniques.[32] Families with poor communication and weak family bonds have been shown to have a correlation with children's development of aggressive/criminal behavior.[33] Therefore it seems obvious to conclude that those families who are less financially sound, perhaps have more children, and who are unable to consistently punish their children will have a greater likelihood of promoting an environment that will influence antisocial or delinquent behavior. Another indicator of future antisocial or criminal behavior is that of abuse or neglect in childhood. A statistic shows that children are at a fifty percent greater risk of engaging in criminal acts, if they were neglected or abused.[34] This has been one of the most popular arguments as to why children develop antisocial or delinquent behaviors. One additional research finding in the debate between genetic and environmental influences on antisocial or criminal behavior has to deal with the age of the individual. Research seems consistent in recognizing that heritability influences adult behavior more than environmental influences, but that for children and adolescents the environment is the most significant factor influencing their behavior.[35] As an adult, we have the ability to choose the environment in which to live and this will either positively or negatively reinforce our personality traits, such as aggressiveness. However, children and adolescents are limited to the extent of choosing an environment, which accounts for the greater influence of environmental factors in childhood behaviors.

Another significant factor in the development of antisocial or delinquent behavior in adolescence is peer groups. Some researchers believe that there is a correlation between the involvements in an antisocial or delinquent peer group and problem behavior.[36] One of the primary causes as to why this occurs can be traced back to aggressive behavior in young children. When children are in preschool and show aggressive tendencies towards their peers, they will likely be deemed as an outcast. This creates poor peer relationships and relegates those children to be with others who share similar behaviors. A relationship like this would most likely continue into adolescence and maybe even further into adulthood. The similar tendencies of these individuals create an environment in which

[29] Miles, D. R., & Carey, G. Genetic and environmental architecture of human aggression. *Journal of Personality and Social Psychology,* (1997)72, 207-217.
[30] *Ibid*
[31] M. Schmitz, (2003). *Influences of race and family environment on child hyperactivity and antisocial behavior.* Journal of Marriage & the Family, *65,* 835-849.
[32] Ibid
[33] N. Garnefski, & S. Okma, (1996). Addiction-risk and aggressive/criminal behavior in adolescence: Influence of family, school, and peers. *Journal of Adolescence, 19,* 503-512.
[34] S. Holmes, J. Slaughter, & J. Kashani, (2001). Risk factors in childhood that lead to the development of conduct disorder and antisocial personality disorder. *Child Psychiatry and Human Development, 31,* 183-193.
[35] S. Rhee, & I. Waldman, (2002). Genetic and environmental influences on antisocial behavior: A meta-analysis of twin and adoption studies. *Psychological Bulletin, 128,* 490-529.
[36] Ibid

they influence one another and push the problem towards criminal or violent behavior.[37] Social learning theory has been cited as way to explain how the environment can influence a child's behavior. Using this theory to explain the aggressive or antisocial behavior of a child means that a child observes aggressive behavior between parents, siblings, or both. As a result, the children believe that this aggressive behavior is normal and can therefore use it themselves because they do not see the harm in acting similar way to their parents.[38] As stated earlier, interaction between family members and disciplinary techniques are influential in creating antisocial behavior. Using the social learning theory these two factors are also critical in the development of aggression. Children who are raised in an aggressive family environment would most likely be susceptible to experiencing a lack of parental monitoring, permissiveness or inconsistency in punishment, parental rejection and aggression. The exposure to such high levels of aggression and other environmental factors greatly influences and reinforces a child's behavior. A significant point that should be known however is the fact that other research has supported the notion that genetics do influence levels of aggression, which stands in opposition to the social learning theory.

7. Criminal Behaviour in Women

This identification of an antisocial personality with criminal behavior leads to the idea that criminal mischief is more prevalent in males. Although our justice system is heavily loaded with male criminals, women are still part of the criminal 'world.' It has been determined that men are much more physically violent than women. A few points are essential when discussing women and violence. First, women should not be entirely eliminated from the spectrum of criminality just because of their smaller predisposition toward aggression. Second, women are just as capable as men of committing a violent act. Jones discussed how certain neurochemicals are associated with criminal behavior. These neurochemicals might be more active in men, but women can still grow up in environments in which certain tendencies are brought on. Family environment is crucial in the development of a child's brain and personality. Genetics can only go so far, and environment works to shape a child's mind after the child has left a mother's womb. Jones discussed how poor communication and weak family bonds are correlated with the development of aggressive and criminal tendencies. She also mentioned how a financially unstable family and child abuse or neglect are associated with criminal behavior. Environment is important for a child to grow and develop into a normal, prospering adult. Without proper nurturance, guidance, and support, no child, male or female, will learn coping strategies, learn life skills, or grow up with a strong sense of right and wrong and respect other people. Whether one is male or female, growing up in an environment in which one is beaten or neglected is going to cause serious traumatic repercussions. The aggressive tendencies in males lead them to become more aggressive in adulthood, which in turn is why they are more apt to commit violent crimes. Yet women have been known to commit those same violent crimes, regardless of the prevalence relative to males--women are capable of criminal behavior. Men have committed more crimes and are known to be more violent, yet women should not be eliminated from the discussion. It has not been shown that genes or environment alone determine criminal behavior, as Jones mentioned in her paper, so there should be no reason why only men are mentioned, whether directly or by implication.

