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1 Introduction to evolutionary psychology

Key concepts the Environment of Evolutionary Adaptation (EEA), proximate and ultimate levels of explanation, the inheritance of acquired characteristics, particulate inheritance, eugenics, Standard Social Science Model (SSSM), 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. A central claim is that the brain (and therefore the mind) evolved to solve problems encountered by our hunter-gatherer ancestors during the upper Pleistocene period over 10,000 years ago, a time known as the Environment of Evolutionary Adaptation (EEA). The mind, therefore, is seen as equipped with species-specific 'instincts' that enabled our ancestors to survive and reproduce and which give rise to a universal human nature. This idea is in sharp contrast to that adhered to by many other social scientists who see the mind as originally a 'blank slate' that is moulded into shape by a process of learning and socialisation. 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 can 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 the heart and hand. A classic example is the peacock's tail. This huge structure encumbers the animal to the extent that it makes it difficult to escape from predators. So what is its purpose? With no knowledge of Darwin, this question would be difficult to answer. We could certainly engage in 'blind empiricism' and design some experiments in an attempt to determine what its function is. After many such experiments we might even conclude (correctly) that its function was concerned with attracting a potential mate. But there would still be many questions to answer. Why employ such an elaborate and costly method for attracting a mate? Why not simply rely on more subtle means which would be cheaper to produce and would be less of an impediment? Why is it the male who has such an appendage rather than the female? It is partly its ability to provide answers to these types of 'why' question that has made Darwinian theory such a success in biology. Can Darwin also lend a hand in understanding behaviour and thought? Evolutionary psychologists believe that he can. Evolutionary psychology is the application of evolutionary theory to the study of human behaviour and makes the claim that our minds evolved to solve specific problems faced by our hunter-gatherer ancestors in a period known as the EEA (Environment of Evolutionary Adaptation or Adaptedness). This approach can lead to a strikingly different style of explanation. To see how this might work, the following is a sample of some familiar questions in psychology.

- Why do people discriminate against those who are perceived as different from them? (chapter 8)
- Why do people appear to reason logically in some contexts, but hopelessly illogically in others? (chapter 9)
- Why is it that people who live in the industrialised West fear snakes and spiders, which are unlikely to cause them harm, but tend not to fear much more dangerous entities such as cars and guns? (chapter 11)
- Why do we find certain physical characteristics in people appealing, and others unappealing? (chapter 4)
- Is there some evolutionary advantage for individual differences? For example, that some people are shy whereas others are outgoing, some people are more cooperative than others, and is there an evolutionary function for variations in intelligence? (chapter 13)

Traditionally, psychology has attempted to answer these questions in terms of **proximate** mechanisms: causes that relate to the goals, knowledge, disposition or life history of the individual. For instance, it might be suggested that people exhibit ethnic prejudice because they categorise individuals of other ethnicities differently from those of their own ethnicity. Evolutionary psychology, as we saw in the peacock's tail example, allows us to ask **ultimate** questions. That is, what was the advantage (in terms of reproduction) to the peacock's male ancestors? Similarly, we can ask what advantage, if any, might the mechanisms that underlie ethnic prejudice have conferred on the ancestors of human beings? We are therefore asking why a particular behaviour is present in humans at all.

A history of evolutionary thinking

Evolution before Darwin

For millennia human beings 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 was not permissible to teach it as science in the classroom.

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

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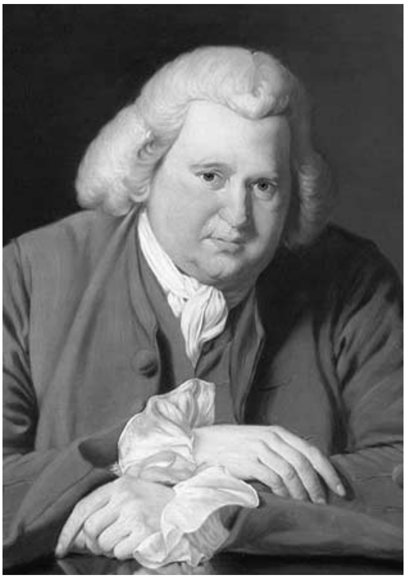

Figure 1.1 *Erasmus Darwin*

was reestablished. 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.

