

To what extent is human behaviour a product of our biology, or our environment?

For centuries, if not millennia, man has sought to understand human characteristics, behaviours, and interactions. This essay will show the reader that both biology and environment play a significant role in the establishment of human behaviour using cross-cultural references and exploration into both historical and contemporary research. It is perhaps poignant to mention at this stage, that the essay will not entertain religious interpretations, as this may be considered to be an environmental factor, and the discussion of such not only broadens the spectrum of the essay too greatly, but renders it philosophical and not physical (Buss, 2016). The first part of this essay will discuss several fields of study within psychology, in order to establish their role in the gene/environment (GE) “debate”. Ethical considerations must be made when researching living subjects (British Psychological Society, 2014, 2018). A glut of research methods have been devised to reveal definitive solutions in the GE “debate”, although some have been incredibly morally questionable (Luo et al., 2010; Munafò et al., 2003; Tabery, 2008). This essay will therefore discuss the ethical standards in psychological practise, and identify potential concerns for studies of behaviour (Gardiner et al., 1998; Gardner, 2006; Haworth et al., 2013). This body of work will then identify statistical measures used to identify the extent of each factor, highlighting bivariate statistical measures that have been developed as algorithms to specifically record several independent variables (IVs) (Plomin & von Stumm, 2018; Tabery, 2008). This essay will arrive at the conclusion that both genetics and environment contribute to the development of a human’s behaviour (Tabery, 2008), though how psychologists utilise their findings to inform the world is arguably more of an ethical question than a scientific one.

This piece will focus upon recent psychological history, or rather the last 150 years, which has witnessed the development of psychology as a science. One of the challenges facing the discipline, and there are many, is applying a scientific approach to experimentation within the field (Tabery, 2008). It appears impossible to analyse behavioural traits without a fundamental understanding of neurological processing, environmental factors, genetics, and an individual’s perceptions of the world (Baddeley, 2010, 2012; Gregory, 1998; Tabery, 2008). The question this essay intends to answer is to what extent two binary and opposite influences have upon

human behaviour. By applying scientific methods it must therefore be possible to measure both, and create a ratio between them (Tabery, 2008).

Behaviourists such as Watson and Skinner applied the scientific approach to studying behaviour (Buss, 2016; Gardner, 2006). By controlling the environment and using stimuli to antagonise or reward their subjects they were able to demonstrate that behaviour can be learned, and therefore inferred that behaviour is solely a product of our environment, and not one of nature (Buss, 2016). There are numerous shortcomings with this argument, although the results remain clear, behaviour can be influenced by the environment an organism is in, at least to some degree (Buss, 2016; Chomsky, 2000; Gudmundsson, 2018).

Cognitive psychologists such as Baddeley and Tulving applied the scientific approach to studying memory, and are still finding the subtleties of the inner workings of a human brain difficult to map (Baddeley, 2010, 2012; Tulving, 2001). Nevertheless, by discovering various glimpses of the computational processes of a mind, some level of understanding to how behaviour is affected internally is produced (Eustache et al., 2016). Cognitive psychology also concerns itself with attention, perception, and therefore the resulting behaviour (Gregory, 1998). It is evident that more research is required within this field, yet the findings demonstrate that there is a biological and environmental impact on human behaviour and understanding the mental computations within a mind is vital to establishing the extent each factor influences the organism (Eustache et al., 2016; Eustache & Desgranges, 2008).

Evolutionary psychology attempts to explain how, over, and here it must be stressed, millions of years, adaptational development allows organisms to survive in their environment (Buss, 2016). This discipline aligns itself with both genetic factors and environmental factors, although a deficiency, if it could be described in such a way, is that there is no parameter for the extent to which either contributes to a behaviour. Buss (2016) states that the human brain has adapted behavioural responses to an "if/then" scenario. For example: "**If** the bear attacks me **then** I will play dead", "**If** I kill the ostrich **then** my family can eat", "**If** I write my essay in lots of time **then** I will not be as stressed on the due date". This could be surmised that the environment has impacted on genetics over millions of years, and that genetically we are adapted to

cope with previous environments (Buss, 2016). This, Buss points out, can lead to poor adaptations in the future, because the organism is responding to its current environment, rather than a future one. Criticisms of this approach appear to be few and far between, and those academic questions previously unanswered can rely on a wide variety of psychological evidence, and centuries worth of data to form new conclusions (Buss, 2016).

