Covert Positivism in Forensic Domains

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Abstract

Variable conceptions of positivism exist, although at the heart of the notion is the assumption of the scientific ideal of 'objectivity' as it pertains to the individual and society. Despite much debate and criticism of positivism in criminology, contemporary modes of positivism continue to inform criminological research. However, this more recent positivism is not necessarily the crude, overt positivism associated with the eighteenth- and nineteenth-century modes, but a more sophisticated and insidious brand - 'covert positivism'. Most recently, in the domains of forensic genetics, objective research and empirical methods are being used subtly to make claims about the nature of criminal individuals and populations. These forensic domains utilise modern-day biological and psychological scientific procedures to assess, predict and make conclusions relating to 'criminals, deviants, and pathologicals' at genetic and neuronal levels. Critiques of these approaches are presented, as these scientific interventions are paralleled with historical modes of positivism.

Keywords

Familial DNA; forensic genetics; forensic psychiatry; matching; neuroimaging; positivism.

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Introduction

Science is at the heart of the positivist approach. As the definition of science becomes increasingly provisional with time, so does the concept and practice of positivism. Positivist thought, historically speaking, seeks to ground knowledge in sensory experience (i.e., sight, sound and touch), and conduct analyses through empirical, objective and verifiable methods that derive from the scientific method. In doing so, positivism seeks to counter other modes of knowledge, such as metaphysical, intuitive or 'divine relations' (Lenski 1991). Contemporary versions of positivism, especially in the last few decades, blend traditional notions of positivism with the idea that knowledge can also be fragmented, biased and socially constructed (Henderson 2011). Contemporary positivism does not necessarily operate in the name of positivism, yet continues to shape how we produce knowledge, research and investigate the world (Kincheloe and Tobin 2009: 514). As it relates to criminology, present and emerging forensic practices utilise covert positivist methods to construct new modes of biological determinism, to achieve 'scientific truth' with respect to their objects of study: genes and brains. The following essay takes two forensic paradigms to exemplify modes of contemporary positivism as they emerge, at times, rather imperceptibly in line with scientific methods, have consequent effects on the social world, as well as critiques of such techniques. To begin, however, is an outline of historical, contemporary and criminological positivism, and the interchange between these three, as they relate to and sustain scientific ideals.

The Transition of Positivism Over Time

The definition of science, as it informs positivism, becomes increasingly impermanent with time. The earliest attempts to study social phenomena scientifically derived from conceptions of science that reflected nature, utilised the techniques of observation and induction, and adhered to the overall scientific method. In this sense, positivism varied from theological or metaphysical knowledge (Rafter 2004). One of the first positivist philosophers, nineteenth-century French philosopher Auguste Comte, proclaimed science was knowledge based on theoretical laws, absolute empirical observation, precise and certain techniques, and sensory experience (Hasan 2016). Further, Comte, with influential followers Herbert Spencer and Emile Durkheim, proposed that realism is synonymous with sensory experience, philosophy derives from science, common logical and methodological principles bind the scientific and social sciences, and there is a notable distinction between what is considered a 'fact' and a 'value.' On this last point, Comte argues that facts are in the realm of science, while values are separate from or outside science (Hughes and Sharrock 1997, in Hasan 2016: 319).

More recent conceptions depict increasingly contingent views of science as they inform positivism. Particularly as they stem from the science and technology studies (STS) perspective, Olson (1995: 2) proclaims, 'I neither deny nor doubt that the interactions between science and other aspects of culture are bi-directional; to be sure, the scientific tradition is itself transformed through its interactions with other elements of culture'. Likewise, Erickson (2015: 9) argues that, 'where many social science accounts see science as being confined to laboratories and other designated sites of scientific production', in actuality science is, 'spread through our society and culture, unfolding in multiple domains and in multiple forms. Science is a social construction, but all of society is involved in constructing science, not just scientists'. A leading figure in the STS literature, Bruno Latour (2004), has also sought to show the contingency of science. Through actor–network theory, specifically, Latour refocuses on the *practices* of scientific work (as opposed to reasoning alone) as, at times, problematic, in determining scientific 'facts' (Asdal 2005: 256).

