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1 Introduction to evolutionary psychology

KEY CONCEPTS

the Environment of Evolutionary Adaptedness (EEA) • proximate and ultimate levels of explanation • the inheritance of acquired characteristics • particulate inheritance • eugenics • the Great Chain of Being (*scala naturae*) • sociobiology • modularity

Evolutionary psychology is a relatively new discipline that applies the principles of Darwinian natural selection to the study of the human mind. The principal assumption of evolutionary psychology is that the human mind should be considered to be an organ that was designed by natural selection to guide the individual in making decisions that aid survival and reproduction. This may be done though by species-specific ‘instincts’ that enabled our ancestors to survive and reproduce and which give rise to a universal human nature. But equally the mind is an organ which is designed to learn, so – contrary to what many people think – evolutionary psychology does not suggest that everything is innate. In this chapter we trace the origins of evolutionary psychology, and present some of the arguments between those who hold that the mind is a blank slate and those who believe that human behaviour, like that of other animals, is the product of a long history of evolution.

The origins of evolutionary psychology

The fundamental assumption of evolutionary psychology is that the human mind is the product of evolution just like any other bodily organ, and that we gain a better understanding of the mind by examining evolutionary pressures that shaped it. Why should this be the case? What can an understanding of evolution bring to psychology? After all, scientists were able to learn a great deal about bodily organs such as the heart and the hand long before Darwin formulated the theory of natural selection. Unfortunately, not all body parts are as easy to understand as heart and hand. A classic example is the peacock’s tail. This huge structure encumbers the

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animal to the extent that it makes it difficult to escape from predators and requires a considerable amount of energy to sustain it – energy that might otherwise be used for reproduction. Darwin was similarly troubled by this and in a letter to his colleague Asa Gray remarked that 'The sight of a feather in a peacock's tail, whenever I gaze at it, makes me sick' (Darwin, 1859). Or to take another even more perverse example, the male Australian redback widow spider (*Latrodectus hasseltii*) who sacrifices himself to the female following copulation: why would you design an animal to do *that*? These types of questions are known as **ultimate** questions as they ask why a particular behaviour exists at all. These are usually contrasted with **proximate** questions which ask about, for example, how a particular behaviour develops, what are its neural or cognitive underpinnings or whether it is acquired or innate.

The answers to these questions highlights a deep-rooted problem in the foundations of traditional psychological thinking. To the extent that psychologists ever consider why we perform particular behaviours – and this, admittedly doesn't happen very often – they usually concern themselves with the benefit to the individual who performs the behaviour. But current Darwinian theory turns this thinking on its head. We are not necessarily the beneficiaries of our own behaviour: the beneficiaries of behaviour are, in many cases, our genes.

It is worth pausing for a second to reflect upon this point and considering its implications. The peacock dragging his tail behind him might well prefer – should he be able to consider such things – to be rid of it. The male redback widow spider might choose, on reflection, to forgo indulging the cannibalistic urges of his erstwhile squeeze. But placing the individual at the centre of the action in this way doesn't always give us the complete picture. Modern evolutionary theory sees the individual as merely an ephemeral and transient bit-player in the theatre of existence, acting out a script that was not of his or her writing, a script written in the language of the genes. Richard Dawkins probably best summarised this when he made the famous replicator–vehicle distinction (see chapter 2). 'We are survival machines – robot vehicles blindly programmed to preserve the selfish molecules known as genes' (Dawkins 1976, p. xxi). If you think about it this has to be the case. Life originated from replicating chemicals – precursors of DNA – and only after many millions of years did these chemicals start to build structures around them to form the precursors of cells: unicellular organisms became multicellular, tissue became organs until we eventually ended up with animals with brains and behaviour. So bodies and brains clearly benefited DNA otherwise they wouldn't have been produced; they would have been outcompeted by the brainless and the bodiless. So our genes aren't for our benefit, we are for their benefit. Dawkins goes on to say '[t]his is a truth which still fills me with astonishment'. If you aren't astonished, you haven't understood it, but don't worry, we discuss this further and in greater depth in chapter 2.