Epigenetics is the analysis of genomes and how they are expressed (Buss, 2016; Gardiner et al., 1998; Haworth et al., 2013; Tabery, 2008). According to this branch of research, all individuals are their own phenotype, regardless of their genetic base. Monozygotic twins (MZ) can be genetically identical but appear to be physically different, so they have the same genotype, but are different phenotypes (Blum et al., 2011; Haworth et al., 2013). The implication of epigenetics is that if physical appearances can be dissimilar, therefore it follows that behavioural differences are probable (Blum et al., 2011; Siira et al., 2004). This discipline will allow a determination of potential characteristics that are possible for a zygote to obtain within a lifespan, from health implications to behavioural traits (Munafò et al., 2003; Siira et al., 2004; Viding et al., 2007). For example a lack of empathy, coupled with conduct issues, can be inherited by English and Welsh children (Viding et al., 2007). The rate of which these traits are inherited is higher in boys than girls, however, for girls an unstable environment increases the chances of the traits occurring (Viding et al., 2007). This particular study attempted to display the overlap between genetic and environmental factors, and found that genetic factors were the more dominant, and that environmental factors were almost negligible despite the higher rate of conduct issues in girls (Viding et al., 2007).

At this point, having briefly illuminated various areas of research, it is worth declaring none of this work is considered erroneous. Behaviourism is still valid and reliable, it is possible to condition humans and animals (Baddeley, 2010, 2012; Buss, 2016; Gardner, 2006). Cognitive psychological studies have countless reams of evidence to show that the human brain works in specific ways for the vast majority of people (Baddeley, 2012). Evolutionary psychology assists in aligning behavioural studies with Darwin's Theories of Natural Selection, Sexual Selection, and Adaptation, which are regarded as close to factual as science can determine, and therefore allows an exploration of the reasons organisms react to their environment how they do,

including novel experiences (Buss, 2016; Chomsky, 2000). Epigenetics is difficult to convey to the wider public, the connotations of which are subtle, nuanced, ethically questionable, and still very new to behavioural study (de Zeeuw, 2014; Munafò et al., 2003; Viding et al., 2007). More research is required to understand the potential of what it will be able to establish, and more still to determine a parameter for expectations on the extent of the impact upon human behaviour (de Zeeuw, 2014; Rimfeld et al., 2016; Turkheimer, 2016).

The British Psychological Society (BPS) has a professional code of conduct for psychologists (British Psychological Society, 2018). Based around four principles (Competence, Integrity Respect, and Responsibility) the BPS offers guidelines for conducting ethical research to protect the scientific reputation of the discipline as well as a code for human research ethics (British Psychological Society, 2014, 2018). This has not historically been the case, and a plethora of controversial studies have taken place which required ethical guidelines. Research like that of Watson (Little Albert - Competence, Integrity, and Responsibility), Mengele (Genetic studies on Jewish prisoners - Respect, Integrity, and Responsibility), Freeman (Lobotomies - Competence, Responsibility), and Curtiss (Genie - Respect and Responsibility), have all been in direct opposition to at least one of the four ethical principles, yet, have all arguably contributed to the furthering of behavioural understanding (Buss, 2016; Tabery, 2008). The BPS has determined the fluidity of morality and ethics, and therefore explicitly states that Psychologists are to use their judgement when making ethical considerations (whilst recording such decisions) including biases, within a legal framework (British Psychological Society, 2014, 2018).

An ethical consideration that occurs in the gene/environment debate is how to alter the variables of the experiment without affecting a lifelong impact in the subjects (British Psychological Society, 2014, 2018; Tabery, 2008; Viding et al., 2007). An example of an experiment facing this consideration is a twin/adoption study. Hypothetically, if the IV is to place twins in separate homes from different fiscal backgrounds (Environmental) to determine a DV of aggression levels, then the IV must potentially steal an alternative, happy life from at least one of the twins to understand the impact of environment on behaviour (Chomsky, 2000; Gardiner et al., 1998; Gardner, 2006). This hypothetical experiment not only impacts the twins relationship with each other, it impacts upon the twins' free-will, a price considered