8. Behavioral Genetics in Criminal Trials

More recently, behavioral genetic evidence of a predisposition to violent or impulsive behavior is on the rise in criminal trials. However, a panoply of data suggests that such evidence is ineffective at reducing judgments of culpability and punishment, and therefore its use in the legal process is likely to diminish. Behavioral genetics, once largely the preserve of scientists exploring the relative influences of heredity and environment on behavioral traits, is now an increasingly frequent visitor in the courts.[39] The interest of attorneys—particularly the criminal defense bar—in the genetic roots of behavior lies in the presumed effect of genetic explanations on perceptions of individual responsibility. If a defendant's criminal behavior, rather than being determined by conscious choices, were driven by unconscious genetic predispositions to commit antisocial acts, the person may seem less responsible for the outcome and therefore less deserving of punishment.[40] Behavioral genetics, at least in principle, thus has become a tool for legal claims of reduced culpability and mitigated punishment. The future of its use in criminal trials, however, is less clear. The science behind the legal argument is based on studies that have found an association between certain genetic variants, often interacting with childhood maltreatment, and impulsive or antisocial behavior.[41] One of the most influential such reports analyzed data from a longitudinal epidemiologic

[37] Ibid; Holmes (2001)

[38] R. Miles, & G. Carey, (1997). Genetic and environmental architecture of human aggression. *Journal of Personality and Social Psychology, 72*, 207-217.

[39] D. Denna. Courts' Increasing Consideration of Behavioral Genetics Evidence in Criminal Cases: Results of a Longitudinal Study (2011) Mich. St. L. Rev. 967

[40] Baum, M. L. The monoamine oxidase A (MAOA) genetic predisposition to impulsive violence: Is it relevant to criminal trials? (2013) *Neuroethics*, *6*(2), 287–306. https://doi.org/10.1007/s12152-011-9108-6

[41]Byrd A., Manuck S.: Childhood maltreatment, and antisocial behavior: meta-analysis of a gene-environment interaction. Biol Psychiatry. (2014 Jan) 1; 75(1):9-17. doi: 10.1016/j.biopsych.2013.05.004. Epub 2013 Jun 18. PMID: 23786983; PMCID: PMC3858396

study of a birth cohort in Dunedin, New Zealand, examining high- and low-activity polymorphisms in the promoter region of the monoamine oxidase A (MAOA) gene on the X chromosome in male subjects. The investigators found a gene-by-environment interaction between a history of childhood maltreatment and MAOA status: subjects with an allele associated with reduced MAOA production who had a history of childhood maltreatment made up only 12% of the sample but accounted for 44% of convictions for violent crime.[42] Although the exact relation between specific genes and antisocial behavior is far from settled, the admission of behavioral genetic evidence into court proceedings is on the rise, especially in death penalty cases, in which criminal defendants have sought to introduce behavioral genetic evidence in sentencing hearings to argue for mitigation.

9. The Effectiveness of Behavioural Genetic Evidence in a Criminal Court

Several highly publicized cases have illustrated the potential impact of behavioral genetic evidence. Two convicted murderers in Italy successfully proffered such evidence to reduce their terms of imprisonment.[43] In one case, the trial judge reduced the defendant's sentence by three years after learning that he suffered from mental illness; an appellate court reduced his sentence by an additional year on being told that the defendant possessed a low-activity MAOA allele. Less than two years after this holding, another defendant – who was convicted of killing her sister, burning the corpse, and attempting to kill her parents – had her sentence reduced from life in prison without parole to a term of twenty years in part because it was discovered that she had a low-activity MAOA gene. Researchers have also begun to examine experimentally the effect that such evidence might have on culpability and sentencing decisions. One study found that a sample of U.S. state court judges reduced a hypothetical defendant's average prison sentence by less than one year, from approximately 14 years in the control condition to roughly 13 years, when behavioral genetic evidence was proffered to support the diagnosis of psychopathy.[44] Another program of research, using large, representative samples of the U.S. population, systematically varied the heinousness of the crimes/behaviors, the presence or absence of behavioral genetic evidence, and other factors related to characteristics of the defendant, and asked participants to render a variety of decisions (including whether a criminal defendant was guilty or not guilty by reason of insanity; whether the defendant should be sentenced to death; and what the length of incarceration should be).[45] Across eight separate experiments, behavioral genetic evidence had no effect one way or another on perceptions of responsibility or on the degree to which individuals should be punished for misbehavior. However, the studies did consistently find that both the egregiousness of the behavior and the strength of participants' beliefs in free will increased the magnitude of the punishments they levied. This lack of effect is consistent with research failing to find consistent impact on culpability judgments of neuroscientific explanations of misbehavior typically based on interpretations of functional magnetic resonance imaging (fMRI) data. Thus, for all the potential that some legal commentators and others have seen in the use of behavioral genetic evidence in support of arguments for diminished responsibility and mitigation of punishment, such effects have been difficult to detect in actual cases with rare exceptions and are modest or entirely absent in the experimental data.