Reflected in this increasingly provisional view of science, the definition of positivism has also changed in the last few centuries. The assumption that objective and universal realities are made possible through science, as determined through empirical methods, is inherent to early positivism (Creswell 2014, in Kelly, Dowling and Millar 2018: 10). This positivism attempts to

ground knowledge in sensory experience, empirical, objective and reductionist methods, to counter 'intuition, logical reasoning, moral imperatives, or divine revelations' (Lenski 1991: 188). Early positivist beliefs adhere to scientific assumptions and models in an attempt to produce quantifiable, observable, undisputable, value-free empirical facts (Miller 1985, in Schizas, Psillos and Stamou 2016: 707).

By the middle of the twentieth century, positivism dominated not only the philosophy of science, but also the methodologies of most natural and social sciences (Caldwell 1980, in Schizas, Psillos and Stamou 2016: 707). Although there is no clear-cut division in the transition of positivism from its historical to contemporary formations, a shift has been noted from the Comptean version to the logical positivists of the early- to mid-twentieth century. Logical positivism developed primarily in Vienna during the early twentieth century, and formed in part to 'confront' the earlier positivism (Stadler 2015). The major tenets of logical positivism are not altogether different from traditional positivism, but vary in the specific application and focus of mathematics to the study of philosophy, as a means to eliminate metaphysics, ethical values, aesthetic judgments and religious beliefs (Crotty 1998). Logical positivism attempted to, 'express all true statements about the world in a single scientific language' (Bronowski 1974: 627, in Kincheloe and Tobin 2009: 516). For Brand (1996), logical positivism derives from an understanding of science that assumes the reality of objectivity, prioritises universal knowledge, incurs cause-and-effect relations among natural phenomena, and uses techniques such as systematic observation to achieve such objectivity.

The positivist influence continues today albeit, arguably, not as crudely and obviously as it did in earlier formations. Referred to interchangeably as post-positivism, neo-positivism, contemporary positivism and, what I will argue is 'covert' positivism, this takes many forms. Proponents claim, in opposition to early positivism being defined as *deterministic*, this contemporary mode is understood to be more flexible and *probabilistic* (Lenski 1991: 190). Here, current positivism varies from previous connotations in that it views scientists as more actively constructing knowledge as opposed to passively noting laws that are found in nature (Crotty 1998). Taken together, contemporary positivists seek a more flexible notion of the social and natural worlds with a broader and more diverse framework in place that is, 'grounded on the centrality of meaning (and often language) to human affairs' (Connelly and Anderson 2007: 215). A more critical stance towards contemporary positivism, as outlined by Giroux (1997, in Kincheloe and Tobin 2009: 517), states that we are currently in the midst of a 'culture of positivism' that continues with a focus on objective research and results in reductionist epistemological practices. Following Kincheloe and Tobin (2009: 513), contemporary positivism is so embedded in Western cultures, including academia, that this thought and practice is often 'invisible' to investigators in the course of their research. These theorists argue that this 'undead' positivism operates covertly, not always assuming the title of positivism, yet shaping how we think and produce knowledge. Contained within this hidden positivism is the continued application of quantitative research methods 'without conscious awareness', and those that identify contemporary modes of positivism are deemed 'paranoid' (Kincheloe and Tobin 2009: 514). Paradoxically, then, contemporary positivism is able to 'deny its own existence while concurrently exerting a powerful influence' (Kincheloe and Tobin 2009: 517, 519).

Criminological Positivism

By the early nineteenth century, enlightenment influences introduced positivist thought to criminology, as witnessed in prioritising the acquisition of 'facts' to study the biological and psychological motivations of offenders (Rafter 2004). Leading figures were, as mentioned previously, Comte, but also Charles Goring, Richard Dugdale, Earnest Hooton, William Sheldon, Cesare Lombroso, Raffael Garofalo and Enrico Ferri—the latter founded what became known as the Italian School (Lanier and Henry 2010).