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. If these individuals survive and reproduce, the overwhelming majority of their offspring will be identical to them and the process repeats itself. 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, as a result of geographic separation, both versions might co-exist 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. This increased variation inherent in sexual reproduction might be one of the reasons why sex evolved in the first place.

Figure 1.2 *Gregor Mendel*

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. 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 back up this assertion. 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 have known for some time.

Not all observations are consistent with the blend model. Mendel showed 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. Moreover, often it is impossible to decide just by looking at parental traits what the traits of the offspring will be. In some cases two red pea plants might result in offspring that are all red (which is to be expected if we adapt the blend model), in other cases they might be red or white in mixed proportions.

It did not require Mendel to point out 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 features, 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**, an approach that is concordant with the perspective of modern cognitive psychology that sees the mind as being ultimately reducible to the activity of the brain, or as Steven Pinker puts it, 'the mind is the information processing activity of the brain' (Pinker, 1997). This materialism is important 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. Materialism proposes that everything is ultimately reducible to interactions of physical matter. It is best contrasted with **dualism**, the proposal that there are two fundamental substances: physical matter (which makes up the body and the rest of the physical world) and an immaterial substance which constitutes the mind or soul. This view, attributed to the French philosopher René Descartes, provides an escape route for those who believe that evolution is irrelevant to psychological processes. Because in dualist philosophy mind and brain (body) are made of different substances, mental processes remain unaffected by evolution which affects only the physical. The adoption of materialist philosophy leads, therefore, not only to a unification of mind and brain, but to the possibility that the mind is the product of natural selection.

Darwin did make some forays into psychology. In *The Expression of the Emotions in Man and Animal* (1872, see chapter 11), Darwin theorises on the evolutionary origins of emotions and their expressions. In 1877 Darwin wrote *A Biographical Sketch of the Infant* based on his observations of his infant son. This last work, however, is largely descriptive and although it speculates on the instinctive 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

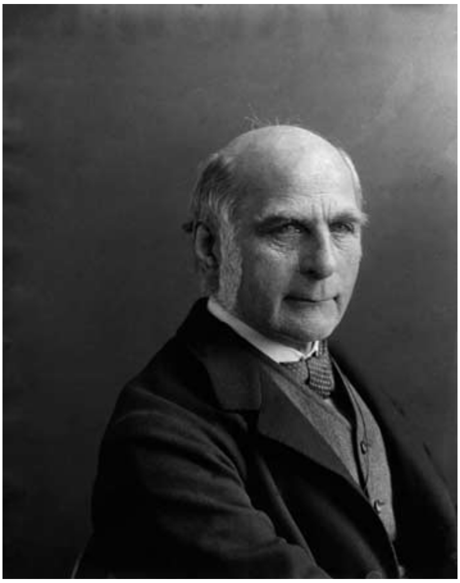

Figure 1.3 *Francis Galton*

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 the EEA might be less useful in modern (i.e. 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.

The argument that traits that were important in hunter-gatherer communities might be sub-optimal 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 falls on the basis of the evidence. More controversial was his 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. We should encourage those individuals whose traits might benefit society (the innovators, the highly intelligent, etc.) to produce many offspring, and discourage those whose traits are seen as less desirable (the less intelligent, the indolent, etc.), an enterprise 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:

> Nothing is commoner than the remark that man differs from the lower creatures by the almost total lack of instincts and the assumption of their work by reason. (James, 1890, p. 389)

He went on to add that human behaviour might be characterised by more instincts than other animals rather than fewer, an idea that has been embraced by modern evolutionary psychologists such as John Tooby and Leda Cosmides. James's argument relating to instincts was so influential that in 1921 psychologist Ellsworth Faris, a critic of the instinct approach, was able to comment that:

> So well did he [James] argue for the existence of instincts in man that we may now say: Nothing is commoner than the belief that we are endowed with instincts inherited from the lower creatures. Whole systems of psychology have been founded on this assumption. (Faris, 1921, p. 184)

Many students of psychology know of William James's work on memory, attention, consciousness and learning, but his views on instincts are less widely known. In fact, the concept of instinct was dropped from social scientists' terminology in the twentieth century partly because it was considered too imprecise a term to be scientifically meaningful (see Bateson, 2000). Furthermore, many so-called instinctive behaviours are capable of being modified by experience, in which case it is difficult to see where an instinct