It is worth adding a caveat to all of this: the above only applies to evolved behaviour (or organs); any behaviour which has not evolved, such as a purely learned behaviour, may not benefit genes at all. Deciding exactly which behaviours are evolved and which are not (and which are a bit of both) is a difficult task and one to which we return many times throughout the subsequent chapters.

In terms of psychology, we have only scratched the surface in trying to apply evolutionary thinking to understanding behaviour. Many of the ideas expressed in this book will doubtless be proved wrong in the fullness of time, but if we are to properly understand humanity in all its shapes and sizes, loves and hates in sanity and madness, then we need an understanding of basic evolutionary principles and, in particular, the gene-centred view of life.

It is said that science has presented humans with three hammer blows to its sense of self-importance. Copernicus taught us that the Earth was not at the centre of the universe; Freud showed us that our instincts are emotional and sexual rather than rational and godly; and Darwin demonstrated that we were descended not from angels but from apes. To this we might add the gene-centred view of life which shows that in many cases we are not the final beneficiaries of our own behaviour; the buck stops not with us but our genes.

A history of evolutionary thinking

Evolution before Darwin

For millennia humans have been fascinated by the natural world, not just the complexities of the organisms that constitute it, but the interdependencies that exist between different species. Flowers provide food for insects that are eaten by birds that are consumed by small mammals that are preyed upon by larger animals that eventually die and provide food for the plants that produce flowers and so the cycle continues. Surely such a complex system could not have arisen by accident? Surely this must have somehow been designed, created by some all-powerful being? The idea that nature in all its complexity was created all at once held sway for a long time, not just as religious doctrine but as a true account of the origin of Everything. It still does hold sway in the minds of many today. Debates about the scientific status of creationism and intelligent design have recently approached boiling point and, in the United States, entered the courtroom. In December 2005 Judge John Jones ruled that intelligent design was not science and therefore it is not permissible to teach it as science in the classroom. More recently the so-called ‘new atheist’ movement, headed by Daniel Dennett, Richard Dawkins, Sam Harris and the late Christopher Hitchens (sometimes referred to as the Four Horsemen) have written provocative and, in some cases, inflammatory anti-religious texts. However, the purpose of bringing up religion in this chapter is not to ultimately bury it, but to show how many religions

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were grappling with the same problems as many scientists: to understand where life came from, and what it means.

Not every ancient belief system proposed steady states and immutability. The Ancient Greek philosopher Thales (*c*.624–545 BC) tried to explain the origins of life in terms of natural as opposed to supernatural terms. He also proposed that life ‘evolved’ out of simpler elements with the most basic element – from which all else ultimately derived – being water. Later another Ancient Greek, Empedocles (495–435 BC), suggested that in the beginning the world was full of bodily organs which occasionally came together and joined up, driven by the impelling force of Love. The results of most of these unions were ‘monstrosities’ and died out, but a minority were successful and went on to reproduce, producing copies of themselves. Although we can clearly recognise this as being fanciful in that we now see love as a human emotion rather than as an impelling force of nature, Empedocles’ mechanism has conspicuous similarities to natural selection (see chapter 2). In particular, the idea that change occurs over time by a gradual winnowing of less successful forms. Aristotle (384–322 BC) seemingly killed off evolutionary thinking for some time by proposing that each species occupied a particular space in a hierarchical structure known as the *Great Chain of Being* or *scala naturae*. In this scheme, which was later adopted by the Christian religion, God occupied the topmost rung of the ladder followed by angels, then the nobility (males *then* females), then ordinary men, ordinary women, animals, plants and finally inanimate objects. Moving from one rung to another was not permitted which meant that there was a natural order of things. Aristotle’s view was not merely descriptive (describing the way the world is) but was also *prescriptive* (this was deemed to be the way the world *should* be) so any change to the established hierarchy would lead to chaos until the order was re-established. By fixing the hierarchy in this way Aristotle’s view effectively closed down debate about evolutionary change, not only would such an approach be considered theoretically incoherent, it was also considered morally wrong to question the way things should be.