Two of these authors, Dugdale and Lombroso, will be highlighted, as they relate significantly to this argument. To begin, Dugdale (1877), in *The Jukes: A Study in Crime, Pauperism, Disease and Heredity,* studies the Juke family to exemplify how some families contain 'criminals' in multiple generations. His research focused on Max Juke (circa 1750) and followed the Juke family until 1870. The key findings were that of 709 subsequent relatives, an estimated 20 per cent were criminals, and over 40 per cent required state financial support. Based on these findings, Dugdale concluded that criminality was linked to heredity and poor social adjustment (Andrews and Bonta 2010). Dugdale's work on the heritability of criminality in families relates to the discussion on forensic genetics, especially with respect to 'familial' DNA matching that investigates, observes and predicts criminality within families at the genetic level.

Second, typically known as the founder of criminological positivism, and the author of the renowned 1876 book, *The Criminal Man*, Lombroso was a professor in forensic medicine, psychiatry and criminal anthropology. He was one of the first to apply scientific techniques to analyse criminality in individuals (Gibson and Rafter 2006). He assumed deviant and criminal behaviour was the product of biological, psychological and social degenerations as they are contained within the human body—what he termed the 'born criminal'. Lombroso's work transcends the fields of not only contemporary forensic genetics, but also forensic psychiatry. Particularly, the current emphasis on neurological studies in forensic psychiatry exemplifies modern-day versions of the 'born criminal' logic, using scientific techniques to assess and measure criminal behaviour as it is thought to stem from regions in the brain.
Dugdale and Lombroso are underscored, as they signify early perspectives and trends in biological and psychological determinism that this essay will argue continue today, albeit less apparently, in the broad fields of forensic familial genetics and forensic psychiatry. Taken together, these have initiated what Walsh and Beaver (2009: 7) call a modern 'biosocial criminology' that 'integrates relevant data, concepts and methods from the biological sciences into traditional criminological approaches'. This notion is reminiscent of Foucault's (1978: 142–143) 'biopolitics', summarised as being where:

> … biological existence was reflected in political existence; the fact that living was no longer an inaccessible substrate that only emerged from time to time, amid the randomness of death and its fatality; part of it passed into knowledge's field of control and power's sphere of intervention. Power would no longer be dealing simply with living subjects over whom the ultimate dominion was death, but with living beings, and mastery it would be able to exercise over them would have to be applied at the level of life itself; it was the taking charge of life, more than the threat of death, that gave power its access to the body.

Like the Foucauldian biopolitics that precedes it, the notion of a biosocial criminology associates crime and criminality as somehow being physically embedded in life through the human body. Biological and psychological positivists believe that studying an individual's biological characteristics and differences will reveal the underlying causes of criminal tendencies (Lanier, Henry and Anastasia 2015). The wrongdoer is prioritised over the law-breaking aspect of the crime, with his or her behaviour recognised as being *biologically determined:* 'the idea that a person's destiny is fixed at birth by their genes' (Wortley 2011: 141).

Responses to crimes under determinist philosophy advocate for the biological and psychological diagnosis, classification and treatment of individuals through criminal justice systems (Lanier and Henry 2010). Again, resembling Foucauldian biopolitics, such legal responses are contained within the larger framework of 'biocriminology' that focuses on the body as a key site for intrusion, analysis and data collection. By incorporating biological details (i.e., DNA profiles or neuroimaging results) about 'criminals' from legal practitioners and expert witnesses, the larger criminal justice system under this logic attempts to respond and regulate such individuals in a

similarly unbiased, measured and calculable way. Biocriminological trends are intensified today, especially in forensic contexts surrounding genes and brains. These have led to rather troubling calls for measures such as, 'screening clinics, early diagnosis and preventive treatment as policy options' (Lanier and Henry 2010: 121). Consequently, the last few decades in particular have witnessed a resurgence of positivist approaches in forensic genetics (i.e., familial DNA), and forensic psychiatry (i.e., brains). Both scientific techniques provide the bodily and psychological knowledge foundations to support concealed modes of biological determinism through the utilisation of forensic profiling and neuroimaging strategies.