Behavioral Genetic Evidence and the Null Effect

Several possibilities might explain why behavioral genetics fails consistently to affect culpability judgments and punishment decisions in experimental settings. One is that biogenetic explanations for behavior appear to induce countervailing beliefs, leading both to the perception that persons are less blameworthy for their behavior but also that they are more likely to commit such acts again. Thus, the net effect of behavioral genetic evidence may be null.

An additional possibility is that the lay public simply does not comprehend the intricacies of behavioral genetic evidence and therefore ignores it when rendering decisions about culpability. Yet another option is that the lay public does not view genes as the primary or even the major determinant of behavior and therefore finds evidence of a genetic predisposition to be of little relevance in determining culpability or imposing punishment. Or judges and the lay public alike may recognize that genes have some influence on behavior, along with a host of other factors, but not see that as incompatible with an expectation that people will exercise sufficient control to conform their behavior to the law, even if for some people that may require more effort than for others. Whatever the reason, and a combination of factors may be at play, most people are unpersuaded that evidence regarding the role of biological factors such as genes should alter their decisions about criminal punishment. In rejecting behavioral genetic evidence as a basis to reduce culpability and punishment, judges and lay people appear to be in agreement with a group of scholars who have argued that genetic explanations of behavior should have only a limited effect

[42]*Caspi A., McClay J.* :Role of genotype in the cycle of violence in maltreated children. Science. (2002 Aug 2); 297 (5582):851-4. doi: 10.1126/science.1072290. PMID: 12161658.

[43]Feresin, E. Italian court reduces murder sentence based on neuroimaging data. *Nature News Blog* http://go.nature.com/2vAykX0 (2011).

[44] T. Aspinwall , G. Lisa & R. Brown. 'The Double-Edged Sword: Does Biomechanism Increase or Decrease Judges' Sentencing of Psychopaths?'(17 Aug 2012) 337,6096•pp.846-849•DOI: 10.1126/science.1219569

[45] Scurich, N., & Appelbaum, P. (2016). 'The Blunt-Edged Sword: Genetic Explanations of Misbehavior neither Mitigate Nor Aggravate Punishment'. *Journal of law and the biosciences*, *3*(1), 140–157. https://doi.org/10.1093/jlb/lsv053

on legal determinations of responsibility and punishment. Demonstrating an increased risk for antisocial behavior associated with a particular genetic variant, they argue, is an insufficient basis on which to predicate a claim of reduced responsibility. The law traditionally has required the presence of either decreased rationality or impaired ability to control behavior as an indicator of diminished responsibility. Only if a genetic variant acts through one of these mechanisms, these scholars argue, and produces a substantial decrement in rationality or behavioral control, should the law take it into account in assigning blame and apportioning punishment. To date, behavioral genetic evidence generally has failed this test, and hence the impact of behavioral genetic evidence on claims for mitigation understandably has been weak.

How likely is genetic and neurobiological research to overcome these limitations? As Buckholtz and Meyer-Lindenberg note, studies have identified a number of changes in brain structure and function in men with the MAOA-L allele that can plausibly be linked to increased impulsive aggression.[46] These include reduced gray matter volume in the amygdala and cingulate gyrus, increased activation of the amygdala and other brain regions associated with emotional responses, and diminished activity in areas that modulate such reactions, including the anterior cingulate. Yet, most studies of the relationship of MAOA-L alleles to violence have shown no effect of the low-producing allele per se, in the absence of indicators of childhood maltreatment, suggesting that these alterations in themselves are insufficient to account for increased violence risk. To our knowledge, comparable studies of brain structure and function in subjects having both the MAOA-L allele and a history of maltreatment in childhood have not been performed. Nor have these changes been directly linked to violent and other anti-social behavior. At best then, we are a long way from having the kind of evidence that the law might find probative on issues of responsibility and punishment.