Much more recently in 1798 the German philosopher Immanuel Kant wrote in his work *Anthropology* that:

> [A]n orang-utan or a chimpanzee may develop the organs which serve for walking, grasping objects, and speaking – in short, that he may evolve the structure of man, with an organ for the use of reason . . . (Kant, 1798)

In direct contradiction of Aristotle, Kant imagines how one organism can change over time, perhaps acquiring the characteristics of other organisms. Notice also that Kant does not merely refer to physical change: ‘an organ for the use of reason’ is a psychological faculty. In this way Kant presaged evolutionary psychology by two centuries.

Figure 1.1 Erasmus Darwin

Darwin's own grandfather, Erasmus Darwin (1731–1802), wrote that all living things could have emerged from a common ancestor (what he called 'one living filament'). He also suggested that competition might be the driving force behind evolution. He saw this competition occurring between different species and within a species between members of the same sex (presaging the theory of sexual selection proposed in 1871 by his grandson). In *The Laws of Organic Life*, he states:

> The final course of this contest among males seems to be, that the strongest and most active animal should propagate the species which should thus be improved. (Darwin, cited in King-Hele, 1968, p. 5)

Although we can see close similarities between these ideas and Darwin junior's theory of evolution, Erasmus failed to produce a plausible mechanism for evolutionary change.

A contemporary of Erasmus Darwin, Jean-Baptiste Lamarck (1744–1829), proposed just such a mechanism to account for change. Lamarck's first law suggested that changes in the environment could lead to changes in an animal's behaviour which, in turn, might lead to an organ being used more or less. The second law was that such changes are heritable. Taken together these laws prescribe an organism's continuous gradual change as the result of the interaction between the organism's needs and the environment. Most evolutionary biologists agree that **the inheritance of acquired characteristics**, as Lamarck's theory has since been called, is incorrect. Although the environment can indeed affect bodily organs, for example increased exercise can increase the capacity of the heart and lungs, such changes cannot be passed on to the organism's offspring. Although Lamarck's theory has fallen from favour, Charles Darwin did cite Lamarck as a great influence in the development of his theory of evolution: natural selection.

Darwin and natural selection

Natural selection depends on two components: **heritable variation** (individuals within a population tend to differ from each other in ways that are passed on to their offspring) and **differential reproductive success** (as a result of these differences some individuals leave more surviving offspring than others). You can see this process laid bare in asexual species where an individual reproduces simply by producing an identical copy of itself. In such cases, the overwhelming majority of offspring will be identical to the parent, but a few will be different in some way due to errors in the copying process. Should these different offspring survive and reproduce, then the majority of *their* offspring will be identical to them and the process repeats itself. However, copying errors seldom have positive consequences. To see this, imagine that you make an error copying down a recipe: there is a good chance that this error will make no noticeable difference to the end product (for instance you might add two grinds of pepper rather than one). On the other hand, it may make the end product substantially worse (adding a tablespoon rather than a teaspoon of salt); only very rarely will an error actually improve the recipe. Similarly, in the natural world, copying errors would probably have no effect or would lead to the individual failing to pass on its genes. On very rare occasions, however, an error might produce an organism that is actually better fitted to the environment than its parents or it might be able to exploit some property of the environment that its ancestors could not. In such cases, barring unfortunate random accidents, this individual will tend to produce more offspring and the 'error' will soon become the norm. In some cases the new lineage might outcompete the old, and come to replace it. In other cases, particularly if the two variants become geographically separated, both versions might coexist and ultimately form two different species.