Forensic Genetics

The positivist program generally lost favour in the 1960s and 1970s, although criminologists are again examining biological and psychological components of crime and criminality with increased fervour, particularly in the forensic domain. While some criminologists remain unconvinced of biological and psychological determinants as they coincide with crime, positivist efforts are resurfacing with greater technological detail and attention to social and cultural influences (Rocque, Welsh and Raine 2012; Beauchaine et al. 2008; Walsh and Beaver 2009). The philosophy of biology has been deemed a 'growth industry' (Bradie 1987), a 'biological revolution' (Wright and Cullen 2012) and a 'biological age' (Rose 2013), which includes further movements such as biogovernance (Heitmeyer 2017), biotechnology (Owen 2009; Pellizoni 2016), biosocial (Vaske 2017; Walsh and Wright 2015), sociobiology (Wilson 2000; Hosle 2012), biohumanities (Kang 2016) and epidemiological criminology (Lanier, Zaitzow and Farrell 2015; Akers, Potter and Hill 2012) as some of the ways emerging scientific methods coalesce with criminology today. In forensics particularly, this version of contemporary criminological positivism seeks to produce a more provisional view of biology (Lynch et al. 2008; Cole 2001), in which the boundaries between biology, psychology and criminology are increasingly indistinct (Fuller 2007).

Contained within biology as a broad category is the field of genetics. While some theorists argue that genetics does not cause crime, recent research seeks to demonstrate how crime is genetic (Boutwell and Barnes 2016), attempts to link specific genes to violent crime (Hogenboom 2014) and determine genetic susceptibility in criminality (Morley and Hall 2003). Other fields of inquiry include inheritance, family histories, racial aspects and twin studies as they relate to criminal behaviour (Rose 2000). The emerging biological approach to DNA profiling—familial DNA matching—will be underlined next to grapple with covert positivism's current influence in genetic, racial, familial and larger social, political and cultural contexts.

The Emergence of 'Familial' DNA

In 1984, Alec Jeffreys at the University of Leicester, England, discovered that segments of the DNA strand were highly variable between individuals (known as alleles). Thus, they could produce unique genetic profiles, a procedure that significantly altered forensic science. Today, DNA profiling is used regularly in criminal investigations and prosecutions across the globe, with many novel techniques emerging (Curran and Weir 2016). In addition to traditional DNA profiling, some of these techniques include low copy number DNA (Kirgiz and Colloway 2017), epigenetic profiling (Lee et al. 2017), forensic DNA phenotyping (Wienroth 2018), protein profiling (Kamanna et al. 2018), microarrays (Voskoboinik et al. 2015), microbial profiling (Quaak et al. 2018) and biometric/robotic methods (Comar et al. 2017). Developing DNA technologies, databases and biometric interventions are deemed necessary by governments to combat serious and large-scale crimes such as organised crime and terrorism, as well as the identifications of persons killed in mass disasters and wars (Bieber, Brenner and Lazer 2006: 1315; McCartney, Wilson and Williams 2011). Correspondingly, an assortment of DNA profiling techniques has developed and proliferated in conjunction with the databases that store this genetic material. As discussed next, positivism operates insidiously through familial DNA matching in the

assumptions used to scientifically analyse genetic relationships, as well as conduct database searches.

Scientific Analyses

The science behind familial DNA matching is complex. Forensic scientists analyse similar genetic populations in a criminal context to estimate the degree of relatedness that may exist to produce partial match likelihoods between suspect and relative DNA profiles. Relatedness, here, is a scientific concept that assumes the shared genetic lineage of family members within a given population. The genetic relationship is framed in terms of statistical probabilities that assume potentially related genes have ascended from a single ancestral gene: a scientific and statistical configuration termed 'identical-by-descent' (IBD) (Weir, Anderson and Hepler 2006). Forensic technicians and law enforcement, in their investigations, assume that genetic relatives share similarities in their DNA depending on their relationship to one another along both familial and racial lines. It is worth noting that these probabilities demonstrating family connection are also analysed by racial characteristics. Based on these tenets, the key assumption regarding how a familial match may be identified depends on a close genetic relative sharing a higher number of the alleles (polymorphic regions on the DNA strand) with a suspect in a given database, potentially resulting in the partial match. That is, a close genetic match, such as between parent and child, will depict allele similarities in a way that is consistent with the production of a genetic relationship (Weir, Anderson and Hepler 2006). Parent–child matches, for instance, must match one allele at each marker, and there are currently 13 or more markers identified through the Federal Bureau of Investigation's CODIS system (McCarthy 2011).

Databases

A novel extension of traditional DNA profiling is the evolving familial DNA searches that compare crime-scene DNA evidence to relative offender profiles that may already be lodged in a DNA database. The concept of familial genetic searching has been around since the early twenty-first century. Database searching involves inputting crime-scene genetic data into a DNA database to find a partial DNA match to the suspect's close relative that may be already stored in the database. In the event that a partial match is found, this information is to be used only as an investigative lead and not as evidence in court (McCarthy 2011). A typical database search seeks to exactly match a crime-scene sample to a suspect's profile whereas familial DNA searching hopes to inexactly match a crime-scene sample to possible relative profiles already stored in genetic databases.

In familial DNA testing, then, covert positivism insidiously implies the heritability of criminality in two key ways: at the level of scientific analyses and the level of the database search conducted. In the first instance, the scientific (and statistical) methods that measure relatedness among genetic populations assume a heritability dimension to crime that is applied in a criminal investigative context. For example, extrapolations about potential criminality within families are made in the scientific assumptions used to determine such concepts and practices as 'relatedness' and IBD. Inherent to a criminal familial genetic search is the assumption that genetic relatives share similarities in their DNA, which is used to infer criminality within families.

Second, and likewise, forensic experts assume a potential criminal and/or deviant family in the moment that a familial search is initially conducted. That is, familial DNA supports typecasts about the heritability of criminality in families by virtue of the database searches conducted, drawing on the assumption that there is already criminal activity within a given family. Thus, not only the immediate offender, but also the larger family is assumed criminal, and this leads to potential stigmatisation and labelling at the family level. Further, family members whose DNA might already be stored in a database are under a type of 'genetic surveillance' (McCarthy 2011: 382), with no clear guidelines presently in place regarding the role family relationship should

play in criminal investigations. Familial DNA exhibits a hidden positivism in associating 'relatives' to a pool of suspects generated as a result of a database partial match search, rendering 'suspects' and 'relatives' interchangeable (Murphy 2010). Thus, the offender could be labelled a *genetic informant* in two ways: first, through providing his or her DNA to the database, and second, through providing information about his or her relatives (McCarthy 2011). Familial DNA matching thus exemplifies a mode of covert positivism facilitated through extrapolation and assumption about the heritability of criminal conduct; hence, producing knowledge and realities that foster the idea that 'crime runs in families' (Murphy 2010).

Forensic Psychiatry

Contemporary psychiatric research as it pertains to crime derives from historical conceptions of mental illness, particularly that of 'moral insanity'—criminals deemed by psychiatrists as the most irrational and unreasonable (Rafter 2004). The first scientific criminologists were, thus, psychiatrists during the 1800s, seeking to produce early modes of psychological and behavioural sciences (Rafter 2004). A key philosopher tracing the historical origins of madness and/or mental illness is, again, Foucault (2001) in *Madness and Civilization*. Foucault claims that during the Classical period, 'madness' ceases to have a place in society and becomes, rather, displaced, hidden and stigmatised:

> By a strange act of force, the classical age was to reduce to silence the madness whose voices the Renaissance had just liberated, but whose violence it had already tamed (2001: 35)

The silencing of the 'mad' corresponds to the rise of science in the form of psychiatry as experts in explaining, diagnosing and sanctioning mental illness. Curra (2017), following Foucault, argues madness is, thus, 'manufactured' in this early period. The rise of mental institutions in the mid-1700s further allows for mental illness to be contained and treated through psychiatric interventions, which advance psychiatry's validity (see Goffman 1961, in Curra 2017: 129).

By the mid-nineteenth century, psychiatry began to further embrace scientific methods to calculate, quantify and measure mental illness. During this time, Wilhelm Griesinger is regarded as one of the first founders of scientific psychiatry, who hypothesised that the origins of all mental illness are to be found in the brain (Chung and Nolan 1994). World War II (WWII) was a further turning point for psychiatry as it relates to crime and criminality. Kutney (2006) argues that after WWII, logical positivism began to dominate psychiatry as witnessed in the profession's growing dependence upon valued outcomes (i.e., scales, surveys and the results thereof) to achieve its legitimacy. During the 1950s, with the advent of psychoactive drugs, new categories and definitions of mental illness flourished, as did the types of hereditary or brain issue that became targets of psychiatry (Scull 1977, in Curra 2017: 130). By the 1970s, however, psychiatry was considered largely unreliable (Sabshin 1990). Psychiatry was viewed as having no valid understanding of the individual factors leading to mental illness, or the cures best suited to a particular diagnosis (Frances 2013, in Curra 2017: 133). As a result of this negative perception, psychiatry sought to gain recognition as a true science by moving towards empirical methods in the late 1970s, constituting an overall paradigm shift in the discipline. Starting in the 1980s, psychiatry embraced biological conceptions of the mind to supersede what had been the psychodynamic approach to mental illness. For example, the use of psychotropic medications proliferated, and classification systems emerged (i.e., the Diagnostic and Statistical Manual [DSM] of Mental Disorders manuals). Yet, the DSM was criticised for being unable to accurately distinguish between social deviance and mental disorder (Rashed and Bingham 2014).

Today, psychiatry generally locates biological and neuronal abnormalities as the basis for unusual or distressing behaviours. Mental disorder is now classified in accordance with the 'medical

model' that assumes mental illness is the product of physical illness, all of which stems from the brain of the 'diseased'. The medical model prioritises abnormal biological and neurological structures and separates this biological knowledge from an individual's meaning or belief system (Szasz 1974; Margree 2002). The client, under this 'medical model', is now viewed as a source of data or variables, observed by trained specialists and experts, to produce objective assessments about his or her mental state (Kutney 2006). Psychiatry became linked to the larger medical culture by virtue of such scientific technologies as risk assessment tools and neuroimaging strategies (Luhmann 2000). This biological conception resonates with the current American Psychiatric Association's (APA) (2017) formation of mental illness as: 'a medical problem, just like heart disease or diabetes'. By reducing mental illness to physical illness, psychiatry appears as an impartial, neutral and objective source of scientific medicine, in which 'irregular' or 'irrational' conditions of mentally ill persons are located in some form of neurological and/or bodily defect or disorder (Margree 2002).

Neuroimaging and 'Neuroevidence'

The medical model is visible in many of the psychiatric measures used in practice today (Salzman 2001). This is witnessed specifically in the major contemporary psychiatric practice surrounding the study of neurological processes and disorders. Current forensic psychiatric research, as it relates to the relationship between criminal behaviour and the brain, focuses on neurotransmitters (i.e., dopamine) (Grigorenko et al. 2010), the amygdala (Schlitz et al. 2007), the adolescent brain (Beckman 2004) and hormones (testosterone and cortisone) (Booth et al. 2006), to name a few. Some researchers even follow what has been labelled 'evolutionary neuroandrogenic theory' to uncover brain processing of 'deceptive thoughts' (Ellis and Hoskins 2015). Moreover, greater acceptance of mental disorder as a 'disease' or valid physical illness sustains and legitimises the biologically deterministic aspects of what are regarded as psychologically unsound criminals and deviants.

Forensic psychiatric neurosciences may be regarded as a contemporary adaptation of the historical, Lombrosian 'born criminal' logic, as they seek to locate brain dysfunction as the source of criminality, justifying neuroimaging as a necessary technique in the pursuit of psychiatric interventions into crime. As a case in point, the current search for neurological defects in 'psychopaths' can be regarded as a 'new phrenology' (Markowitsch 2008; Moskowitz 2011). Other research suggests a link between traumatic brain injury in youth and later risk behaviour (Kennedy, Heron and Munafo 2017). With neuroimaging results in place, psychiatric practitioners feel able to delineate and locate the material components of mental illness (Dumit 1997). This psychiatric investigation is meant to support medical assumptions that an individual's perception and conduct may be modified by functional disturbances in certain areas of the brain (Applebaum 2009). Consequently, present-day research along these lines seeks to correlate criminal behaviour with brain defects (Basserath 2001; Bufkin and Luttrell 2005).

Neuropsychiatry and the Courts

As visual representations of the brain become progressively refined, the courts are increasingly interested to integrate such neuronal knowledge into their deliberations and decision-making processes (Eastman and Campbell 2006). In the context of the criminal law, then, neuroimaging evidence has been incorporated into criminal cases to determine the insanity defence, declarations of incompetence to stand trial, and claims for alleviation in punishment (Applebaum 2009). Another goal for forensic psychiatrists acting as expert witnesses is to produce more 'accurate' predictions regarding the potential for future criminality based on the offender's neurovisual brain patterns (Witzel 2012). Thus, customary practices of forensic psychological and psychiatric expert testimony appear to be enhanced with evidence such as neuropsychological findings, neurobiological markers and neuroimaging profiles (Salmanowitz 2015; Witzel 2012). Like traditional scientific evidence such as DNA profiling and fingerprinting, neuroscientific evidence is often perceived as more objective and reliable as a source of evidence

than nonscientific forms of evidence (i.e., witness testimony), even though the dangers of 'neuroprediction' to calculate future criminal activity has been outlined by numerous psychiatric and neuropsychiatric authorities (Murphy 2013).

Neuroscientific evidence is increasingly subsumed within criminal law broadly, and criminal trials more specifically, to verify and predict criminality. Forensic psychiatrists and neuropsychiatrists are typically involved in the court process for two purposes: first, to evaluate the level of responsibility of a given offender and, second, to predict their imminent criminality, risk of recidivism and/or threat to the public to discern the treatment or punishment options to be imposed for the crime of which they are accused (Gkotski and Gassar 2016; Rose 2010). With the acceptance of neuroscience at societal, as well as national and global levels, judges are found to be increasingly at ease relying on neuroscientific profiles to assess an offender's responsibility, dangerousness and risk of reoffending (Nadelhoffer and Sinnott-Armstrong 2012). With such forensic psychiatric knowledge in place, preventive treatment approaches (i.e., medications and hospitalisation) are often supported in lieu of traditional punishment (i.e., prisons) (Looney 2009).

Forensic Positivisms

To summarise, contemporary positivisms exist in degrees of certainty: rather covertly in familial genetic profiling, although more overtly in the psychiatric neurosciences. To discern precisely how these versions of positivism function is to perhaps examine ontological and epistemological dimensions of positivism. Ontology focuses on what constitutes 'reality', while epistemology explores how knowledge is created (Creswell 2014, in Kelly et al. 2018: 10). Kincheloe (2008, in Kincheloe and Tobin 2009: 518) outlines six epistemological and ontological assumptions found in positivistic research: it is formal (adherence to a quantitative research methodology); intractable (based on the ontological assumption that the world is static); decontextualised (the removal of a phenomenon from the diverse contexts of which it is part); universalistic (applies to all domains of the world); reductionistic (a focus on the dynamics of an entity that lends itself most easily to measurement); and, one-dimensional (the belief that one true reality can be discovered). Contemporary positivism, especially the covert brand, differs at ontological and epistemological levels from its traditional counterpart in that it results in an estimation of, rather than an absolute truth (Phillips and Burbules 2000, in Kelly et al. 2018: 10). Ontologically, contemporary positivisms assume that understandings of reality are potentially imperfect, with the goal of seeking an approximation of the truth (Welford et al. 2011, in Kelly et al. 2018: 10). Regardless of the mode of positivism (i.e., early, logical, contemporary or covert), what links all forms is the conjoined goal of seeking the 'scientific ideal of objectivity' (Daston and Galison 2010).