by many, worldwide, not just academically, too high (Blum et al., 2011; Haworth et al., 2013; Plomin & von Stumm, 2018; Tabery, 2008). In addition, this experiments repetition to provide conclusive, impactful data would require the same ethical questions for potentially thousands of pairs of twins. Another global ethical consideration is the distribution of the results of a study. Gardner (Gardner, 2006) states that the Stanford-Binet IQ test measures intelligence in a biased way, as it is a measure of a type of competency held in high esteem in the west. The test, he says, doesn't measure values also regarded societally, such as spatial competence, and therefore the results do not provide an accurate measure of intelligence (Chomsky, 2000; Gardner, 2006; Gudmundsson, 2018). However, the IQ test is still considered a marker for intelligence, particularly in the west, as it measures numerical and linguistic skills that are highly regarded, particularly in white-collar professions (Gardiner et al., 1998; Gardner, 2006). This cross-cultural bias could cause significant damage to communities that rely on other competencies for survival, such as agricultural communities, and could lead them to be severely impacted by being measured against communities with a priority focus upon the mathematical and linguistic talents required to be deemed "Intelligent" (Chomsky, 2000; Gardiner et al., 1998; Gardner, 2006).

The essay will now discuss methods of analysing results through statistics. This enables researchers to statistically divulge the extent to which the GE factors contributed to the DV (Munafò et al., 2003; Siira et al., 2004). There is no one size fits all statistical model, and in particular, there is no one model that will correctly identify the extent to which GE factors impact human behaviour, without careful consideration of the IVs being tested (Munafò et al., 2003; Siira et al., 2004). The IVs need to be rigorously measured to provide reliable and valid results (British Psychological Society, 2014, 2018; Gardner, 2006; Haworth et al., 2013; Plomin & von Stumm, 2018).

To produce mathematical data to condense results into groups (particularly qualitative data), a scale must be chosen (Luo et al., 2010; Plomin & von Stumm, 2018; Tabery, 2008). Many numerical scales exist already, but psychologists have the freedom to explain variance in many different ways (Siira et al., 2004; Tabery, 2008). The issue lies in selection of a significant, valid, and reliable numerical scale, and this would depend upon the experimentation methodology (Ayorech et al., 2016;

Plomin et al., 2016; Viding et al., 2007). Typical statistical analysis will represent the mean of the data, as well as the standard variation to show margin for error, and the confidence interval will also be shown (Plomin et al., 2016; Rose, 2017). Whilst this is perfectly acceptable for singular IVs, this method is not mathematically accurate when outside or uncontrollable factors are involved, as these factors will affect the results (Collyer et al., 2015; Haworth et al., 2013; Siira et al., 2004; Tabery, 2008; Viding et al., 2007). Analysis of these effects upon variance was developed by Fisher, when he made the ANOVA (Analysis Of Variance) table, an algebraic method of discerning which factors affected the results with a percentage for each factor in the end column (Collyer et al., 2015; Tabery, 2008). Another way of accounting for variation and deviation is the DeFries-Fulker regression, another algebraic format that separates multiple variables into a linear, graphable pattern (Ayorech et al., 2016; de Zeeuw, 2014; Munafò et al., 2003). These functions are useful to psychologists as they can, if correctly tested, identify IVs that may not be controllable (de Zeeuw, 2014; Plomin et al., 2016). Other ways of measuring effect size include the “Cohen’s D” model (Glen, 2016; Siira et al., 2004). As with all algebraic formulas, once the correct variable is identified and numerically nominated, it simply becomes a matter of inputting the figures into the formula, various software designs are now available for long-term, in-depth research which should enable future researchers to replicate and reproduce accurate, valid, and reliable statistics to show the extent of the variables on a behavioural trait (Blum et al., 2011; Collyer et al., 2015; Glen, 2016; Haworth et al., 2013; Siira et al., 2004). It is also possible to check the balance of figures produced during experimentation by using a plethora of methods including the Akaike Information Criterion (AIC), other models exist but this one allows researchers to test the models they have used against other models to see if the data they are producing shows signs of appropriate representation (Date, 2019).

To conclude, this essay has shown briefly some of the disciplines that have guided GE research, assessed using examples some of the ethical considerations researchers have to contemplate, and highlighted statistical methods and formulas used by psychologists to display their results and account for the variables in their research. The essay has shown that with an underlying scientific approach, psychology is on the very brink of being able to determine with almost certainty how

much impact genetic and epigenetic factors have on human behaviour. With further consideration of the environmental factors that influence the expression of genes, psychologists should be able to determine, and divulge, the extent to which both factors drive human behaviour. The final remark of this work is that with this information readily available, the effect it will have upon human kind is potentially astronomical. To what extent do we create an environment that ethically supports all members of it?

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