As we shall see in chapter 3, the state of affairs is somewhat more complicated for organisms that reproduce sexually. For asexual species, variation only comes from copying errors (or mutations). Sexually reproducing species combine the genes of two individuals during reproduction, meaning that offspring will always be different from either parent. The increased variation produced by sexual reproduction is thought to be one of the reasons why sex evolved in the first place.

Mendel and the birth of genetics

Darwin knew nothing about genetics, and for good reason: at the time of Darwin's death, no one on earth knew about genetics except the Austrian monk Gregor Mendel.

Figure 1.2 Gregor Mendel

Between 1858 and 1875 Mendel conducted a series of breeding experiments on hybrid pea plants in the garden of his monastery in Brunn.

One of Mendel's greatest insights was that inheritance was **particulate**. Darwin presumed that the traits of an individual were some sort of blend of the traits of the mother and father, as might happen when mixing paint. Some observations seem to support this belief. In many species, the result of a mating between a comparatively large female and a small male will tend to produce offspring whose size is somewhere in between the two: a fact that animal breeders had known for some time. Mendel demonstrated that the blend model is incorrect. He found that if two pea plants were crossed, one having white flowers and one having red flowers, the offspring would be either red or white, never pink, as might be expected if the two traits blended. The reason why some traits, such as height or skin colour, seem to blend is because they are controlled by a number of genes, for traits controlled by single genes, inheritance is always particulate.

In truth, it probably didn't need Mendel's data to highlight the inadequacies of the blend model. Any child who has mixed the colours in a paint set will soon realise that after a few mixes you always end up with the same dirty brown colour. Likewise if sex merely blended traits, after a sufficiently large number of generations everyone would end up being the same, reducing variation. Since natural selection depends on variation to work, evolution would soon grind to a halt. Darwin was certainly aware of the shortcomings of the blend model (Dawkins, 2003), but did not produce a better theory to replace it, although he did come close; in a letter to his friend Alfred Wallace (and co-discoverer of the theory of natural selection) in 1866 he wrote that:

> I crossed the Painted Lady and Purple sweetpeas, which are very differently coloured varieties, and got, even out of the same pod, both varieties perfect but none intermediate [. . .] [T]ho' these cases are in appearance so wonderful, I do not know that they are really more so than every female in the world producing distinct male and female offspring.

Unfortunately Darwin never made the next step that would have enabled him to understand the true mechanism of inheritance, nor, it seems, was he aware of Mendel's work. There were rumours that Darwin possessed a copy of the journal containing Mendel's article 'Versuche über Pflanzenhybriden' ('Experiments in plant hybridisation') but no copy was found in Darwin's extensive library now housed at Cambridge University. Generally, the scientific community was rather slow to realise the significance of Mendel's ideas and biology had to wait until the twentieth century before Mendel's work was rediscovered. The subsequent fusion of genetics and evolutionary theory led to what in biology has become known as 'the modern synthesis' (see chapter 2).

From evolution to evolutionary psychology

Although most of Darwin's examples in *The Origin of Species* concerned physical traits, he also believed that natural selection had a role to play in the evolution of behaviour. Darwin appeared to see the human mind as being explainable by the same fundamental physical laws as other bodily organs, in terms of mechanistic principles. In one of his early notebooks, written in 1838, he speculated that:

> Experience shows the problem of the mind cannot be solved by attacking the citadel itself – the mind is function of body – we must bring some *stable* foundation to argue from.

That stable foundation was **materialism**, the approach adopted by modern cognitive psychology that sees the mind as being ultimately reducible to the activity of the

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brain, or as Steven Pinker puts it, 'the mind is the information processing activity of the brain' (Pinker, 1997). This materialism is important to evolutionary psychology because if the mind is just the activity of the brain, then the brain, being a physical organ, is subject to the pressures of natural selection. Therefore the mind and hence behaviour is also, at some level, the product of evolution by natural selection (see chapter 9).