Analysis and Critiques

Genetics in forensic familial DNA profiling and the brain through forensic neuropsychiatry have been illustrated as 'approximations of scientific truth' in contemporary times. Both techniques provide varying degrees of evidence for a renewed sense of biological determinism, as both genes and brains are associated with (criminally oriented) behaviour. Such positivist insights from both fields have many implications for criminology and criminal law. Importantly, then, an analysis and critique of these theories and techniques are presented as they relate to and support modes of increasingly clandestine biological and psychological positivism in criminological settings.

As it applies to genetics more broadly, and familial DNA specifically, positivism operates covertly in the assumptions made about criminality as they are applied to genetics, both at the level of scientific analysis (i.e., the IDB model) and the database searches conducted. Family, race and genes are intermingled in the context of the heredity of criminality in the 'reality' that marginalised families/populations are already affected heavily by familial DNA testing, as they

are often already over-represented in criminal justice systems (Murphy 2010; McCarthy 2011). The assumption of criminal disposition as it links to race is also inseparable from genetics and biology in that many legal systems across the globe construct DNA database classification systems by racial and ethnic lines. Familial searches have also been flagged as indiscriminate and prejudiced, working against lawful and evidentiary rules such as guilt by association and racial discrimination (Murphy 2010).

Similarly, critiques of psychiatry and neuroscience render salient issues. From a scientific perspective, attempts to link brain function to criminal behaviour render a more explicit display of positivism. Proponents point to how neuroimaging can detect lesions and impairments from physical injury, both of which appear to alter behaviour considerably. However, problems exist in relating complex functions of the brain to precise types of (criminal) behaviour. Positivist methods also rear themselves in the interpretation of visual neuroprofiles when experts are tasked with, for example, associating a dramatic contrast on a brain scan to a degree of criminal activity or level of mental illness (Applebaum 2009).

From a legal perspective, the visual impact of brain abnormalities through neuroimaging has significantly influenced judges, lawyers and juries, as such information affects legal decision-making. This is despite the fact that many legal personnel are not trained in science and, thus, may be ill-equipped to comprehend and interpret neuroimaging findings. Further dangers exist in the potential to overestimate the importance of neurobiological abnormalities for the assessment and prediction of criminal behaviour. Positivist tenets guides neuroscience at the point at which experts are tasked with contingently linking certain areas of the brain to certain behaviours, even when there has been no proven association between certain brain regions as they invoke specific criminal activities, degrees of criminal responsibility or the ability to measure intentionality (Aggarwal 2009). Consequently, there is significant uncertainty among scientific and legal experts alike in accepting neuroprofiling data as evidence of criminal behaviour (Applebaum 2009).

Conclusion

The forensic practices of genetic profiling, in the name of familial DNA matching, and forensic psychiatry, through neuroimaging, exemplify how bodily material is used to infer criminological characteristics in, more often than not, subtle ways as they pertain to offenders and mentally disordered individuals and groups. Traditional positivist concepts and practices, such as biological and psychological determinism, are implied, assumed and extrapolated through genetic and neuronal analysis and prediction about present and potential criminal behaviours. Criminal justice systems at a global level are increasingly incorporating such positivist-informed forensic evidence, whether directly or indirectly, into their judgments and decision-making as it pertains to treatment and punishment options, regardless of the fact that scientifically, such evidence is often insecure and unstable. However, this forensic scientific knowledge is increasingly accepted due to it being perceived as more objective and reliable than other types of evidence (i.e., witness testimony). The prospective dangers of utilising bodily information as the basis for assuming criminal behaviour in investigative procedures and legal determinations is in the consequent coercive and discriminatory measures undertaken. These include larger social and cultural implications and effects that target already-marginalised families, races, the mentally ill, and those in lower socio-economic classes, as they are already over-represented in criminal justice systems. To conclude, and following Murphy (2010), familial DNA profiling and neuroimaging may be thought of as a means to achieve 'scientific truth', however contingent this evidence may be.

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