



ONCE UPON A TIME ... THE EVOLUTION OF HUMAN BEHAVIOUR

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1.1 INTRODUCTION

Psychology asks the big questions, and among the biggest are questions like ‘Who am I?’ and ‘Why do I think, feel and behave in the way that I do?’ ‘How did I come to look like this, be like this and behave like this?’ One part of the answer comes from our understanding of evolution and genetics. From single-celled swamp organisms we have evolved into the complex creatures we are today. In this chapter, we will consider how this development has taken place, what effect our ancestry has on us today and where we may be heading in the future. Don’t expect all the answers, but do expect to think differently about some of the questions. What better place to start a psychology book than to ask what are human beings, and how did they come to be? So, let’s start this story at the beginning. Are you sitting comfortably? Once upon a time...



FRAMING QUESTIONS

- What are the basic ideas of the theory of evolution that we can apply to human behaviour?
- What is a human being?
- Why did our ancestors develop bigger brains?
- Does human culture affect evolutionary change?

1.2 THE HUMAN APE

What are we? This has been a question that has stimulated intellectual debate for centuries. In the fifteenth century, the debate was dominated by a view that placed humans at the centre of the universe. Therefore, the philosophers of the day, in line with the European religious doctrine of the time, had the earth at the centre of the universe with all the other planets, including the sun, revolving around the ‘seat of man’. This began to change when Copernicus, a Polish astronomer and mathematician, using empirical data, disproved the geocentric theory of the universe. His work, published in *De revolutionibus orbium coelestium* in 1543, challenged the religious thinking of the time by demonstrating that the earth revolved around the sun. The work of Copernicus is seen as the start of the **scientific revolution**.

Growing out of this scientific revolution was a commitment to the scientific ideals of observation, analysis and experimentation (we cover more about the development of science in the next chapter). Over the centuries, science

Scientific revolution In the sixteenth and seventeenth centuries there was a period of rapid change in the intellectual endeavour of making sense of the world that people lived in. Medieval philosophy was replaced by scientific principles of observation, measurement and experimentation. These developments are linked with Bacon (1561–1626), Galileo (1564–1642), Descartes (1596–1650) and Newton (1642–1727).

has progressed our understanding (and control) of the world around us. For psychologists, even more significant than the ideas of Copernicus was the contribution in the nineteenth century of **Charles Darwin** (1809–1882), which changed the way we see ourselves in relation to life on earth. From his careful observations on his voyage aboard the *Beagle*, and through his experiments involving selective breeding of domestic animals, such as dogs and cattle, he developed his theory of evolution by natural selection.

1.2.1 Some basics on evolutionary theory

Evolution as a concept was not invented by Darwin. Evolution describes a process whereby there is change in the features of some body or system over time. The key question is to find out what are the processes that bring about these changes. In 1859, Charles Darwin published a book entitled *On the Origin of Species*. A key idea outlined in the book was that human beings share a common ancestor with other contemporary primates, such as chimpanzees and gorillas. Darwin proposed that the way in which organisms changed over time (evolved) was through a process of natural selection. This provided the basis of the explanation of how a common ancestor could evolve into more than one species.

Many people feel they are familiar with the theory of natural selection; however, it is often mistaken as simply being the survival of the fittest, with the term *fittest* being taken to mean the *strongest*. Yet, if we look at Darwin's (1859) and Wallace's (1858) theory of natural selection, we see that the underlying principles of natural selection are far more complex.

There are three key principles that lead to the concept of fitness in Darwinian terms. The first principle is that of *variation*: this suggests that individuals within a species all show variation in their behavioural and physiological traits (the **phenotype** of the individual). If individuals were all the same, then there would be no possibility for change. The second principle is that of *inheritance*, whereby the variations exhibited by individuals are heritable. The third principle is that of *adaptation*. Adaptation refers to an organism's suitability or fit to the environment that it inhabits. That environment contains limited resources (of food, water and safe spaces, for example) and this leads to competition between individuals, groups and species for those resources. Therefore, if an individual has inherited certain variations in behaviour or physical makeup that make them more effective at competing for these resources, then there will be a greater chance that they will produce more offspring and so pass this variation on to the next generation.

These three key principles lead on to the concept of *fitness*, as those individuals that show heritable adaptive traits are likely to leave more offspring. Those offspring that inherit these traits are suggested as having an evolutionary advantage as they are likely to be better adapted to their environment and, as such, natural selection has occurred. This process gives us the rich variation of species on the planet that have each found an environmental niche where they fit. This gives us the neck of the giraffe, the spots of the leopard and the testicles of the chimpanzee (see below).

Since the 1850s, biological science has progressed, and of course when we now refer to natural selection we are also taking into account the genetic makeup of an individual (their **genotype**). The principle of inheritance now refers to how genes that code for specific proteins that can lead to certain behaviours or physiological traits are passed on to future generations. The first person to recognise this process was an Austrian monk called **Gregor Mendel** (1822–1884),

Phenotype The characteristics of an organism resulting from the interaction between its genetic makeup and the environment. These characteristics can be biological or behavioural.

Genotype Genes that make up the genetic code for an individual are described as the genotype. In humans, the genotype comprises approximately 25,000 genes. Genes mostly come in pairs. Each member of a pair of genes is referred to as an allele.

Gene The basic unit of heredity. It is a segment of DNA that occupies a specific place on a chromosome. Genes act by affecting the synthesis of proteins which in turn influence specific physical traits, such as the shape of a leaf or the texture of a person's hair. Different forms of genes, called alleles, determine how these traits are expressed in a given individual.

who was very observant in his work growing peas. Like any good farmer, he selectively bred his peas to promote certain characteristics, such as flower colour, smoothness of the pea, mushiness, etc. The selective breeding was done systematically and records were carefully maintained so that the lineage of his peas could be clearly specified. Through careful study, Mendel was able to demonstrate that the transmission of the physical characteristics of his peas across generations obeyed certain laws, sometimes referred to as the *basic laws of inheritance*. We now refer to these laws as *Mendelian laws of genetics*. The basic element involved in the transfer was called a **gene** and this has become part of our everyday language. Mendel published his work in 1866 and is seen as the father of genetics. There is no evidence that Darwin was aware of Mendel's work, which was rediscovered at the turn of the century. The gene, however, is the discrete element of inheritance that Darwin attempted to grapple with in his account of the impact of evolution through natural selection.