10. Conclusion and Recommendations

There cannot be enough possible evidence to conclude the point that genetics play the most important role in the outcome or behavior of an individual. The opposing viewpoint of environmental factors is not without its doubts either as to being the prominent factor influencing antisocial or criminal behavior of an individual. In this paper, there is more evidence supporting the genetics viewpoint, but that does not mean it is more important. With the research and studies having numerous flaws and the inability to adequately separate nature and nurture, there is still a great debate between genetic and environmental factors. Researchers, however, have certainly come far in their progression, to the point where there is a large consensus of the fact that genes do influence behavior to a certain extent. Although not as widely publicized, it is the belief of the author that these same researchers also believe that environmental factors account for what cannot be explained by genes. Therefore it seems obvious to reach the conclusion that an individual's antisocial or criminal behavior can be the result of both their genetic background and the environment in which they were raised. One researcher has proposed a theory relating to sociopaths and their antisocial behavior. According to the theory, a primary sociopath is lacking in moral development and does not feel socially responsible for their actions.[47] This type of sociopath is a product of the individual's personality, physiotype, and genotype. A secondary sociopath develops in response to his or her environment because of the disadvantages of social competition. Living in an urban residence, having a low socioeconomic status, or poor social skills can lead an individual to being unsuccessful in reaching their needs in a socially desirable way, which can turn into antisocial or criminal behavior. The first type of sociopath is dependent on their genetic makeup and personality, while certain factors of the second type can also be heritable. Notwithstanding, the second type has a greater dependence on environmental factors.[48] Perhaps from this review of both genetic and environmental factors, it seems clear to support the idea of the secondary sociopath type. An individual can inherit certain genes and when combined with the right environmental factors can lead them to engage in antisocial or criminal behavior. Although not mentioned extensively in this paper, there is a great need to try and identify those individuals, especially children, who may become susceptible to certain disorders or personality traits that can lead into antisocial, delinquent, or criminal behavior. Society should not try to imitate the era of controlled breeding, but rather focus on the treatment and rehabilitation of those individuals in need. Certain educational, environment enrichment programs have been shown to have a lasting effect on children if given by a certain age.[49] If more of these programs could be developed, society could help prevent the future antisocial or criminal behavior of children.

Given the doctrinal and empirical challenges to its effective use of behavioral genetic evidence for mitigation, we question the consensus of most commentators that the presence of such evidence in court proceedings will continue to grow, at least for the foreseeable future. To be sure, defendants facing the death penalty or long prison terms have little to lose by mustering every argument that could possibly have a mitigating effect. In addition,

[46] J W. Buckholtz & A. Meyer-Lindenberg. 'Genetic Perspectives on the Neurochemistry of Human Aggression and Violence' (2015) Psychology, Neuropsychology Online.DOI:10.1093/oxfordhb/9780199753888.013.009

[47] E. Russo, & D. Cove, (1995). *Genetic engineering dreams and nightmares.* New York: Freeman

[48] Ibid

[49]Raine, A., Mellingen, K., Liu, J. & ORS (2003). Effects of environmental enrichment at ages 3-5 years on schizotypal personality and antisocial behavior at ages 17 and 23 years. *American Journal of Psychiatry, 160,* 1627-1635.

genetic and other neuroscientific evidence is already being used to support claims of incapacity or the presence of mental disorders. We also observed that forensic genetics can play a crucial role in the investigation of a diverse criminal case. It should also be noted that potential use of behavioral genetic evidence is not limited solely to criminal trials. Employers contesting claims that mental disorders are work-related, civil litigants rebutting arguments that their behavior caused a plaintiff's emotional distress, or parties involved with child custody disputes all might believe that behavioral genetic evidence is potentially helpful to their case. Indeed, civil defendants may attempt to compel complainants to undergo genetic testing in order to corroborate their claims. However, unless the introduction of behavioral genetic evidence can be shown materially to affect the outcome of cases, its role in the legal process is likely to diminish. If legal decision makers whether juries or judges are unlikely to be swayed by genetic evidence, there would seem to be little reason for courts to fund genetic testing for indigent defendants or for them to overturn the convictions or sentences of defendants who contend that their legal counsel was ineffective in failing to introduce evidence regarding the genetic influences on their behavior. Greater legal impact of genetic explanations of behavior, in turn, may await elucidation of the mechanisms associated with increased risk of antisocial outcomes and demonstration of their relationship to the traditional legal standards of rationality and behavioral control. Until that happens and a sufficient body of evidence is not likely to appear soon, the wisdom of the general public may be worth attending to, resisting the allure of science may result in fairer outcomes all around. Furthermore, there is no contradiction to the fact the nation and people will be better with the use of genetics. Modern genetic techniques are very relevant to crime detection. The traces of the traits of the criminal can be detected using genetic analysis; it is very easy because every individual has peculiar fingerprinting according to Prof. Kwon-Ndung. Lastly, the government of each state should encourage and supports GNS to gain access to more funds for research. Therefore, we continue to call on our government and development partners to invest in research through increased funding across various sectors. Research is capital intensive and public research which is for our common good must be supported by capital budgeting.