HUMAN AFFAIRS *15*, 116–131, 2005

SOCIOLOGY AND MODERN EVOLUTIONARY THEORY

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The current attitude of sociology to evolutionary theory is biophobic. It was not always so in the history of sociology. The founders of sociology were inspired by the theory of evolution in biology. The best known example is probably Herbert Spencer. We think that in contrast to the understanding of evolution in the past, it is chiefly the molecular-genetic dimension of modern theory of evolution that disturbs contemporary researchers, who regard it as an unacceptable form of reductionism leading to dangerous socio-political consequences. However, in our opinion, it is detrimental to the social sciences, and sociology in particular, that these researchers are not able to accept new inspirations from sociobiology and evolutionary psychology, as represented today by modern evolutionary theory applied in the area of social behaviour. We use Trivers theory of reciprocal altruism between genetically unrelated individuals as an example of an inspirational source that leads to a more universal understanding of human cooperative behaviour than exists today within the framework of social sciences.

Contemporary sociologists react with a certain amount of scepticism, even aversion, to the prospect of applying modern evolutionary theory to their discipline. Solitary voices of warning from sociologists who declare that this is a suicidal attitude go unheard (Lopreato, Crippen 1999). These voices state that in contrast to anthropology and psychology, sociology is at the moment unable to incorporate evolutionary biology and, therefore, these sciences (with a considerable contribution from political science) will absorb sociology in the future. Joseph Lopreato and Timothy Crippen begin their book *Crisis in Sociology: The Need for Darwin* as follows:

> We are proud but concerned sociologists. We worry lest in the near future the current course of sociology will lead to academic self-destruction. We trust, therefore, that our readers will be influenced less by our discipline and more by our sincere, enthusiastic attempt to suggest a way out of what is by many accounts a very grave and deepening crisis (Lopreato, Crippen 1999, xi).

American sociologist Lee Ellis (1996) finds several causes for the phenomenon called the biophobia of social scientists. The term "sociological biophobia" was coined by Canadian evolutionary psychologists in their ground-breaking book "Homicide" (Daly, Wilson 1988, 152) to show sociologists' tendency not to regard

biological factors as important for explaining human social behaviour. According to Ellis, biophobia is one of several reasons for the decline of sociology as an academic subject in the USA. He argues that from 1960 onwards, the number of university students increased threefold, but the number of students studying sociology decreased by one half during the same period. (We should, however, point out that according to the President of the American Sociological Association, Maureen Hallinan, we should look for the real cause in the changes occurring within the academic job market). Ellis thinks that it is the conceptual sterility of sociology, a consequence of biophobia that is responsible for the decline of sociology at American Universities. He identifies four causes for this biophobia: in semantics, education, the narrowing of the subjects within the scientific discipline, and for moral and political reasons.

Similar voices can also be heard amongst sociologists on the other side of the Atlantic. German sociologist Frank Salter from the Max Planck Institute for Human Ethology confirms the existence of a universal biophobia in sociology. For instance, he points out that in the Concise Oxford Dictionary of Sociology (1994), prepared by scientists from the University of Essex, there is no entry on behavioural genetics (Holden 1996).

The main thesis of this paper is to show that sociological thought can only benefit from being enriched with the evolutionary perspective, as it is articulated by the modern theory of evolution. We shall use an example of an important social phenomenon: cooperative behaviour among unrelated individuals. The perspective introduced into this debate by modern evolutionary biology, which is represented today by sociobiology and evolutionary psychology leads to a much broader understanding of cooperation among individuals: it goes beyond the limits of the conscious behaviour of the species *Homo sapiens* and points to some universal and systemic laws common to all living beings that fulfil certain conditions.

It is not the idea of evolution itself that is rejected by sociology. Quite the reverse—the concept of evolution was one of the great sources of inspiration in laying the foundations for the sociological thought found in the work of A. Comte, H. Spencer, E. Durkheim or K. Marx. The idea of the evolution of social communities had an immense bearing on theorists, such as J. Schumpeter, T. Parson, J. Habermas or A. Giddens (Wallace, Wolf 1999, 154-186) and of course, on many other sociologists.

How can we explain then the substantial difference in the attitude of sociology to evolutionary theory both at its inception and today? Have sociology and evolutionary biology changed so much during the past decades that they are now completely incompatible? Is the source of this incompatibility a certain deficit on the side of sociology or on the side of biology? And how can we explain the extraordinary paradox that while on the one hand, sociology accepts the idea of evolution on the other hand, it vehemently rejects it in its most scientifically rich version—in the form of neo-Darwinism?

Although I do not wish to deny the enormous development that both sociology and biology have made over the past hundred years, I do not think that this is the cause of the afore-mentioned paradox and current incompatibility, even animosity, of both these scientific disciplines.

In this context, we should bear in mind that the attitude of sociology to biology is nothing exceptional—quite the reverse: it fits into the general "biophobic" trend of the social sciences and humanities, which is dominated by the paradigm of social/cultural constructivism and its associated rejection of the concept of human nature. To put this in a nutshell:

> The social sciences have sought to explain all customs and social arrangements as a product of the socialization of children by the surrounding culture: a system of words, images, stereotypes, role models, and contingencies of reward and punishment. A long and growing list of concepts that would seem natural to the human way of thinking (emotions, kinship, the sexes, illness, nature, the world) are now said to have been "invented" or "socially constructed" (Pinker 2002, 6).

The evolutionary psychologist S. Pinker calls this dominant paradigm of social sciences the model of the *blank slate* (the English equivalent of Locke's *tabula rasa*). This does not mean that social scientists deny that all humans share a certain common biological basis rather they regard it as irrelevant to answering the questions that the scientists raise. By contrast, sociobiologists and evolutionary psychologists think that this universal biological basis is not only relevant to the analysis of human social behaviour but it also brings the possibility of a wider perspective for the social sciences and humanities without which the understanding of several crucial social phenomena is incomplete, even incorrect.

Evolution in the broader and in the narrower sense of the term

There seems to be a difference in the way in which sociologists and biologists talk about evolution and evolutionary theory. Little emphasis, if any, is put on the fact that the term "evolution" has two meanings: the first is general and denotes the development of anything; while the second is more specific and denotes only biological evolution. When referring to evolution in the general sense, scientists are concerned with phenomena such as the evolution of chemical elements, the atmosphere, stars, planetary systems, galaxies, or indeed the whole universe. Research in the social sciences and humanities refers to cultural evolution, the evolution of modern cities, the evolution of technological inventions (of cars, planes, etc.), the evolution of the military, etc. In all these cases it is evolution in terms of the slow gradual transformation of an entity or structure that is under consideration.

Biologists would not use the term evolution in this way. They prefer to speak of ontogenesis, which means the development of an individual organism in

contrast to evolution—phylogenesis—the development and history of organisms on our planet.

Moreover, the term evolution as used in the general sense easily leads to the mistaken idea that a universal evolutionary process exists with its own universal laws, which are equally valid for the evolution of stars, organisms, and cultures. This is how Herbert Spencer, for instance, thought about evolution. We should in fact be grateful to him for the current most common use of the word evolution, which denotes a process of gradual development, a process of slow change (in contrast to the word revolution). What is piquant about the use of the word evolution is that none of the great nineteenth-century evolutionists used this word. Darwin spoke of "descent with modification", Lamarck of "transformism" while Haeckel calls his theory of evolution "Descendenz-Theorie" (Gould 1977).

Biologists began to use the word evolution long before the emergence of the theory of evolution but its meaning was different. As early as 1744, the term evolution was first used simply to indicate the development of an individual organism in embryology. At that time, the field of embryology was dominated by performist theory, which held that individual development (for instance that of a human individual) is simply the slow growth of a fully-formed miniature human (homunculus). The Latin meaning of the word evolution was particularly suitable for denoting this conception—the Latin word *evolvere* literally means to roll out, e.g. a parchment roll. However, Spencer used the word evolution (*First Principles,* 1862) to denote the process of the gradual transformation of a structure from a simple to a more complex form. He was able to do so for two reasons—firstly, the performist meaning of the term evolution was, at the time he was working in embryology, already redundant; and secondly, he could turn to the English concept, which meant gradual development and still had currency.

In this respect, we sometimes come across the opinion that H. Spencer was actually the first to introduce both the term evolution, as well as the concept of natural selection before Charles Darwin did. If we simply referred to the published editions of his work, this would seem a logical conclusion. In 1840, H. Spencer read the groundbreaking work by the geologist Charles Lyell 'Principles of Geology' (1830-33), which discusses Lamarck's theory of evolution. In 1852, Spencer published his work *A Theory of Population Deduced from the General Law of Animal Fertility,* introducing the famous phrase "the survival of the fittest". Darwin borrowed the phrase from him in the fifth revised edition of his *The Origin of Species* to better elucidate the process of natural selection. Spencer thus published the idea of evolution as early as in 1852. Thus it really seems as if it was at least seven years before Darwin's book on the theory of evolution was published in 1859. We know, however, that Darwin's idea of evolution by natural selection dates back to 1837. In 1842 he wrote a short, though unpublished, outline of his theory of evolution (32 pages). He expanded it to a voluminous work, which was published as late as fifteen years later (for more about the origin of the concept of natural selection, see Sýkora 1989, 262-270).

In contrast to Darwin, contemporary biologists rarely refer to H. Spencer in their work on evolution. If he is mentioned at all, then it is only as a museum piece; and moreover, negatively evaluated—as originator of the controversial concept of "social Darwinism" (although Darwin himself was not an advocate of the term). Herbert Spencer mentioned this theory before Darwin did and we can therefore agree with those who propose that social Darwinism should rather be called "social Spencerism".

If we refer to the currently generally accepted theory of evolution as a modern theory, it does not mean that it is a recently discovered theory of evolution. In fact, the theory was formulated in the 1930s and 1940s by three researchers: by Ronald A. Fisher (1890-1962), John B.S. Haldane (1892-1964) and Sewall Wright (1889-1988). At the time of its discovery, the theory of evolution was denoted as "modern synthesis" or "evolutionary synthesis" or, simply "neo-Darwinism".

With regard to the ever-accelerating development of biology in the twentieth century, the question arises as to whether "modern synthesis" is still modern. Surprisingly, if we consider the development of biology in the second half of the 20th century, this theory of evolution is not only still topical in biology but is also still the only scientifically relevant theory of the evolution of life.

It is necessary to emphasise that there is no universal theory of evolution in natural history (as Hegel, Marx, Spencer, or Teilhard de Chardin dreamt of) but that there are only partial evolutionary theories applicable to certain domains of reality (astrophysics, climatology, geology, biology). These theories have nothing in common except name. Of course,, there have also been more current attempts to create mathematical evolutionary models explaining the evolution of both social systems and organisms. We should, however, point out that no attempt to create such a model has been successful so far, and perhaps we should question whether there is any sense in trying to achieve something along these lines. Is not the search for such a "holy grail of evolution" an effort to establish a new metanarrative which, together with other modern metanarratives, belongs to the last and penultimate centuries? Should we not rather accept the status quo, in which several theories of evolution are valid alongside each other, each within the limits of its domain of reality? Many researchers in the humanities see the attempts of sociobiology and evolutionary psychology as "the colonization of sociology", or as "biological imperialism".

Modern theory of evolution (neo-Darwinism)

Where sociologists have let themselves be inspired by the concept of evolution, the result has almost always been (possibly with the unlucky exception of social Darwinism), the application of the theory of evolution at the macrosociological level in terms of structural transformism. Sociobiologists and evolutionary

psychologists are concerned with the application of the theory of evolution in a narrower sense of the term, mainly at the level of microsociological theories. Of course, the placing of the neo-Darwinist perspective within microsociological theories cannot occur without a considerable revision of the socio-constructivist paradigm.

We shall be best placed to understand the essence of neo-Darwinism when we understand why it is that biologists speak of it as synthesis. Not many contemporary biologists realize that the linking of of natural selection with genetics in the modern theory of evolution did not occur simply as a matter of course. It was hard work arriving at both the main conceptual synthesis of the most important of Darwin's concepts, that of natural selection, and the central concept of Mendel's genetics, the gene. Inheritance was the Achilles' heel of Darwinism from its very inception. Darwin's theory of heredity was based, wrongly, on the idea of combining the genetic material of both parents in successive generations. However, this inheritance was not in accordance with the principles of his evolution mechanism. His contemporary critics were right when they objected that as long as the hereditary traits from parents combine, then evolution is impossible because the advantageous evolutionary traits gradually disappear until they become extinct. Darwinism requires quite the opposite—the gradual growth of hereditary traits appropriate to evolution.

Today we know that the key to solving this problem lay in Mendel's hands but at the time his theory was not understood by his contemporary researchers. Paradoxically enough, when Mendel's genetics was re-discovered at the beginning of the twentieth century, it was understood to be a new counter-argument against Darwinism. Contemporary leading geneticists thought that the existence of genes hindered the likelihood of there being a continual variability of traits within the population, without which natural selection is unthinkable. These researchers did not deny the existence of evolution but they thought that new species arose through mutations rather than natural selection (Futuyama 1986, 9-12).

The three authors of "big synthesis", mentioned above, Fisher-Haldane-Wright were able to conceptually place genetics and Darwinism into one frame and to demonstrate with the use of mathematical models the way in which mutations and natural selection are in fact complementary. The key concept was that of the gene pool, which is a virtual pool of genes created by the sum of all the genes carried by all the individuals belonging to a particular species. Each biological species forms a specific megapopulation of organisms which is isolated from other megapopulations. As a result of chance mutations, new variants arise from a single genetic variation. This is the first step in the evolution mechanism.

The second step is the influence of natural selection. As long as a particular genetic variation contributes in some way to the fact that the organism in which the genome is found has more offspring in its final stages than an organism with a different genetic variation, then the frequency with which this alternative occurs

in the gene pool increases from generation to generation. In the extreme case, the most successful variation can "push out" all the other variations from the gene pool and thus become the only variation. What is more commonly found in nature, is a situation where genetic variations are represented in different ratios (so-called genetic polymorphism). As a result of natural selection (a fusion of populations or a sudden decrease in the size of population can also be attributed), systematic changes take place from generation to generation leading to a relative abundance of various genetic variations (mathematical models can be used to predict which ones exactly). New biological species are formed once a certain number of changes have been exceeded and a new megapopulation or new gene pool is formed.

Unselfish behaviour—the greatest paradox of Darwinism

At first sight, there is no difference between Darwin's theory of evolution and neo-Darwinism: the classical theory is concerned with more or less successful organisms; while neo-Darwinism talks about more or less successful genetic variations. A change in the number of offspring will be reflected in a change in the number of genes in the gene pool; so it is as if the new theory simply focuses on a different stage or level of what is essentially an account of the same process. However, there is a difference, which immediately becomes clear once we start looking for the answer to the question: what is the point of evolution, what causes it and what is the result? The consequences of changing the stage which is described—from that of organism to gene—are enormous, if not immediately evident. It took almost another thirty years for researchers to realize the significance of the description of the genetic stage.

First of all, it helped throw light on probably the greatest paradox of classical Darwinism—the existence of sterile castes of social insects. Some members, e.g. (worker) bees may give up their own reproduction in favour of their mother—the queen bee. However, classical Darwinism is unable to explain the existence of such self-sacrifice in this salient case of altruistic behaviour.

Let us mention here, in brief, that this paradox can be elegantly explained by *the theory of kin selection*, where natural selection takes place not among organisms but among genes and/or different genetic variations in the gene pool.

It is important to realize that there is a strong probability that a certain genetic variation occurs in our relatives—the closer they are to us genetically, the higher the probability. From the point of view of evolution, relationships within the extended family (grandparents, parents, children, siblings, grandchildren, uncles, aunts, cousins, nieces, nephews) are also relevant. If under certain circumstances the number of the relatives' offspring is so great that the contribution to the gene pool of a particular shared genetic variation is higher than that contributed to the gene pool by our offspring, then from the point of view of the gene, altruistic

behaviour is more advantageous, since it supports the reproduction not of our own offspring, but of the offspring of our relatives. This is the quintessence of Hamilton's rule (for details, see Sýkora 1999).

Within the theory of neo-Darwinism, the significance of the paradigmatic shift from organisms and genotypes to genes in the gene pool lay unappreciated for decades, until the beginning of the 1970s. Natural selection is in fact applied to organisms and thus also to genes this mediated selection occurs for the simple reason that it is only the gene, thanks to its stability, (which is far greater than the stability of the organism, genotype, or even chromosome), that may become the target of the long-term process of evolution . This is the main reason why it is the genes that are most important for evolution. R. Dawkins called this relevance, unluckily enough, as was shown later, the selfish gene. In fact, his metaphor does not concern either selfishness or the gene (Sýkora 2003b).

Selfishness is a metaphorical way of expressing the mere biological facticity that a gene exists as a segment of genetic information in order that a successful copy of this information can be produced. The stability of the gene does not result from the stability of the nucleic acid (which is merely a material carrier of genetic information but not this information!) but because it is able to increase the number of copies (as pieces of information) in both time and space. Unless new copies of the gene are formed, the genetic information disappears with the death of organism. For this simple reason, everything that is connected with the existence of certain genetic information has to lead to the sole aim of preventing the loss of the gene from the gene pool. The gene is either selfish or it simply does not exist. If a certain genetic variation resulted in the fact that other variants of the genes were copied more, then these other variations would exist. The argument that a gene is by nature selfish has the character of analytical judgement—the concept of the gene itself contains the concept of selfishness.

This does not mean, however, that the only way in which a gene can introduce as many copies into the gene pool as possible is by prompting the organism to act selfishly. The selfish behaviour of an organism is only one of many possible alternatives. Selfish behaviour can even be counter-productive under certain ecological conditions and ensuring the altruistic behaviour of an organism is a much more advantageous strategy for the selfish gene.

An example of such a condition is a situation in which it is better in the case of an organism that does not have its own offspring for the gene to support the behaviour of the organism so that it prefers to support its close relatives in order that they have as many offspring as possible.

The theory of kin selection elucidates such a situation where altruistic behaviour is oriented towards the closest relatives. Social scientists argue, and their objections are justified, that the theory is unable to account for behaviour which is the quintessence of human societies—the phenomenon of altruism and cooperation between unrelated individuals. Therefore, this naturally leads to the conclusion that

the theory of evolution based on the concept of genetically determined behaviour is unable to explain interaction between unrelated individuals, which is essential for sociologists. Does this mean that biology cannot explain this any further and that the space should therefore be opened up to traditional explanations, such as the process of socialization, the influence of culture, the existence of moral norms and noble spiritual ideals?

The problem is that there are fascinating examples of cooperation and altruistic behaviour among unrelated individuals, even amongst distant biological species in nature, and therefore outside the sphere of human culture. In the early 1970s Robert Trivers introduced *the theory of reciprocal altruism* (1971). Trivers observed that unselfish animal behaviour is dependent on *cooperation*. If we can understand under which conditions a regime of cooperation can be formed during the process of evolution, we shall also find the key to understanding the biological foundations for human cooperative behaviour.

According to Trivers, the universal principle of cooperative behaviour between organisms is that of the reciprocity of receiving and giving "you scratch my back (when I can't scratch it myself) and I'll scratch yours". Reciprocal help occurs for the simple reason that both would be much worse off without the help of the other. Therefore, from the point of view of each side it is more reasonable to choose cooperation. But it is not that simple because we can hardly expect rational choice to occur amongst biological species other than Homo sapiens. Rational choice is a concept that has been firmly established in sociology for decades. Rational choice theory, as it is advocated by sociologists, along with economists, anthropologists, political scientists and psychologists assumes that decisions are made by rational human beings, who choose to behave in a way which they regard as the most effective and that will help them achieve their goals. This assumes that the process of weighing up the alternatives is a rational one, however, we clearly cannot rely on this being the case for species other than human beings.

Rational choice theories entered sociology within the framework of social exchange theory, which represents "one of the most significant and essential paradigms of current sociology" (Maříková, Petrusek, Vodáková 2000, 92). According to this theory, the exchange of various types of human social activity is the core of all social relations. Although the basic model of rational choice was implicitly present in the thought of nineteenth-century economists (Adam Smith) and philosophers (utilitarians), it entered sociology mainly through anthropology (gift theory). The roots of philosophical and political contemplation on the tension between selfish and cooperative behaviour reach much farther—to the concept of the social contract as presented by T. Hobbes and J.J. Rousseau. In all these concepts, humans beings represent both the starting point and the aim of all contemplation on cooperation—humans with their specific ability to project the future, consider the consequences of their actions, and how others might respond to them in turn. For Anthony Giddens, the uniqueness of sociology lies in the fact that

it studies social life as a meaningful activity for humans—in contrast to animals, people not only realize what they do, but it is also possible to establish the particular aims that lie behind their every action. According to sociologists, the study of human behaviour therefore differs considerably from the study of natural science. Thus, it cannot easily be fitted into the scheme of natural sciences (Giddens 1999, 27). Reason, mind, consciousness therefore become crucial social factors (as the title of the journal Rationality and Society suggests).

I will now give some examples of cooperation—between humans, chimpanzees, and bats to demonstrate certain universal rules of reciprocal altruism, which can be seen as a kind of "social" glue.

Unofficial agreement in the First World War trenches

During the First World War, a system of reciprocal tolerance was formed between the enemy sides fighting in the trenches. Soldiers stopped shooting at one another and if they had to, they fired into the air. There was an unofficial agreement not to use guns at certain times of the day. Shooting on both sides had a strictly ritual character. For instance, the use of artillery was predictable, so that soldiers on the opposite side were able to hide. The precision of German artillery was such that British soldiers were always able to move from one area to another where the shelling had already ceased. Patrols in the trenches on opposing sides of the front were often only a few meters apart and they therefore knew each other. There was an unwritten rule that for every soldier killed, the opposite side would then kill two and that neutralized the threat of snipers. This non-attack "social contract" appeared spontaneously without any previous negotiations between the participating sides. It was based on a very fragile confidence that was continually strengthened by ritual regularity with the chief goal being the predictability of the behaviour of the opposite side. Once established in one unit, the system of collaboration between the opposing sides spread rapidly as it was imitated by other units along the trenches until it was so widespread that at a particular moment of the war at least one third of the soldiers in the trenches were cooperating with the enemy.

Officers were unable to break down this spontaneously formed system of cooperation until they realized that punishment would not help, instead it was necessary to eliminate the system of confidence that formed the basis of the cooperation of both sides. They replaced the soldiers in the trenches with reserve units, who did not know the soldiers on the other side, who did not understand the built-up network of rituals and silent agreements and therefore had no problem killing the enemy soldiers. The units were organized so as to make sudden and quick attacks on the other side. This broke down the system based on the predictability of behaviour. The units were quickly exchanged to avoid another system of confidence being established.

Chimpanzee politics

Through his observations of chimpanzee groups in Arnhem ZOO, the Dutch ethologist Frans de Waal (1982) demonstrated that males form coalitions in order that they may achieve a higher position in the hierarchy. The colony of chimpanzees was formed through relatively promiscuous relations between several males and females. The females did not belong exclusively to one male (a harem) as is known to exist among gorillas. However, there was a hierarchy of males and females.

The old male ape Yeroen was the alpha male in the troop, which meant he had preferential (although not exclusive) access to the females during the mating season. He participated in 75% of all the copulations that took place within the group. One of the young males Luit stopped sending submissive signals to Yeroen and on other occasions he made it clear that he was not afraid of him. This never led to a battle to decide the status of the males, however the females gradually turned away from Yeroen and showed their deference to Luit instead. There is reciprocal support between the alpha male and females—females preferentially mate with the alpha male and in turn he defends them against the attacks of other males.

The transfer of power from Yeroen to Luit was gradual and became established at the endof the two months after Yeroen had started sending submissive signals to Luit. Before becoming the alpha male, Luit took part in a fourth of all copulations, after winning his new status he took part in every second copulation. Yeroen did not participate in copulations at all. Nevertheless, he did not give up completely. He allied himself with Nikkie, another young male. Neither would have dared to challenge Luit alone, but together they were stronger. Only a few weeks had passed since the change in status of the alpha male before conflict broke out in the troop. A coalition formed between Yeroen and Nikkie won. This time it was Nikkie who who participated in 50% of the copulations, whereas the figure for Yeroen was 25%. It was less than had been the case initially, but it was still much better than nothing.

Food sharing in vampire bats

A textbook example (Cartwright 2000) of reciprocal altruistic relations in animals is the behaviour of vampire bats, in particular the species *Desmondus rotundus*. They live in colonies of about a dozen adult females and their young. They hide in dark places during the day and start looking for food during the night. They feed on the blood of livestock and horses. Young vampire bats (younger than 2 years) are only 66% successful in this, which means that a third of young vampire bats do not suck blood during the night. In older bats the percentage of success is

much higher—up to 93%. Since bats are flying mammals they have a very high energy consumption and can only do without food for a maximum of 2-3 days. Scientists have observed that other bats help the hungry ones when necessary and regurgitate blood to them.

In the first half of the 1980s a series of experiments were conducted on an artificially created colony of vampire bats in an aviary by mixing two unrelated colonies. The colony was fed with blood in plastic bottles. Every night a bat was chosen at random and it did not get its share of the blood. It was then placed back in the aviary together with the others. Observations showed that the hungry bat received its blood from those bats that had helped it in the past. They were both related and unrelated. The decisive factor was the length of time the bats had spent in close vicinity. They only fed each other if they had spent at least 60% of their time together. There was not a single case where a hungry bat received food from another bat unless it had spent more than half of its time in the vicinity. Observations also showed that other bats would help those bats that are hungry, depending on how hungry they are and the extent to which they need their help. It was also shown that a bat remembers who helped it and is more likely to return the favour in the future.

Game Theory

The cooperation between the soldiers in the trenches, the reciprocal help of the competing chimp males and the food-sharing amongst vampire bats are all subject to certain rules that control the creation of a symbiosis between organisms, even in genetically very distant biological species or the formation of coalitions of political parties or nation states (Sýkora 2000). At the beginning of the 1970s, the evolutionist John Maynard Smith showed that animal behaviour can be modelled by game theory in the same way that economists search for optimum strategies of rational agents on the market (Maynard Smith 1976). We only need understand that the gene may "behave" rationally, despite the fact that it has no reason to do so.

We should not forget that the genes that determine such cooperative behaviour remain "selfish". The application of game theory enabled evolutionary biologists to see that the character of rationality is more universal. In the same way that we can explain the rationality of the way in which a wing, eye or liver is constructed we can also explain the rationality of animal behaviour. This was Darwin's major discovery: a rational outcome may be achieved through an irrational mechanism. Today we are already aware of the fact that it is sometimes easier to arrive at the optimum solution through the simulation (on a computer or in a test tube) of the blind Darwinian mechanism for mutation and natural selection rather than through conscious rational thinking (e.g. during the discovery of the chemical structure of new drugs).

Cheater Detector

Modelling the dilemma of "selfish behaviour versus cooperation" according to game theory of the type represented by the iterated prisoner's dilemma led to the remarkable discovery of the universally valid conditions under which a cooperative regime may arise. Surprisingly, these models confirmed mathematically the wisdom of the old rule of human interaction: "an eye for an eye", or "tit for tat" (for details, see Sýkora 2000). It was shown that a system of cooperation can be formed spontaneously on the basis of reciprocal exchange; but the system is unstable because it can be easily destroyed by cheaters, so-called free riders, or individual parasites feeding on the system of cooperation, who only take and give nothing back.

A wide range of methods can be employed in defending society against free riders. Of course, humans may create an entire system of measures based on punishing free riders at a conscious rational level. They assume that it will work as a prevention and deter cheaters from abusing the system. In terms of this paper, we should realize that not only people but all organisms that cooperate have to face a similar problem. We may be able to build a defence against cheaters using sophisticated cultural measures for human beings, but other organisms have to search for other mechanisms. Both humans and organisms are however, linked through communication. Without communication, cooperation is impossible. The problem of cheaters is then transformed into the problem of cheaters in communication.

From an evolutionary perspective it is crucial to reveal the cheater as soon as possible. If we presume together with evolutionists that the human mind and/or the brain in its current form is the result of a Darwinian mechanism, we can consider whether at the time when the influence of natural selection was at its strongest—during the Stone Age and possibly earlier, when people lived in small groups, in which cooperation was often a question of life and death—a mechanism was formed in our mind that would help reveal cheaters abusing the system of social cooperation.

According to evolutionary psychologists Tooby and Cosmides (Barkow, Cosmides, Tooby 1992) such a mechanism exists. They call it *cheater detection module*. Its existence is assumed on the basis of psychological experiments based on the so-called Wason test, which they believe demonstrates the reality that we are subconsciously "oversensitive" to social non-reciprocity.

In the Wason test, subjects are presented with four cards, from which they should select those cards which either determine or deny whether the rule, which has a formal form, is observed. "If P is true, then so is Q". For instance, "If I go to the food market, I am hungry". "If you are unfaithful to me, then I will abandon you." Cosmides found that those tested achieved much better results if the rule was formulated in terms of a social contract, in which case the test of the logical rule

becomes a test of social justice. Tests showed that the best results are obtained if the task is conducted in such a way that it reveals social cheating.

If it is indeed the case that the Wason test shows the existence of an unconscious psychological mechanism for revealing social cheating (not all accept such a conclusion—for an alternative explanation see the discussion in Badcock 2000), then it is logical to see this in terms of a product of biological evolution and we should therefore expect its incidence in children, who could not acquire such an ability through learning and socializing. Similarly, this module should be detected by Wason test in human cultures, where we would not expect the knowledge of formal logic. Experiments with the image version of the Wason test in children and among members of hunter-gatherer communities in the Amazon forest confirmed this assumption (Gaulin, McBurney 2004, 158-159).

The social cheater detection module is far from being the only one which evolutionary psychologists are concerned with. By contrast, they see the human mind as a conglomeration of a large number of modules, each of which is specialized for a particular cognitive activity and was formed as a result of the adaptation of humans to a particular problem in the Stone Age (Barkow, Cosmides, Tooby 1992).

Social scientists show a tendency to understand genetically determined behaviour in strictly deterministic terms: a person's genes do not directly influence their behaviour, but rather the motivation and emotion which is linked to the behaviour. So-called somatic markers are also a good example: the kind of inner feelings of pleasure and displeasure that are linked to our decisions and lead to a particular behaviour. Experiments showed that the rational ability of logical thought is not enough for rational human selection, but an irrational emotional component is also required (Damasio 2000).

Maybe, the old dilemma that has long fostered the enmity between sociologists on the one hand and sociobiologists and evolutionary psychologists on the other hand, has a simple solution, similar to Kant's solution of the old dilemma of rationalism and empiricism. We can imagine the influence of the environment and the influence of the genes to be complementary in such a way that the gene-determined mechanisms for motivation, emotions, cognitive modules or Damasio's somatic markers (and many other vehicles of the mind, still awaiting discovery) create only a "form" of behaviour which is then filled with its particular content by the environment—culture, nurture, socialization. By separating behaviour into its formal aspect, which is genetically determined, innate and therefore universal and into its content aspect, which is constructed by the environment, it could be possible to make natural historian scientists and social scientists speak the same language. For example, quarrels between the camp of instrumentalists and premordialists about the character of ethnicity could be overcome by such a model of the form and content of behaviour (Sýkora 2002, 2003a).

I have tried to show the way in which the modern theory of evolution is able to enrich our understanding of one of the most characteristic types of human social behaviour—cooperative behaviour between unrelated individuals. It is by no means the only type of behaviour, which sociobiology and evolutionary psychology seeks to explain. It would seem that the evolutionary perspective is able to enrich several of the great themes found in sociological discourse, such as every day social interactions, sex and sexuality, family and marriage, aggressive behaviour, power and war, ethnicity, social stratification, religion and ethics, with a new perspective. We can only hope that the biophobic trends that currently dominate the social sciences and humanities will be successfully overcome.

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