1.2.2 Applying the principles of evolution to human beings

Building on the work of Darwin and Mendel, we have developed our knowledge of genes and how they affect us. This work is still ongoing and, although we know a lot more than we did 100 years ago, there is long way before we have a full understanding of the processes involved. Indeed, we have to consider whether it might actually be beyond our understanding in the way that cooking is beyond the understanding of a dog.

Richard Dawkins (1976) argued that it is the genes that are the driving force in natural selection and that behaviour and physiology are actually a consequence of genes maximising the chances of their **heritability**. To put it another way, human beings are just the carriers of genes rather than the main event, and in this case, we are like an apple that has developed to ensure that the apple seeds are eaten and planted (think of it as being an apple that is foraged in a forest rather than Sainsbury's). The seeds are the main event, not the apple. Such a perspective widens the definition of fitness to the wider gene pool of a species. So, rather than thinking in terms of direct inheritance between parents and offspring, we can now consider inheritance in terms of the contribution to a shared gene pool and the number of genes an individual has in common with others. This leads to the concept of inclusive fitness, whereby not only the genes passed directly to offspring are considered, but also those of close relatives with shared genes.



KEY STUDY

Why the chimpanzee has big testicles – an example of the power of evolution: Harcourt, A.H. (1977). Sperm competition in primates. *The American Naturalist*, 149(1), 189–194 and Harcourt, A.H., & Stewart, K.J. (1977). Apes, sex and societies. *New Scientist*, 20, 160–162.

There are many similarities between chimpanzees and gorillas, as we might expect, but the interesting thing is the differences that exist and how they might have developed. Some of the physical and behavioural differences between the two species are summarised in Table 1.1, and the question to answer is why two similar species develop such striking differences. The key driver for change is often presented as changes in the environment, but in this case the changes are closely linked to the social organisation of the two species.

Table 1.1 The differences between chimpanzees and gorillas (reproduced with permission from Harcourt & Stewart, 1977)

Characteristic	GORILLAS	CHIMPANZEES
Sex differences	Male gorillas are much bigger than the females and also twice the weight	Male and female chimpanzees are nearly the same size as each other
Female sexual swellings	Barely visible	'Enormous' (p. 161)
Size	A male gorilla is about three times the size of a chimpanzee	A chimpanzee's testicles are six times the size of a gorilla's
Male courtship display	Virtually none	Flamboyant and vigorous
Time taken to copulate	Gorillas usually copulate for between two minutes and a quarter of an hour	'... can mount, thrust, ejaculate and dismount, all within the average time of seven seconds' (p. 162)

Chimpanzees live in loose communities with an equal number of males and females. When the males reach adolescence they stay with the group in which they were brought up, which is relatively unusual in mammals, but the females leave the home troop to join a neighbouring one before mating. The males protect the troop and its territory through collective action.

The social organisation of gorillas is very different. Each troop of gorillas is dominated by one large male who tolerates only one or two other males, most likely his offspring, who may well take over the leadership when the old male dies. The other young males leave the troop. The male gorillas do not get together to protect their troop and territory but challenge each other for control of the small mating groups.

There is a big advantage if you are a male gorilla in being large. Being large means that you can beat off the challenge of other male gorillas and so gain exclusive mating rights with a group of females. Therefore, it is no surprise that the male gorilla has evolved a much larger body, and so is visibly bigger than the female.

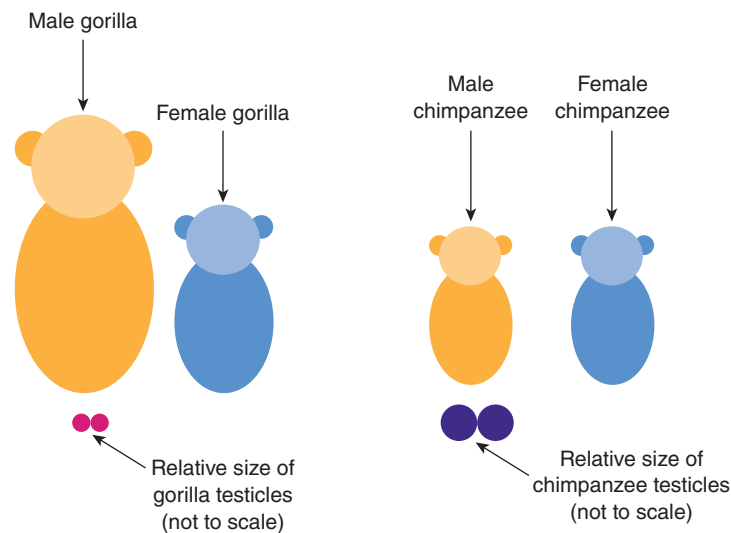


Figure 1.1 Graphic to illustrate the differences between chimpanzees and gorillas

(Continued)

The male chimpanzee, on the other hand, gains very little advantage from being large. This is because the female often mates with several males and, if the largest male is fighting off his rivals, then someone else steps in while the fight is going on. So, the male chimpanzee has not developed a more muscular frame because there is no reproductive advantage in it.

So why are chimpanzee's testicles so big and a gorilla's so small? The female chimpanzee might well mate with several males, but she develops only one fertilised egg. The male who is most likely to fertilise that egg is the male who mates with her most often or who produces the most sperm. Therefore, the feature of large testicles has been bred into the male line of chimpanzees because larger testicles produce more sperm. The gorilla does not have these competition problems and so has some of the smallest testicles in the animal kingdom.

So how can this be applied to humans? The ever-changing complexity of human behaviour can at first appear to be difficult to break down into simple heritable traits, as we are undoubtedly not genetic automatons. It is perhaps this flexibility in behaviour and the ability to vary our behaviours in response to changing circumstances that our most important adaptive traits. However, this plasticity in behavioural and physiological traits is still mediated by our evolutionary past and results in characteristic human behaviours.

1.3 WHAT IS A HUMAN BEING?

1.3.1 Approaches to evolutionary psychology

There are a variety of different behaviours that appear to be typically human. These include the use of complex language, cooperation and helping behaviours, complex social networks, and extended childhood to name a few. However, to what extent can these behaviours be considered as evolved behaviours and not simply a consequence of the environment in which we live? An evolutionary approach to the problem allows us to consider what traits are *human universals* and to what extent a behavioural characteristic can be inherited. In order for a trait to have been an evolved adaptation, it has to be passed on to the next generation. This makes studying such areas of psychology particularly tricky given that it is difficult to measure and obtain data across multiple generations. However, evolutionary psychologists tackle such obstacles via the use of *comparative studies* with closely related species, *anthropological approaches* that identify human behaviours that appear to be universal traits and by using *experimental and questionnaire studies* to examine the proximate mechanisms that might highlight specific cognitive biases or traits.

A common misconception is that we have evolved from apes and that we can see our ancestors around us on this planet. The error here is to ignore that during the thousands of years of human evolution these apes have also been changing and evolving. Evolution doesn't stand still. The way to think of this is that we have a common ancestor to these apes and so your great great (add a lot more greats here) nan was also the great great etc. nan to the chimpanzees in the zoo. They are your cousins, not your ancestors.

The evolution of hominids began around 2.5 million years ago. The origin of the **genus** is open to debate, but in general what we see is change in a number of key features. The interesting changes are an increase in overall size, greater emphasis on bipedalism (walking on two legs) and an increase in brain size. From around 1.5 million years ago, our ancestors had similar anatomical features to ourselves, although they had smaller brains. The later **species** in the hominid line portrayed increased brain size. *Homo sapiens* (that's us) are associated with language development, social organisation (culture) and sophisticated problem solving (tool use).

Genus A class, group or category that possesses common attributes. Our own species exists in the genus *Homo* alongside other species (all of which are now extinct).

Species A group that exists within a genus. Members of a species in the same or in different populations are able to interbreed under natural conditions to produce viable offspring. Species are defined by reproductive isolation. There is one hominid species which we all belong to called *Homo sapiens*.

1.3.2 Proximate and ultimate explanations

One issue that needs to be considered is the distinction between proximate and ultimate explanations for human behaviour. **Proximate** explanations describe the mechanisms involved in terms of how they contribute towards a specific behaviour that may benefit an individual and aid survival. However, **ultimate** explanations for human behaviour examine why a particular behaviour or trait can improve inclusive fitness and why a particular proximate behaviour can be favoured in evolutionary terms. For example, social reasoning, in terms of possessing the necessary cortical functions to understand the viewpoints of others, is a proximate explanation for a behaviour, while social reasoning as an aid towards cooperation and deception in order to maximise inclusive fitness is an ultimate explanation.

There are numerous hurdles that face evolutionary approaches; in particular, the complexity and diversity of human behaviour and whether any one behaviour can be studied in isolation to show that it provides an evolutionary advantage. Therefore, there is not one particular method that is appropriate for all questions that are posed. Comparative methods allow us to look at human behaviour within the context of other species, perhaps where the measurement of fitness outcomes and evolutionary benefits are clearer. For example, Hosken and Ward (2001) demonstrated that when there was increased competition for mates among male yellow dung flies, there was an evolutionary response whereby over subsequent generations there was an increase in testis size in response to sperm competition. Such studies would not be possible on animals with longer lifespans, but, via experiments on flies, they provided some of the first evidence that sperm competition not only has an effect on mating strategies but can result in traits (testis size) being inherited, increasing the chances of reproductive success.

Comparative methods also allow for comparisons among closely related species – for example, the primates – and allow us to see where in our evolutionary past there might have been a change in behaviour or cognitive ability. However, many approaches tend to focus primarily on the proximate mechanisms and how these might be beneficial to an individual and aid survival. For example, studies of Florida scrub-jays (Woolfenden, 1984) have provided plenty of evidence of the benefits of having close relatives assisting in the rearing of chicks to increase survival. However, there is debate as to whether this behaviour is an evolved trait or a response to environmental pressures.

Anthropological methods allow us to see how different populations have adjusted their behaviour in response to environmental pressures and how culture can provide an adaptive mechanism. Historical data also allow us to examine how certain traits and behaviours might improve inclusive fitness. Volland, Siegelkow and Engel (1991) showed that during the eighteenth and nineteenth centuries, farmers in Krummhörn, Germany, who were subject to limited resources and reduced reproductive opportunities, would invest less in sons, with the youngest son inheriting the farm. This was shown to be a beneficial strategy in that it secured the farming rights and wealth for future generations by delaying inheritance and reducing the potential for multiple heirs, thus improving the inclusive fitness of the family. Anthropological studies also provide a lot of evidence for traits that can be considered as human universals and, as such, might highlight behaviours that could have been considered adaptive in our evolutionary past.

1.3.3 Altruism and cooperation

As a species, humans are experts at cooperation and deception: we are equipped with the necessary cognitive skills to understand the belief and desires of others (see the discussion about theory of mind in Chapters 17 and 19), think prospectively about possible future outcomes and consequences, and also have the ability to draw upon previous experience to avoid repeating the same mistakes. However, these proximate explanations do not explain why, as a species, we exhibit such complex behaviours and how these traits can be adaptive.

One issue that is of interest to evolutionary psychologists is the problem of altruism (it is also of interest to social psychologists; see Chapter 16). **Altruism** can be defined as an act that benefits the recipient at a cost to the donor. In evolutionary terms, this can be a bit of an issue as a behaviour that is detrimental to an individual does not immediately appear to be an adaptive trait. However, when we look at such behaviours within the context of an individual's indirect fitness, we see that perhaps there are scenarios where apparent altruism can be an advantageous behaviour. Hamilton (1964) suggested that altruism that preferentially aids individuals that have more genes in common with the donor (i.e. genetic relatives or kin) can ensure that an individual's indirect fitness benefits, even if there is an apparent cost to an individual's direct fitness. Hamilton's rule suggests that if there is a high probability that the donor and recipient have genes in common, then the benefits can outweigh the cost to the donor. So, imagine that you are in a life and death scenario – are you more likely to save your siblings or a stranger? In most cases people will favour their relatives and this can be considered as kin selection (Maynard-Smith, 1964).

J.S. Haldane famously said 'I would lay down my life for two brothers or eight cousins' (Connolly & Martlew, 1999: 10). This remark refers to the calculation about how many of your genes continue to exist after you have died; as each sibling has 50% of your genes and each nephew has 25% and each first cousin has 12.5%, you can see how your genes can live on.

So what about the flipside of altruism and cooperative behaviour? Does it pay to punish another individual or to allow them to get away with a perceived transgression? One way to study this is to look at how punishing another individual could be detrimental directly or indirectly to an individual's inclusive fitness. The welfare trade-off ratio (WTR) indicates the extent to which an individual or group are willing to trade-off their own welfare against

another individual's or group's welfare (Petersen et al., 2010). At a more trivial level, this could involve low-cost actions such as perhaps letting someone go ahead of you in a queue or offering to pick up a neighbour's child from school so that they can work late. However, this model can be applied to more serious scenarios, such as seeking punishments for crime and even when people consider whether or not it is worth committing a crime.

Factors that need to be considered when looking at welfare trade-off ratios include the formidability, degree of relatedness and the mate value with the other party, as well as the impact an action will have on your own relatives, the resources gained, and the social status of the parties involved. Basically, there is a complex interaction between the potential gains and costs that result in either valuing another party or in perceiving a particular action as detrimental and worthy of punishment or reconciliation. Severe punishment would therefore indicate a low WTR as an individual would be placing little value on the other party involved. Of course, this term value does not have to be purely biologically-based. It can also refer to the value of cultural traditions between groups, where, for example, insulting another culture's belief system could indicate that one group is not perceived as being as valuable as another group. However, this does raise the issue of group selection and identity in that the cost and benefits to the group have to be considered as well (see Chapter 23 for more about the self and group identity).

EXERCISE

STOP THIEF! (OR NOT)

Consider the following scenario: you are in a restaurant having a meal and you have caught someone stealing a significant amount of money from your wallet (which will mean you cannot pay your bill). You have two choices: first, you could call the police and have them arrested; second, you could let the criminal go free. What decision would you make for the following criminals?

1. Your sibling (brother or sister)
2. A stranger
3. A very attractive member of the sex you are attracted to
4. A known member of a violent crime syndicate that will retaliate (i.e. a Berserker)
5. A homeless person who is likely to starve to death without the money

Arguably, your decisions might be influenced by your current financial status, how others see you, your marital status, whether you are seeking a mate, how aggressive the criminal or the degree of relatedness you have with the perpetrator. As such, you would be making a series of complex trade-offs between the costs and benefits of punitive action.

Watch this video to see a discussion of acting in one's best interests in the short term versus long term:

<http://sk.sagepub.com/video/roy-baumeister-defines-enlightened-self-interest>



Although many historical documents and fiction might not necessarily present an accurate interpretation of human behaviour, they can provide clear examples of how evolutionary principles can be attributed to specific behaviours or, at the very least, an example of how individuals construct their mental worlds. Indeed, if we look at the concept of murder and revenge, on the surface a maladaptive trait, we can see how in terms of inclusive fitness such behaviours could be tolerated. For example, the Icelandic Viking sagas highlight the impact of cost and kinship in relation to Viking Berserkers. Berserkers were fearsome individuals who were renowned for their ruthlessness on the battlefield. Within the Viking sagas, if a relative was murdered, the victim's family were entitled to either blood money or a revenge killing. However, if the murderer was known to have a Berserker in the family, there was a reduced chance of a revenge killing, therefore lessening the likelihood of further revenge killings (from an exceptionally brutal adversary). Similarly, murder could be a response to a multitude of issues, including trivial disagreements at a feast or in relation to the acquisition of land or resources. Vikings were also less likely to murder close kin over trivial disagreements and would only contemplate this if there were significant gains to be had (e.g. gaining land and resources). However, among non-relatives there was no such distinction (Dunbar, 1995). In many respects, the Viking sagas demonstrate a clear understanding of welfare trade-off ratios and how low WTRs can exist between certain groups based on formidableness, relatedness, social status and potential gains.

1.3.4 Kin selection and parental investment

Parental investment is necessary to rear offspring successfully, especially if an individual is to pass on the genes to subsequent generations. Several factors can influence the amount of parental investment that is provided. This can include paternity certainty, culture and environmental pressures. Frequency-dependent selection would suggest that parental investment might be preferentially attributed towards either sons or daughters, dependent on the balance of the sexes within the overall population, so if there was a lack of males in the population (perhaps due to war), then it would be expected that there might be a shift in the normal 50:50 sex ratio in humans, with preferential investment of sons over daughters in the subsequent generation. Similarly, with cultural influences where there is a societal structure whereby it is advantageous to marry daughters up the **social hierarchy**, then it would pay to invest more in the eldest daughter, perhaps at the expense of the sons and the younger daughters. These examples illustrate how the amount of parental investment can aid the prospect of future generations.

Paternity uncertainty can play a significant role in the amount of parental investment provided by fathers. Unlike mothers, there is no 100% guarantee (without a DNA test) that your father really is your father. This uncertainty is reflected in the amount of parental investment. With mothers giving birth and breast-feeding, there is little doubt about this genetic bond; however, the fathers are not so certain. This lack of certainty can be seen in a variety of different areas. For example, a study in 1996 by Euler and Weitzel showed that, among a German sample, the maternal grandmother and grandfather provided more care for their grandchildren than the paternal grandmother and grandfather. Taking into account the genetic distance in terms of kin, combined with paternity

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Professor Robin Dunbar is currently the director of the Social and Evolutionary Neuroscience Research Group at Oxford University. He has previously held chairs in Anthropology at University College London (1987–1994), and in Psychology and Biology at University of Liverpool (1994–2007). He is probably best known for his research into the cognitive limitations on human group size and, in particular, Dunbar's number (see main text). He has also researched social evolution in a range of mammals, including feral goats on the Isle of Rum and Gelada baboons in Ethiopia, and has been a prolific writer of popular science books. He was also co-director on the 'Lucy to Language: The Archaeology of the Social Brain' Centenary research project awarded by the British Academy.



uncertainty, it makes sense to allow the maternal side to contribute more to the rearing of grandchildren.

The role of the grandparent in childrearing has been shown to be particularly important in childrearing in the Gambia where, commonly, the grandmother from the maternal side provides extensive childrearing support (Sear, Mace, & McGregor, 2000). This improves the inclusive fitness of the grandmother by ensuring that her grandchildren get the best start in life. Also, it allows for the transmission of social knowledge and survival strategies to the grandchildren. If we look at the human lifespan in more detail, we notice that there is perhaps a good reason for this investment in grandchildren. Women, unlike men, undergo a menopause whereby they stop producing eggs and are then considered in biological terms as having low reproductive value. The human menopause is early compared to other species. For example, chimpanzees continue to have offspring for most of their natural life, and this suggests that it might have an evolutionary advantage in improving inclusive fitness. By living longer than their reproductive period, women are available to invest more in their children and their grandchildren. Within the environment of evolutionary adaptation, this would have enabled grandmothers to pass on vital knowledge for survival, help with the childcare and thus enable their offspring to have healthier and potentially more offspring.

So far this section has focused on positive aspects of childcare. However, Daly and Wilson (1988) showed that when looking at family homicide, the degree of relatedness is also an important factor as to whether a family member is killed. Their data suggest that

step-parents are more likely to kill their step-children than their biological children. This picks up on the issue of kin selection and the fact that the cost of murdering one's own offspring is detrimental to the individual's inclusive fitness. Similarly, romantic partners are more at risk of violence than genetic relatives. Arguably, such violence can be considered as being related to paternity certainty and mate guarding. In terms of a welfare trade-off ratio, we have all the key elements in place as the violence tends to be towards a physically weaker individual, not close relatives, and the consequences have little impact on the perpetrator's inclusive fitness. Of course, the extent of this crime is severe enough to be maladaptive in that the perpetrator will likely be punished by the social group and have reduced chances of reproductive success or aiding in the inclusive fitness of relatives.

1.4 WHY DID WE DEVELOP BIGGER BRAINS?

Compared to our closest living primate relatives, the chimpanzee, with whom we share approximately 97% of our genes, humans have significantly larger brains in proportion to our body size. If we look at changes in our brain size compared with ancestral humans

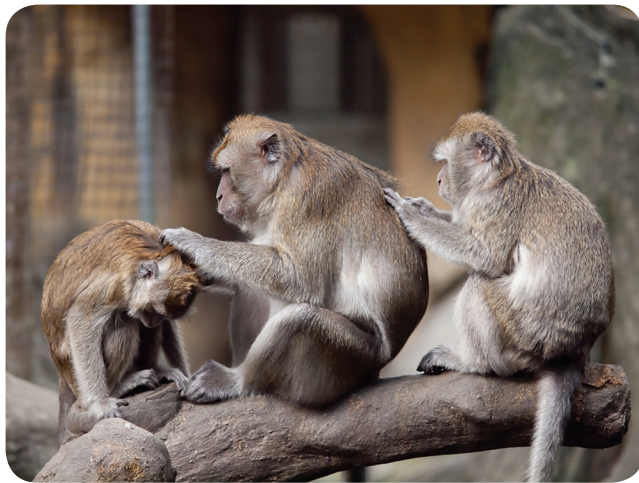


Figure 1.2 Macaques maintaining close contact through grooming

© Acon Cheng/Shutterstock.com

(since *Homo erectus*, who would have lived between 1.8 million and 140,000 years ago), we see that the size of the brain has increased from approximately 900 cubic centimetres in *Homo erectus* to 1,350 cubic centimetres in modern humans. In particular, the areas associated with the frontal lobe (see Chapter 10 for more information about brain structure) show an increase in volume. These brain areas are associated with problem solving and reasoning.

So why is it humans have evolved larger brains? The benefits of larger brains are that we are able to use more complex tools to solve problems, we have a greater ability to plan future actions, we can make indirect links between events (e.g. if we saw a footprint, we could make the link between it being caused by another animal

and even the direction the animal was walking). All of these are undoubtedly advantageous but do not answer why this change has occurred. In our ancestral past, there was an environmental pressure that must have favoured larger brains and made this an evolutionary advantageous trait. One key argument as to why we have evolved these larger brains is that they have enabled us to deal with increasingly complex social lives.

1.4.1 Social brain hypothesis

Why do humans have language? Undoubtedly, the ability to talk is an evolved trait, but to what extent does possessing a complex language system actually aid our survival and

inclusive fitness? Imagine you are a macaque and do not possess the complex vocalisations that are capable of expressing emotions (such as love and friendship) – how would you try to show another macaque that you care? Or that you would like to be friends with them? The chances are you would have to groom them (see Figure 1.2). Many primate species reinforce their social bonds by grooming each other; this is a very time-consuming activity as only one primate can be groomed at a time, but it can help to maintain strong social bonds within the group. Now consider the benefits of language: you can talk to more than one person at a time, thereby maintaining social bonds, and in far less time than it takes to groom each other's fur (if you have fur).

If you consider the use of vocalisations in other primate species, it is limited to a few key characteristic vocalisations that indicate food sources, submissive or dominance status, and predator detection. Despite a somewhat limited vocabulary, primates are capable of some complex signals. For example, Seyfarth and Cheney (1990) identified that Vervet monkeys use a variety of different signals as alarm calls, depending on the type of predator and response required. Vervet monkeys have characteristic alarm calls for leopards, snakes and birds of prey; each signal requires a different response, such as 'climb a tree' for ground predators or 'seek shelter' for aerial predators. One of the interesting aspects of this varied communication is that it is not in the individual's interest to make itself more conspicuous to danger but is actually a form of social communication to others (close kin and fellow group members). Zuberbühler (2002) and colleagues also noted that this sharing of social information is not species-specific; some species of primates that live in mixed species social groups will behave similarly to the Vervet monkeys when faced with a threat.

How does this link in with humans? If we consider how human language is used, it is not only for indicating food sources, danger, social status or mate selection. Language is essential in forming strong, long-lasting bonds with other people. A study of the topic of conversation in a university refectory showed that the main topics of conversation were what could be termed gossip, that is, the topic of conversation was not to do with imminent survival or work, but was related to more trivial topics, such as who did what last night in the pub. So what are the benefits of trivial conversation? One benefit is that it allows individuals to identify with other group members and form strong emotional bonds. It also allows for the detection of social cheats, it allows the development of cultural identity and it allows for indirect learning. Language becomes an essential tool in maintaining direct and indirect social bonds between group members, and in policing social groups. In order to process such complex social information, the human brain has to possess the appropriate hardware for the job. This is where the relative size of the neocortex (the outer layer of the brain associated with higher cognitive functions) in comparison to the rest of the brain (**neocortex ratio**) becomes an important factor.

Comparative studies of the neocortex ratio between primate species suggest that there is an association between neocortex ratio and social group size (Dunbar, 1998). This suggests that, as the average group size for a particular species increases, so does the associated neocortex ratio. By extrapolating the data from non-human primate species, and based on the human neocortex ratio, it can be predicted that the average human social group size should be approximately 150 individuals. This 150 has since become known as *Dunbar's number*, and subsequent analysis of human social networks suggest that this is a commonly occurring number in human social networks – for example, church congregations, Christmas card lists and hunter-gatherer communities.

ASIDE

WEARING THE MONKEY SUIT

When we look at an ape, are we misinterpreting what we see? Do we see an animal, or do we treat them as if they are a human in a hairy suit?

Anthropomorphism is the attribution of human characteristics to inanimate objects, animals, forces of nature, and others. When we say dogs are loyal or foxes are cunning, we are treating the animals as if they think and behave like humans. We often take this a step further and attribute human qualities to machines; for example, talking to your computer as if it is deliberately messing you about.

When we are anthropomorphic, we are assuming that the animals or machines have a theory of mind, that they know what they are doing, and they are also responding to us. There is usually a simpler explanation for their behaviour and they are not thinking or feeling in ways that we do. Sorry about that. (*This is a lie, they are!* – Ed.).



Figure 1.3 When we look at primates, do we see a person in a monkey suit?

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This theory allowed for the extrapolation of the findings to predict the social group sizes of early hominid species such as *Homo neanderthalis*, *Homo erectus*, *Homo habilis* and *Australopithecines*, based upon their estimated neocortex size (which can be obtained from fossil skulls). Again, using a comparative approach, Dunbar and colleagues looked at the amount of time that would be required for **social grooming**, be that via language or physical grooming. The results suggest that *Australopithecines*, an ancient hominid that lived approximately three million years ago, would have had a required grooming time below the limits of current living primates and monkeys. This indicates that these ancient hominids were probably relying on more direct approaches to grooming. It was not until the appearance of modern humans, approximately 500,000 years ago, that the grooming time required exceeded that of other living primates and therefore language became an essential grooming tool. This could suggest that it was not until the arrival of *Homo sapiens* that complex language was required to deal with the cognitive demands of larger societies and this in turn accelerated the need for a larger neocortex.

The social brain hypothesis (outlined above) is a compelling account of how brain size and social complexity evolved alongside each other. **Consciousness** (awareness of self and

others) gives us the ability to place our actions in a social and historical context. It is seen as assisting an individual in identifying group members, their motives and how best to operate within the social world of the group. In terms of human psychology, there is considerable interest in the nature of consciousness, particularly when applied to children or other individuals who demonstrate conscious states different from our own. This begins to lead us towards **theory of mind**, which explores how we develop an idea of another person's thoughts and feelings (see Chapter 17, and also Chapter 19, for a discussion about theory of mind hypotheses and autism).

Theory of mind The ability to attribute mental states such as beliefs, intentions and desires to yourself and others, and to understand that other people have beliefs, desires and intentions that are different from your own.

KEY STUDY



Gonçalves, B., Perra, N., & Vespignani, A. (2011). Modeling users' activity on Twitter networks: validation of Dunbar's number. *PLoS One*, online 3 August. DOI: 10.1371/journal.pone.0022656.

A challenge to Dunbar's calculations about human group size is posed by the social networks that people create online. For example, many people will have a list of friends in the thousands on facilities such as Facebook. These facilities allow us to be connected with an ever-increasing number of individuals, and a question arises about whether digital technologies are changing our social behaviour and our social environment.

It can be argued that microblogging facilities, such as Twitter, enhance the way we deal with social interactions and that this creates a new social environment in an online world, where the limits on human social interaction are changed and where Dunbar's number becomes obsolete. An opposing view is that these microblogging facilities merely speed up the interaction but do not change the structure. If this is the case, the basic limits to social interactions will not be any different in the digital world.

In this paper, the authors analysed over 380 million tweets, from which they were able to extract 25 million conversations. They used these data to create a pattern of social networks involving 1.7 million users. They argue that their data supports Dunbar's number in that users commonly have a maximum of between 100 and 200 stable relationships on Twitter.

Social grooming or allogrooming

A behaviour seen in many social species, including our own. It involves an individual or individuals assisting others to keep clean and in good condition. In addition to the obvious health benefits, the behaviour has also taken on a significant social function.

Consciousness

Often used in everyday speech to describe being awake or aware, in contrast to being asleep or in a coma. In psychology, the term has a more precise meaning concerning the way in which humans are mentally aware so that they distinguish clearly between themselves and all other things and events.

1.5 OTHER INFLUENCES ON CHANGE

1.5.1 Culture

A criticism that is often used against evolutionary approaches in psychology is the issue of culture, and to what extent it can be explained in terms of our cognitive hardware (brains) and genetic factors. There is little doubt that humans are a cultural species and, as such, any attempt to examine human behaviour would be incomplete without acknowledging this. Despite this, it can be a difficult topic to study given that culture is a term that is used frequently in a wide range of contexts and with different meanings. There are three key questions that need to be considered prior to discussing culture from an evolutionary perspective.

1. What is the working definition of culture?
2. What are the units of culture, how are these transmitted and how do they evolve?
3. What is the relationship between biological evolution (genes) and cultural evolution?

The term *culture* can have many different connotations depending on the context within which it is studied. For many, culture is something aspirational and demonstrates a sophisticated level of understanding, mortality and appreciation of the world. For others, it is a shared set of values and beliefs within a society, or it could be considered as a behavioural variation that is passed down across generations via social learning. In terms of an evolutionary approach to studying culture, a good definition would be that ‘culture is information that is acquired from other individuals via social transmission mechanisms such as imitation, teaching or language’ (Mesoudi, 2011: 2–3). This definition highlights the social aspect of culture and distinguishes it from simply being an extension of our phenotype (i.e. a typical behaviour), acknowledging that culture is very much a social construct. One characteristic of culture is that it changes during transmission and these changes can be very rapid and viral in nature.

1.5.2 Memes

Dawkins (1989) proposed that culture can be examined in terms of selection pressures by adopting the term *meme* to describe units of thought or culture that are then replicated in the brain. If culture is considered in terms of memes, then these units can be replicated; there can be variation and mutations in this memetic information, and more memes will exist than can successfully replicate as a consequence of environmental and competing social pressures. So what exactly is a meme? A meme can be anything from a single idea/thought to a specific ritual or way of preparing food. As such, a meme is a very flexible cultural unit in terms of what it actually encompasses. However, unlike genes, cultural transmission is not exclusively from parent to offspring, but also occurs horizontally via peers and social groups.

Susan Blackmore (1999) suggests that, in our evolutionary past, the increase in human brain size (neocortex ratio) can be accounted for by memetics. So, for example, once our ancestors had started to imitate behaviours, memes could be transmitted between individuals, and those individuals who were able to adopt specific memes that aided survival (perhaps the meme for fashioning stone tools from flint) would have had a greater chance

of survival and greater reproductive success. Therefore, having the associated cognitive hardware to replicate memes and imitate behaviour would have been advantageous and provided behavioural flexibility, making those individuals thrive.

Similar to Dunbar's (1998) social brain hypothesis, the human cognitive system has evolved to deal with complex social information, but it is the ability to imitate cultural elements (which arguably could require gossip as a key transmission mechanism) that is driving reproductive success and therefore creating a strong meme–gene interaction. So, although the actual meme might not be an evolved trait, the ability to propagate culture and imitate can be seen as an adaptive trait. However, as Dawkins (1989) points out, it is important to note that some memes can actually be detrimental to an individual's fitness, for example, some religious practices that involve chastity or abstinence. However, the benefits of the associated hardware (big brains) outweigh the costs of these anomalies in terms of the overall inclusive fitness of the gene pool at large.

Although the memetic approach to culture can provide a mechanism for understanding how the brain acts as a meme replication machine, allowing for cultural transmission, Boyd and Richerson (2005) provide a useful framework for examining how biologically-based mechanisms and the cultural ideas can both be seen as adaptive traits. According to the dual-inheritance model, culture is inherited in parallel with genetic inheritance. This frees up the concept that human evolution is solely the product of genetic change. In this model, there is an evolved social learning mechanism that will have developed as a result of natural selection, whereby it is beneficial to use a low-cost learning strategy such as imitation (rather than learning by individual trial and error).

There is also the cultural evolution process which is not genetically-based but follows the methods of transmission outlined earlier (horizontal and vertical). However, we now have to consider what affects the replication of specific behaviours. Two key biases are conformist bias and prestige bias, both of which provide a simple, low-cost heuristic (rule of thumb) for adopting specific cultural traits. *Conformist bias*, whereby the most common behaviour within a group is imitated, results in the adoption of a particular behaviour or cultural trait based on the heuristic that an action can be perceived as advantageous if the majority of people use it. *Prestige bias* shifts the focus away from conforming with the group towards the characteristics of a particular person carrying out the behaviour, whereby if an individual appears to be successful (e.g. they might be wealthy, have many mates), then the way these individuals are acting could contribute to their perceived prestige.

So far, the relationship between genetics and culture has been unidirectional, in that the cognitive hardware is selected and this allows for the epiphenomenon of culture to evolve. However, when looking at the adaptive properties of cultural activities, it is clear that culture can influence our genetic evolution too. So many cultural practices, such as cooking, using tools and wearing clothes, can be seen as practices that, once adopted by the group, can change our environment or the extent to which the environment impacts upon our lives. This in turn is changing our resource requirements and the environmental pressures that natural selection acts upon, and therefore can impact on our phenotype.

Henrich and McElreath (2009) provide a nice example that summarises this. At some point in our ancestral past, the practice of cooking meat would have spread by social learning. This trait in itself is adaptive as it makes food easier to chew, easier to digest and kills harmful parasites. Over subsequent generations, the requirements for large teeth and large intestines to break down the food are no longer needed or favoured by natural selection,

freeing up energy that can be used to develop larger brains. In this way, a cultural practice has modified the biology of the organism, and therefore the cultural evolution and natural selection are working reflexively with each other in changing the human phenotype.

Finally, it is important to note that not all cultural traits are adaptive. Examples of maladaptive cultural practices abound, and again many of these maladaptive traits can be acquired via inappropriate adoption of a conformist or prestige bias.

1.5.3 Epigenetics

Over the past few decades, there has been a wealth of studies looking at identical twins and to what extent certain traits (ranging from depression to vulnerability to diseases) are inherited due to shared genes. However, more recently it has been acknowledged that the old-fashioned view of one gene coding for one protein is actually wrong. One gene can account for several proteins and, as such, it becomes increasingly difficult to suggest that there are specific genes for specific traits. However, perhaps due to selective reporting, there has been an emphasis on the similarities between identical twins in terms of behaviour, personality and psychiatric disorders. What is often neglected is why in identical twins, who by definition should have identical sets of genes, there are so many differences. One argument is that this is due to the environment and that not all traits are inherited; some are acquired via experience. However, this does not explain why certain traits then appear to be inherited in later generations. Traditional gene–behaviour arguments would suggest that life experience cannot be inherited. Another argument is that some of these differences are **epigenetic**.

The epigenetic argument suggests that genes can be effectively switched off by a process called methylation. So, for example, let us say there is a set of identical twins where both individuals share a gene that is associated with happiness, yet only one of the twins actually exhibits the trait (i.e. is happy). The relevant gene in one of the twins could have been ‘switched off’ so they do not show the happy trait. This could be the result of methylation of the associated gene due to some life experience (e.g. a traumatic childhood accident).

EXERCISE

WHAT INFLUENCES YOUR ADOPTION OF CULTURAL PRACTICES?

Consider the following cultural traits and decide whether your adoption of these traits is due to a conformist bias or prestige bias and whether or not they are adaptive or maladaptive (or perhaps neither adaptive nor maladaptive). Just to make you feel better, we will give you an example of a prestige bias in the 1970s, when there was a trend for wearing ridiculously high platform boots. Many celebrities and pop acts of the time wore them and, as such, there was prestige associated with them, with

many people consequently adopting the trend (including one of the editors, ahem, PB), despite this being a maladaptive trait – as wearing these skyscraper heels increased the risk of falling over, vertigo and hitting your head on low doors.

So, looking at the list below, are you showing a conformist or a prestige bias when you make the following decisions?

1. Your choice of clothes to wear in the morning
2. Whether you choose to drink alcohol or not
3. Your choice of food in the evening
4. The music you listen to
5. Your religious beliefs

What is interesting is that for a few generations this trait might be passed on in its shut-down form to offspring. Therefore, the happy twin will have happy children and the traumatised twin will have less happy children. If we revisit the yellow dung fly from the earlier example, it could be argued that perhaps the increase in testes size across the generations is an epigenetic response. In other words, the environment has had an effect on gene expression that is inherited. This does not mean the fly has lost the gene for normal-sized testes, but simply that it has been switched off in response to environmental pressures.

Epigenetics The study of heritable changes in gene expression that occur without changes to the genotype (DNA). So, traits (these can be physical and/or behavioural) that are inherited via epigenetics are not due to changes in the gene combinations, but are due to changes in whether a gene is actively expressed or not.

In evolutionary terms, epigenetic traits are of particular interest as they highlight how some traits can be temporarily passed on without an actual change in genes. Therefore, there has not been an evolutionary change in response to the environment as there is no mutation or change in genetic material across the generations, but instead some genes might not be expressed.

1.6 CHAPTER SUMMARY

We have seen how the development of science enabled people to explain the world around them, drawing upon empirical data. This allowed them to challenge superstitious beliefs with evidence gained from the natural sciences. Psychology has, at its heart, a commitment to empiricism. It also draws significantly from the sister biological disciplines of palaeo-anthropology, neo-Darwinian evolutionary theory and behavioural genetics. The story of human evolution is the story of how our brain and our psychology have evolved alongside each other. Communication, problem solving and tool making are key abilities within our species. Evolutionary psychology can provide a framework for understanding why certain human behaviours have become widespread, and how our cognitive hardware has evolved in response to our physical environment, limited resources and social environment.



WHAT DO PSYCHOLOGISTS DO?

Evolutionary psychologists are interested in the biological and cognitive evolutionary explanation of human behaviour. While much of this research is conducted on humans, they will often take a comparative approach and look at how human behaviour differs from our closest non-human primate relatives. This can involve field research and observing primate behaviour in the wild. For example, for many decades Jane Goodall has observed the behaviour of chimpanzees, our closest relative in evolutionary terms, at the Gombe Nature Reserve in Tanzania. Her research has provided us with valuable insights in their tool use, family life and social behaviour, much of which has changed what behaviours we see as exclusively human and has led to the development of a clearer understanding of observational methods within comparative studies.



CRITICAL EVALUATION

A major challenge for evolutionary psychologists is that it is difficult to find evidence within the fossil record or archaeological digs to justify some of the claims that psychological traits have been inherited and evolved over time as universally human traits. Therefore, the area can be subject to ethnocentric biases (much of the research is conducted by researchers in the US and Europe) and perhaps over-generalises some proposed universal traits, in particular in relation to areas such as mate choice. When researching, we have to acknowledge our own potential cultural biases in what we value as important, for example, is kinship really about genetic relatedness or is it about marital status or social rankings or social proximity. There can also be an over-reliance on behaviours being solely linked to reproductive success. Currently, with over seven billion people on the planet, we can be confident that somewhere our genetic code is represented within the human gene pool and therefore perhaps the genetic imperative to reproduce is not as strong. Perhaps the evolution of human culture is more important than the traditional biological benchmarks of reproduction and maybe we have largely broken free of our selfish genes.

You may also want to watch the following video:

Leda Cosmides discusses evolutionary psychology and how it relates to psychology in general <http://sk.sagepub.com/video/evolutionary-psychology>



DISCUSSION QUESTIONS



Can you think of examples of our own, contemporary behaviour that may be explained from an evolutionary point of view? To help, think of what men tend to look for in their partners if they are attracted to the opposite sex, and contrast this with the signals women use to select men. To what extent do both sexes rate features in the same way? If not much, is this a case of different natural selection pressures applying to the sexes in making a mate choice?

SUGGESTIONS FOR FURTHER READING



Buss, D. (2008). *Evolutionary psychology: the new science of the mind* (3rd edn). Harlow: Pearson Higher Education.

David Buss is one of the key people in the field of evolutionary psychology. The book is written in a style that engages you to consider the argument as an active reader. You are not told what to think but are invited to apply what you are reading to a range of questions that arise from the work he covers.

Dawkins, R. (1989). *The selfish gene* (3rd edn). Oxford: Oxford University Press.

The modern evolutionary approach continues to have a significant impact on how behavioural scientists, including psychologists, think about the function and maintenance of behaviour. This is a classic and very readable text that helped promote the importance of neo-Darwinian thinking in relation to behaviour.

www.apa.org/science/genetics/.

If you are interested in exploring further the relationship between genetics and behaviour, we recommend you visit the very helpful website hosted by the American Psychological Association.

Still want more? For links to online resources relevant to this chapter and a quiz to test your understanding, visit the companion website at <http://study.sagepub.com/banyard3e>

