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1 Introduction to Evolutionary Psychology

Key Concepts

the Environment of Evolutionary Adaptation (EEA) • proximate and ultimate levels of explanation • heritable variability • differential reproductive success • particulate inheritance • eugenics • the Great Chain of Being (*scala naturae*) • sociobiology • gene–culture co-evolution/dual-inheritance theory • naturalistic fallacy • moralistic fallacy

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 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 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 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 and requires a considerable amount of energy to sustain it, energy that might otherwise be used for reproduction (see Figure 1.1).

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, 1860). Or to take another even more perverse example, the male Australian redback widow spider 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 or organ exists at all. These are usually contrasted with **proximate questions** which ask,

Figure 1.1 A peacock displaying his beautiful train.

for example, how a particular behaviour develops, what its neural or cognitive underpinnings might be or to what extent it is acquired or innate; in other words, the questions asked by traditional (i.e. non-evolutionary) psychology. Ultimate questions, on the other hand, focus on asking what the evolutionary function of the particular trait is. How did this particular trait contribute to the organism's survival and its ability to reproduce effectively?

The answers to these questions highlight 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 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 consider its implications. The peacock dragging his tail (or train as it is more correctly called) 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 partner. 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, 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 multi-cellular; tissue became organs until we eventually ended up with animals with brains and behaviour. Brains clearly benefited DNA otherwise they wouldn't have been produced; the brainy would have been outcompeted by the brainless. This means that 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. 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.

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.

Not every ancient belief system proposed an intelligent creator, the Ancient Greek philosopher Thales (c. 624–545 BC) tried to explain the origins of life in 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) largely 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*. For example, he classified animals because of their ability to move as higher than plants, animals themselves were placed higher or lower with vertebrates being placed higher than invertebrates. This entirely biological enterprise was adopted by the Christian religion in the mediaeval period which included supernatural as well as natural beings. 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. Furthermore, the Great Chain of Being was not just descriptive ('this is the way the world *is*') but was also prescriptive ('this is the way the world *ought to be*') any change to the established hierarchy would lead to chaos until the order was re-established. By fixing the hierarchy in this way The Great Chain of Being 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.

Fast-forwarding to more recent times 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*, Darwin senior 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, 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 are not passed on to the organism's offspring. There are some exceptions to this. One that is becoming increasingly significant in evolutionary psychology (as well as other fields) is **epigenetics** (see Chapter 2) in which an individual's lifetime experiences can affect which genes are expressed (which ones are switched on or off) in their children. A recent study claims to have shown that mothers' exposure to air pollution can increase their children's susceptibility to asthma through epigenetic means. Some have suggested that epigenetics is Lamarkian in nature, but current thinking is that it is just a special case of Darwin's theory (Haig, 2007).

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 such as amoeba 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.

Copying errors can be the result of, among other things, radiation which can have the effect of changing the structure of DNA – the material that genes are made from. Mutations caused by radiation are one of the reasons why nuclear accidents such as that which occurred at the nuclear power plant Chernobyl are so dangerous, and why we slather on the sunblock to avoid skin cancer, itself a form of mutation, caused by ultra-violet radiation from the sun. Of course, you cannot pass skin cancer on to your descendants, the mutations that matter from the point of view of natural selection are those that are in the germ cells (eggs and sperm).

But here we are discussing single-cell organisms (sex will come later). When our mutated amoeba reproduces (by simply dividing into two) both of the daughter cells will contain the mutation. This is heritable variation. Now if we imagine that this mutation confers some advantage on the amoeba over the non-mutated version over successive divisions it may become commonplace. This is differential reproductive success.

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.

An example of this, so the story goes, is that chocolate chip cookies were created because one Ruth Wakefield intending to make plain old chocolate cookies realised she had run out of powdered chocolate so chopped up a bar of Nestlé's instead hoping the chocolate would melt into the mix in the oven. It didn't, and chocolate chip cookies were born.

Although there are many stories of such happy accidents, there are vastly more tragic ones that never see the light of day. 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 a 'chocolate chip' 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 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. 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. Between 1858 and 1875 Mendel conducted a series of breeding experiments on hybrid pea plants in the garden of his monastery in Brno, now in the Czech Republic (see Figure 1.2).

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 not because, 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

Figure 1.2 Gregor Mendel tends his plants in his garden.

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:

> 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, 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 and Figure 1.3).

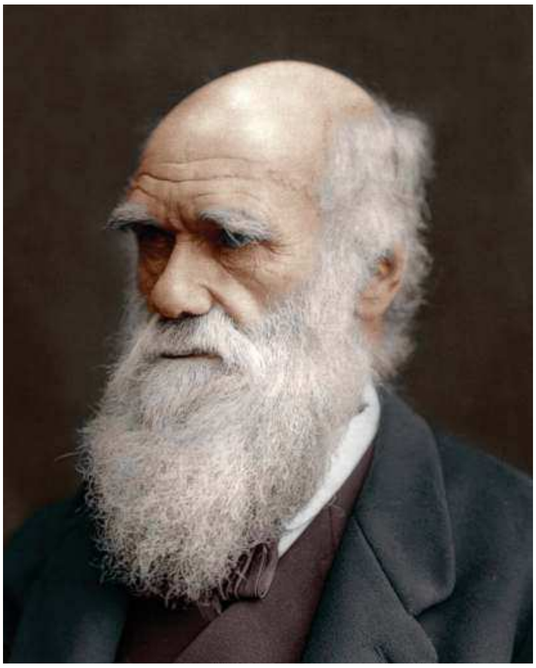

Figure 1.3 Charles Darwin.

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 (see Chapter 9) 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 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 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 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 Darwin's cousin (also a grandson of Erasmus Darwin) Francis Galton (1822–1911) 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, 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 modern (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 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 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).

Box 1.1 Eugenics

The word 'eugenics' coined by Francis Galton comes from the Greek word *eugenes* meaning 'well born'. The idea was also Greek. In *The Republic* Plato proposed that although friendships between the sexes should be permitted, procreation should be controlled by the government with the aim of breeding a better society. In a sense, all sexual beings participate in a form of eugenics, albeit unconsciously. There is evidence to suggest (see Chapters 3 and 4) that when an animal (including a human animal) selects a sexual partner it does so, among other things, on the basis of characteristics that are indicative of good genes. Good looks, it appears, are not arbitrary. But eugenics is rather more than that; it was developed as a method of trying to dictate who breeds with whom and, in extreme cases, who doesn't breed at all.

There are two forms of eugenics, often called positive and negative. Positive eugenics operates by encouraging people with high fitness to mate together and produce many offspring. The word 'fitness' here is used in a quasi-Darwinian sense and can be treated as meaning 'possessing characteristics which are thought to be good for society'. This is probably the most benign form of eugenics although it has to be said that even this form of eugenics is anathema to most people. Negative eugenics, on the other hand, attempts to curtail or prohibit reproduction among those who are considered unfit.

Box 1.1 (cont.)

When Galton founded the Eugenics Education Society in 1907 (later the Eugenics Society and finally the Galton Society in 1989) the goal was to improve the human species by positive means:

> If a twentieth part of the cost and pains were spent in measures for the improvement of the human race that is spent on the improvement of the breed of horses and cattle, what a galaxy of genius might we not create! We might introduce prophets and high priests of civilization into the world, as surely as we can propagate idiots by mating *cretins*. (Galton, 1864, 165–6)

Charles Darwin's son Major Leonard Darwin took over the eugenics society from Galton and instigated the transition from positive to negative eugenics. He proposed that a policy of segregation should be implemented whereby the fit were separated from the unfit. 'Compulsion is now permitted if applying to criminals, lunatics, and mental defectives; and this principle must be extended to all who, by having offspring, would seriously damage future generations' (L. Darwin, 1925).

In the early part of the twentieth century, hundreds of thousands of people were sterilised worldwide on the grounds that they were deemed psychologically unfit. In the United States alone it was reported that by 1960 almost 60,000 individuals had undergone involuntary sterilisation (Reilly, 1991). Undoubtedly the largest and most systematic programme of eugenics occurred in Nazi Germany. Beginning with segregation and sterilisation and finishing with the systematic slaughter of millions, Hitler tried to ensure that the genes of the 'unfit', mainly Jews but many others as well, would not make it to the next generation.

Curious to think in these post-Holocaust days that eugenics was once considered to be a respectable enterprise. Members of eugenics societies included the eminent economist John Maynard Keynes; John Harvey Kellogg of Kellogg's Corn Flakes fame; Lord William Henry Beveridge, producer of the Beveridge report on social insurance in the United Kingdom; psychologists Cyril Burt, Hans Eysenck and Charles Spearman; the sexologist H. Havelock-Ellis; and geneticist Ronald Fisher.

Undoubtedly, many eugenicists probably felt that they had humanity's best interests at heart. However, today most would probably feel that even positive eugenics with its attempt to coerce or interfere with an individual's freedom of choice of sexual partner is an infringement of civil liberties and therefore abhorrent. Eugenics societies are still with us today, but technology has presented us with different if related issues. Currently there is controversy about the role of genetic engineering in determining human traits. It is already possible to screen foetuses for genetic disorders, and soon it will be possible to replace 'defective' genes to produce a healthy infant. Such gene therapy, as it has been called, has been heralded as being of potential benefit for humanity, but some worry that genes might be replaced that are not medically deficient, merely undesirable. If it were possible to detect genes that influence criminality, or anti-social personality, would it be ethical to change such genes for the common good? Would it be morally right to genetically manipulate genes for intelligence, or good looks?

The eugenics controversy has cast a shadow over the use of Darwinian theory in explaining human behaviour (see Box 1.3); it has been all too easy for all evolutionary theories to be

Box 1.1 (cont.)

dismissed as inherently racist, supremacist or otherwise politically incorrect. This is unfortunate. Darwinian thinking could well prove to be the framework that unites the social sciences (Wilson, 1998) in the same way that it unified the disparate areas of biology in the early part of the last century (see Chapter 2). We must not reject it simply on the grounds that some people have used it for nefarious means, any more than we should reject sub-atomic physics for its role in the production of nuclear weaponry. The fact that we do not like the implications of a particular theory does not affect its truth. On the other hand, it would be a mistake to think that science exists in a vacuum, and it is incumbent on all of us – including scientists, perhaps *especially* scientists – to guard against those who might wish to use the results of science for their own political ends.

SIGMUND FREUD Freud is an interesting case in the history of psychology. To many he is the embodiment of cultural relativism, with the great emphasis he placed on the role of the parents and family in the shaping of an individual's personality. However, Freud deserves mention for two reasons. First, unlike many subsequent psychologists Freud was interested in ultimate questions; he was preoccupied by finding out *why* people behaved as they did, not simply *how*. Second, although many of these accounts were distinctly non-Darwinian (e.g. the Oedipus complex in which a male child desires to kill his father), some of his ideas are much more in line with recent Darwinian psychology. For example, Freud's notion of the id as a set of inborn desires including the sexual imperative is one that has many parallels with evolutionary theory, and his view that our conscious selves might be completely unaware of our 'real' motives is one that is echoed in Robert Trivers' theory of self deception. Freud also wrote that:

> The individual himself regards sexuality as one of his own ends; whereas from another point of view he is an appendage to his germ-plasm, at whose disposal he puts his energies in return for the bonus of pleasure. He is the mortal vehicle of a (possibly) immortal substance – like the inheritor of an entailed property, who is only the temporary holder of an estate that survives him. (Freud, 1914)

This idea that we as people are only temporary vehicles for our immortal germ-plasm (we might now call it our genes) which influences our conscious selves to fulfil its motives is at the heart of Dawkins' 'selfish gene' theory of behaviour. Dawkins even uses the same word 'vehicle' to describe the individual, as we saw above.

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, 389)