Darwin did make some forays into psychology. In *The Expression of the Emotions in Man and Animals* (1872; see chapter 11 in this book), Darwin theorises on the evolutionary origins of emotions and their expressions. In 1877 Darwin wrote *A Biographical Sketch of an Infant* based on his observations of his infant son. This last work, however, is largely descriptive and although it speculates on the instinctual basis of early crying and sucking behaviours, it makes no mention of the role of evolution and natural selection in shaping such behaviours.

Early attempts at an evolutionary psychology

Francis Galton

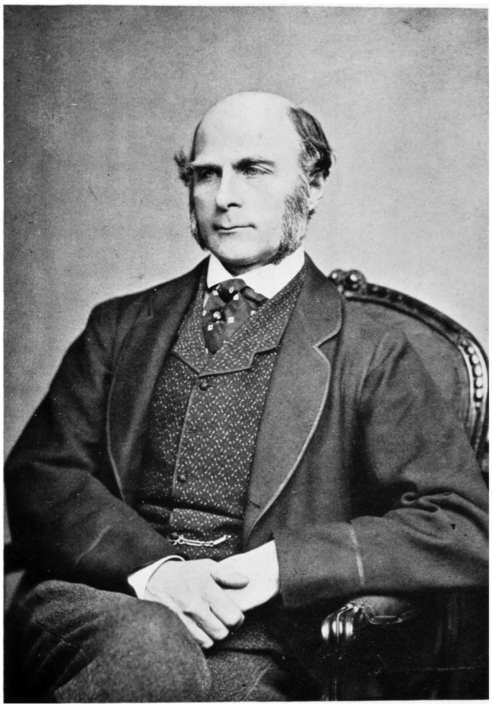

Figure 1.3 Sir Francis Galton

Darwin's cousin (also a grandson of Erasmus Darwin) Francis Galton (1822–1911) (see figure 1.3) was much influenced by the theory of natural selection:

> The publication in 1859 of the *Origin of Species* by Charles Darwin made a marked epoch in my own mental development, as it did in that of human thought generally. Its effect was to demolish a multitude of dogmatic barriers by a single stroke, and to arouse a spirit of rebellion against all ancient authorities whose positive and unauthenticated statements were contradicted by modern science. (Galton, 1908, p. 287)

Galton was a very important figure in the history of psychology; he proposed that character and intelligence were inherited traits and developed some of the first intelligence tests to explore these issues. He was, in many respects, the father of what is now known as psychometrics. He also anticipated the method of experimental psychology by emphasising the need to use quantitative data from large samples of individuals. Galton also proposed that traits that may have been useful in ancestral times might be less useful in contemporary (in this case, Victorian) society. For instance, he suggested that during ancestral times evolution had favoured humans who were group-minded or gregarious. Humans live in groups, he reasoned, so those who thrived under such circumstances would leave more surviving offspring than their less gregarious counterparts. However, in Galton's time, when greater emphasis was placed upon self-reliance and personal industry, gregariousness might be a less desirable trait (see chapter 13).

The argument that traits that were important in hunter-gatherer communities might be suboptimal in contemporary society is a familiar one in modern evolutionary psychology. Such an observation is comparatively uncontroversial and should be judged as a scientific theory that stands or fails on the basis of the evidence. More controversial was Galton's attempt to apply his scientific findings to help the greater good of society. He suggested that one way that society might be improved would be to engage in a little selective breeding. He suggested that those individuals whose traits might benefit society (the innovators, the highly intelligent, etc.) be encouraged to produce many offspring, and those whose traits are seen as less desirable (the less intelligent, the indolent, etc.) be discouraged from reproducing, a controversial programme that he called **eugenics** (see box 1.1).

William James and the concept of instinct

William James (1842–1910) is one of the most influential psychologists of all time. He made the distinction between short- and long-term memory used to this day by modern cognitive psychologists, studied attention and perception, had a keen interest in the nature of consciousness and was also very much interested in applying Darwin's ideas to human psychology. In particular he outlined instincts such as fear, love and curiosity as driving forces of human behaviour and proposed that: