THE SELFISH GENE

(RICHARD DAWKINS 1976)

Richard Dawkins was born in Nairobi in 1941. In 1949 he returned in England with his family where in 1962 graduated in Oxford. In 1970 he became zoology professor at the Oxford university. His first book was "The selfish gene" edited in 1976. It became an international bestseller.

CHAPTER 1. WHY ARE PEOPLE?

The first person who developed a good theory to answer to this question was Darwin. In fact, Darwin explained that evolution occurs when a person has the qualities that allow humans to survive at the expense of other individuals. In addition, Darwin will therefore, pass them on, generation after generation, through his offspring. Everyone knows that Darwin's theory of evolution, but Dawkins is intended to introduce a particular interpretation of the evolutionary process. Dawkins thought that evolution should not be studied at the level of singular individuals or groups (selection of species) but at the level of genes. He also believed that there are two main characteristics of genes, manifested during the struggle for survival: selfishness and fake

altruism, these mean how to increase the welfare of an entity similar to their own expense. These characteristics permit to the genes to be better than the others, to distinguish themselves from the mass and, consequently, to reproduce themselves. The author said, moreover, that humans need to teach generosity and altruism because we, as men, are born selfish and our subconscious is not made for moral discourses, try to find each possible way to defeat the others genes. The ruthless and selfishness of the genes make them able to procreate copies of themselves; this is the basis of the evolution.

CHAPTER 2. REPLICATORS

In this chapter, the author explains, in detail, the issues of birth and evolution of life. Life begins in the primordial soup, where chemical reactions provoked by ultraviolet rays or electrical discharges begin to happen. The results are molecular complexes consisting mainly of nitrogen bases or of building blocks of DNA. The beginning of the evolutionary process occurred when one of these molecules starts being able to create copies of itself. From this moment on, these molecules are usually called replicators. According to the Darwinian theory, these replicators developed themselves when they begin to copy errors randomly. In this way they consequently favor their own reproduction and make easier their diffusion. Dawkins argued that three characteristics are required to spread the replicators: longevity, fecundity and copying fidelity. Longevity is necessary to lead the replicators to a reproductive age. The other key elements in the propagation of the replicators are fecundity and copying fidelity, because although each replicator would prefer to diffuse exact copies of itself, they have sometimes to face some copying errors whose basic importance was already treated. Other important features of the replicators are competition and scarcity of natural resources that leads to the creation of those cells that form all plants and animals (usually called genes survival machines).

CHAPTER 3. IMMORTAL COILS

The title of this chapter refers to the DNA which is made up by a pair of chains wounded together forming the double immortal helix. The basilar elements of Dawkins's theory are the genes or, better, the evolution of genes, the main cause of the evolution and not the individual. Dawkins considered the living beings' bodies as machines built and directed by genes for an unique purpose: the genes reproduction and the creation of copies. It can be concluded that genes are the real evolutionary units, potentially immortal, which, thanks to a random copying error process, may be able, from one generation to another, to codify a body and to make it more suitable for survival than others. The genes are selfish only with their alleles, while they need to collaborate with the other genes to become the best 'surviving machines' as possible.

The chapter ends with the following question: why do we die? The author, following the Medwar's theory, tried to give an answer to this question, explaining it in detail. Death could be determined by a specific typology of genes, called lethal genes, that are actives when living beings are old, it is to say when the reproduction has already taken place and when the offspring has already been bored. The solution would be to deceive the genes, making them think that the living body is still young. Anyway, this solution would lead also to terrible implications.

CHAPTER 4. THE GENE MACHINE

They are divided into two types: plants and animals. Colonies of animal genes need great cooperation between them to exploit the movement due to muscles and nerves. The behavior of the survival machines is controlled by genes not directly but in an indirect way, namely by providing specific behaviors and ways of actions that could help it to survive. The genes, while giving the body the basic prediction of the behavior, do not totally affect the decisions made by animals. this is indeed a task of the brain with the simulation, which the more developed it is, the more autonomy from the genes will take, at the end of the chapter, the author stops to analyze a remarkable behavior, communication, defined as the ability of a survival machine to influence the behavior of another machine. Communication has evolved (and continues to evolve) supporting both the sender and the recipient, even if there is a risk that an individual will use it in the struggle for survival, for his personal interest because of the selfishness that characterizes genes.

CHAPTER 5. AGGRESSION: STABILITY AND SELFISH MACHINE

To a surviving machine any other machine, especially if sent of the same species, is an opponent in the struggle for survival and this is why a certain behavior, is developed named aggression. Cannibalism and murder are very difficult to develop between close relatives, since they have many genes in common. The tactics to face an opponent are many and are determined by genes.

The pattern of 'programmed' behavior according to the situations can define a strategy, and we can say evolutionarily stable strategy (ESS) when is adopted by the majority of the population, can not be improved. Dawkins in this chapter also highlights the fact that the ESS will vary according to particular types of disputes in which the individual are opponents. Disputes can be divided into two categories: symmetric, where individuals are totally identical but with different strategies (hawk and dove) and asymmetric ones, between individuals of different in size, equipment or for the reward in case of winning. In addition, in the study of contentions, we must not overlook the fact that most of them is between individuals of the same species and among

individuals of different species are less common interests. A stable system can be established between genes of different bodies but also within a single body, constituting a genetic evolutionary stable series, which, according to the author, will be successful as characterized by genes determining selfish behavior .

CHAPTER 6. GENESMANSHIP

Dawkins, in this chapter analyzes the fact that genes can also be in other bodies and a possible altruistic behavior among relatives hides the usual selfishness of genes. Dawkins says that this happens because it is clear that they have the same genes in common. Favoring relatives occurs natural selection called 'to relatives'. The genes of altruism assess the cost-benefit analysis, to ensure maximum benefit to themselves.

The 'estimates' of costs and benefits are based on past experience of the gene or of the individual who considers his past.

CHAPTER 7. FAMILY PLANNING

The author divides it in two: bringing new people to life and taking care of individuals that already exist. The only strategy that guarantees a moderate increase in population, is the birth control it is known that animals carry out an inspection but that begs a question if birth control is an altruistic behavior, or for the good of the species, or the selfish gene?

Dawkins presents two theories. According to Wynne-Edwards, a supporter of the theory of species selection, reproduction allowed only males to control a certain territory or find themselves in a high social status is a behavior designed not to increase the number of individuals and, therefore, not to starve the population. The second interpretation, given by Lack and Dawkins is the theory of the selfish gene: it states that the limitation of births tends to favor individuals (kits genetic) as having a limited number of puppies to feed in relation to environmental conditions, each parent can take care of their children more carefully and have, therefore, more likely to propagate their genes.

CHAPTER 8. BATTLE OF GENERATIONS

Dawkins in this chapter asks himself if a mother may decide to favor a son on an other and concludes that in particular situations, like the presence of a too weak son, the mother can sacrifice him and favor his brothers.

We notice that every son tends to assume as much as he can of that parental investment PI) that parents dispose for their sons; but it is real that the selfish behavior against brothers, for genes propagation, has a limit when the family relation between brothers is elevated.

To conclude, Dawkins explain that, because parents would tend to make survive as many sons as possible and every son would desire to have the most of the cares for himself, usually people reach a compromise that is about a mediation between the situation desired by parents and the one desired by them.

CAHPTER 9. BATTLE OF SEXES

In this chapter Dawkins explains that in the different types of family there are clashes of interests between males and females that, being bounded to sons, are forced to cooperate. During their life individuals of both genders want to optimize their reproductive result trying to leave to the partner the duty to grow sons and, in the meantime, to grieve with other individuals . Because of a fundamental difference between the dimension and number of sperms (much more and smaller) and egg cells(less and bigger), female have an initial higher investment and are liable to be blackmailed by the partner that could leave them after the grieving. Female dispose of two countermeasures, the strategy of the domestic joy and the choice of a better male. Obviously will be the characteristic of the specie and the environmental conditions to determinate what will be the strategy and what will be the male reaction.

At the end of the chapter the author wants to underline that an important and steady system for family is the one that expects the birth of male and female in the same number; balance that, even if it would change, would restore.

CHAPTER 10. YOU SCRATCH MY BACK, I' LLRIDE ON YOUR

The author analyzes, in this chapter, the fact that a lot of animals have the disposition to the group life; obviously, according to the theory of the selfish gene, that means that these animals obtain from the associative life more then they give.

Aggregation happens between members of the same specie, but also between individuals of different species; these behaviors, even seeming unselfish, are oriented to give immediate or future benefit to the genes of the individuals that effect them, or to copies of the same genes present in other individuals.

Particular steady systems of collaborative strategies quoted by the author are the ones that ants establish with aphids and the ones of cleaning fishes with their “costumers”.

CHAPTER 11. MEMES: THE NEW REPLICATORS

Culture distinguishes individuals from the other living beings. Cultural transmission is a phenomenon similar to genetic transmission because it can provoke a sort of evolution. For example, changes in clothing, customs and feeding represent forms of progress.

Taken that genes are replicators, a new kind of replicator has recently been discovered, which undergo to evolutionary changes in its primordial soup: this new primordial soup is the human culture, the mimene or meme. Examples at this regard are ideas, melodies, sentences…. Memes pass from brain to brain through a specific process called imitation. For example, although we don't know the origin of God in the memic pool, the idea of God diffuses itself in writing thanks to art and music and it is characterized by the survival value resulting from its great psychological appeal, because it represents a response to deep and disturbing problems. For this imaginary reason, the following generations made of single brains know God and its existence thanks to a meme with high virulence found in human culture. As genes can replicate without success, in the same way some memes are more successful than others. Memes have the following characteristics: longevity, fecundity and copying fidelity. Longevity has a secondary importance, fertility regards the transmission and the copying fidelity concerns the different ways in which memes are transmitted.

A meme-idea could be described as an entity that can be transmitted from brain to brain, the differences in how people represent it are not part of the meme-idea.

As previously said, it is better to image genes as active agents who work specifically for survival, maybe we can imagine memes in the same way. Can we use the adjective "selfish", usually referred to genes, also for memes? It seems that memes have nothing equivalent to alleles, on the contrary many ideas have their opposite. However, the selfishness comes from the fact that the human brain and body, which controls the body, can not do more than one or two things at once. For this reason, if a meme wants to dominate the attention of the brain, it must do so at the expense of the rival memes. As genes, can the memes form complexes adapted to each other? Thinking to the fire of hell could be helpful. When you believe that you will suffer terrible punishments after death if you have not respected the religious rules in life, this is a case of self perpetuating meme that has joined the meme of the idea of God so that they reinforce and help each other in order to survive. The co-adapted memes complexes develop in the same way of the co-adapted genes. In particular, the selection favors the memes that exploit the cultural environment, which consists of other selected memes, at their advantage. When we die we leave two things: genes and memes. In every generation, the contribution of our genes is

halved, the genes are immortal, but the set of genes that makes us is destined to disappear. On the contrary, if we contribute to the culture of the world with ideas, they can live to infinity, even if our genes have already dissolved.

Chapter 12. Nice guys finish first

To explain the title for this chapter we must deal with a simple game called prisoner's dilemma, that fascinated scientists, economists, mathematicians and psychologists.
Its simplicity is deceptive.
Dawking, Axelrod and Hamilton think that many wild animals and plants are engaged in ceaseless games of Prisoner's Dilemma, played out in evolutionary time.

Now, why the 'dilemma'?

Because**,** regardless of which card you play, my best move is *Always Defect,* but i will end up with a fire or a low payoff*.*

Yet each knows perfectly well that, if only they had both played COOPERATE, both would have obtained the relatively high reward for mutual cooperation ($300 in our example).
This is the dilemma.

What I do \ What you do	Cooperate	Defect
Cooperate	Fairly good REWARD (for mutual cooperation) e.g. $300	Very bad SUCKER'S PAYOFF e.g. $100 fine
Defect	Very good TEMPTATION (to defect) e.g. $500	Fairly bad PUNISHMENT (for mutual defection) e.g. $10 fine

'Prisoner' comes from one particular imaginary example. The currency in this case is not money but prison sentences. In the simple game of prisoner's dilemma ,there is no way of ensuring trust. But there is another version of the game. It is called iterated and this have a solution.

What I do \ What you do	Cooperate	Defect
Cooperate	Fairly good REWARD I get my ticks removed, although I also pay the costs of removing yours.	Very bad SUCKER'S PAYOFF I keep my ticks, while also paying the costs of removing yours.
Defect	Very good TEMPTATION I get my ticks removed, and I don't pay the costs of removing yours.	Fairly bad PUNISHMENT I keep my ticks with the small consolation of not removing yours.

What I do \ What you do	Cooperate	Defect
Cooperate	Fairly good REWARD for mutual cooperation 3 points	Very bad SUCKER'S PAYOFF 0 points
Defect	Very good TEMPTATION to defect 5 points	Fairly bad PUNISHMENT for mutual defection 1 point

The iterated game is simply the ordinary game repeated for an indefinite number of time with the same players.
Develop a strategy is the best way to win.
Axelrod expressed 15 strategies into one common programming language, and set them against one another in one big computer.

The winning strategy, remarkably, was the simplest and superficially least ingenious of all. It was called Tit for Tat, and was submitted by Professor Anatol Rapoport, a well-known psychologist and games theorist from Toronto.

How might a game involving Tit for Tat proceed?

Tit for Tats begins by cooperating. In the next move, each player copies the other's previous move,

Naive Prober is basically identical to Tit for Tat except that, once in a while, say on a random one in ten moves, it throws in a gratuito defection and claims the high Temptation score.

Now consider another strategy, called Remorseful Prober. Remorseful Prober is like Naive Prober, except that it takes active steps to break out of runs of alternating recrimination.

Remorseful Prober remembers whether it has just spontaneously defected, if so, it 'remorsefully' allows its opponent 'one free hit' without retaliating.

It is more interesting to classify strategies according to certain categories, and examine the success of these broader divisions:

*nice is the most important category for Axelrod.

A nice strategy is defined as one that is never the first to defect. (tit of tat is an example).

Nice guys do well in this game.

*Another of Axelrod's technical terms is 'forgiving'.

A forgiving strategy is one that, although it may retaliate, has a short memory.

It is swift to overlook old misdeeds.

Friedman is a strategy unforgiving, and it didn’t do particularly well.

Of all the nice strategies , Grudger/Friedman did next to worst. The reason unforgiving strategies don't do very well is that they can't break out of runs of mutual recrimination, even when their opponent is 'remorseful'.

Tit for Two Tats allows its opponents two defections in a row before it eventually retaliates. It is super forgiving. It was created by John Maynard Smith.

So, we have identified two characteristics of winning strategies: nice and forgiving.

Axelrod did run a third round of his tournament as natural selection might have run it, looking for an ESS. After about 1000 generations all the nastiest had been driven extinct, there was no way in which any of the nice strategies could be distinguished from Tit for Tat or from each other, because they all, being nice, simply played COOPERATE against each other.

A consequence of this indistinguishably is that, although Tit for Tat seems like an ESS, it is strictly not a true ESS. To be an ESS, remember, a strategy must not be invaluable, when it is common, by a rare, mutant strategy. Now it is true that Tit for Tat cannot be invaded by any nasty strategy, but another nice strategy is a different matter. As we have just seen, in a

population of nice strategies they will all look and behave exactly like one another: they will all COOPERATE all the time. So any other nice strategy, like the totally saintly always Cooperate, although admittedly it will not enjoy a positive selective advantage over Tit for Tat, can nevertheless drift into the population without being noticed. So technically Tit for Tat is not an ESS. But although Tit for Tat is strictly speaking not a true ESS, it is probably fair to treat some sort of mixture of basically nice but retaliatory 'Tit for Tat-like' strategies as roughly equivalent to an ESS in practice. But always defect is also stable, as well as tit for tat.

Whichever stable point comes to dominate the population first will tend to stay dominant.

Always Defect, through a true ESS, cannot use local clustering to cross the knife-edge. On the contrary, local clusters of Always Defect individuals, far from prospering by each other's presence, do especially *badly* in each other's presence. Far from quietly helping one another at the expense of the banker, they do one another down. Always Defect, then, unlike Tit for Tat, gets no help from kinship or viscosity in the population.

So, although Tit for Tat may be only dubiously an ESS, it has a sort of higher-order stability.

Always Defect resists invasion for a long time. But if we wait long enough Tit for Tat will eventually muster the numbers required to tip it over the knife-edge, and the population will flip. But the reverse will not happen. Always Defect, as we have seen, cannot benefit from clustering, and so does not enjoy this higher-order stability.

*Another of axelrod’s category is not envious.

Tit for Tat is also 'not envious'. To be *envious,* in Axelrod's terminology, means to strive for more money than the other player, rather than for an absolutely large quantity of the banker's money. To be not-envious means to be quite happy if the other player wins just as much money as you do, so long as you both thereby win more from the banker.

Games theorists divide games into 'zero sum' and 'nonzero sum'. A zero sum game is one in which a win for one player is a loss for the other. Chess is zero sum, because the aim of each player is to win, and this means to make the other player lose. Prisoner's Dilemma is a nonzero sum game. There is a banker paying out money, and it is possible for the two players to link arms and laugh all the way to the bank.

In real life, both human life and plant and animal life in many situations are, as a matter of fact, equivalent to nonzero sum games. Nature often plays the role of 'banker', and individuals can therefore benefit from one another's success. They do not have to do down rivals in order to benefit themselves. Without departing from the fundamental laws of the selfish gene, we can see how cooperation and mutual assistance can flourish even in a basically selfish world. We can see how, in Axelrod's meaning of the term, nice guys may finish first.

What I do	What you do: Cooperate	What you do: Defect
Cooperate	Fairly good REWARD I get blood on my unlucky nights, which saves me from starving. I have to give blood on my lucky nights, which doesn't cost me too much.	Very bad SUCKER'S PAYOFF I pay the cost of saving your life on my good night. But on my bad night you don't feed me and I run a real risk of starving to death.
Defect	Very good TEMPTATION You save my life on my poor night. But then I get the added benefit of not having to pay the slight cost of feeding you on my good night.	Fairly bad PUNISHMENT I don't have to pay the slight costs of feeding you on my good nights. But I run a real risk of starving on my poor nights.

But none of this works unless the game is *iterated.* The players must know that the present game is not the last one between them.

Example in the history of tit for tat was in the first world war for British and German troops and in hermaphrodite fish.

There are another case of dilemma is in vampire

CHAPTER 13. THE LONG REACH OF THE GENE

The contrast between the gene, the DNA replication and the single body, a machine with a plurality of intent, a disturbing factor of the selfish gene theory. How can we solve this paradox? All genes seems the same, the only important differences emerge in the effects that they cause to the embryo and then on the form and content of the bodies. The genes which have beneficial effects on the embryo or which favor the development of the embryo in a successful adult, it is to say that will reproduce itself and that will pass their genes to future generations, can be called winning genes.
The term phenotype can be particularly useful to recognize the visible effect of a gene in comparison with its alleles. What happens, when a gene has a beneficial phenotypic effect for itself, but a bad phenotypic effect for the other genes of the body? There are many cases, a significant one regards the meiotic drive. The meiosis is a special type of cell division that halves the number of chromosomes, giving rise to sperm or egg cells. We speak about meiotic drive when a mutant gene influences the meiosis so that the mutated gene has more probability in comparison to its allele to arrive to the egg. These genes cause a mutation that diffuse itself in the population at the expense of its allele. These genes usually cheat the other genes with which they have a body in common, for this reason James Craw called them genes that destroy the body.

The phenotypic effects of a gene are the tools that allow to it to move on to future generations. However, these tools have a range that goes beyond the boundaries of individual bodies, what does it mean? Thinking to the dams of beavers, birds' nests and the home of caddis flies can be clarifying. The Trichoptera are insects that spend their larval life in the rivers bottom in tubular shaped houses that thy built with the materials found on the seabed. Some larvae use sticks, others prefer carefully chosen small stones, or shells. The larvae house is an evolutionary adaptation for Darwinian selection, it represents a protection for the body and it is therefore an advantage for the whole body and all its genes. Thus, there are genes that influence and control the differences between the houses of the larvae. A gene may thus

influence both the roughness of a pea and the hardness of the stone of a larva house. This conclusion leads us to the second point, genes of an organism may have extended phenotypic effects on the body of another organism. Taking the shell as an example, in particular the shells snails and their thickness, which becomes greater in snails parasitized by certain types of worms. The increased thickness of the shell implies in a greater quantity of energy that the snail has to spend in order to reproduce itself, so why does it so? What does the worm earn? The worm has a chemical influence on the snail, the genes of both can benefit from the survival of the snail body. The worm genes influence the snail cells that secrete the shell, this is a beneficial influence for them but too expensive for the snail genes. Genes go outside their bodies to influence the phenotypes of other bodies, in many respects the interests of the parasite gene and those of the host may be the same. At this point a question arises: are the genes of the parasite transmitted by the same vehicles used by the host genes? If not, the parasite can damage the host, but if they are, the parasite will do anything to help the host not only to survive but also to reproduce, during the evolution will cease to be parasite and will cooperate with the host and, eventually, it may even merge with it.

This same explanation can also be applied to our genes, which cooperate not only because they are ours, but also because they share the same output way, either sperm or egg cells. If a gene found an alternative way to spread itself, it would cease to cooperate. When we have a cold or a cough, we usually consider them as related to disorders, that are byproduct of the virus activity, but, in some cases, they are deliberately caused by the virus in order to help itself to travel from one host to another. So there are some genes that use the usual output ways, sperm and eggs, and other genes that pass through side streets. Both classes may include genes that originate from chromosomal genes and genes that originate from external invaders such as parasites.

It follows the proven thesis that genes are physically close to their extended phenotypic effects, but the genes may also act at distance: although the cuckoos do not live inside other organisms, they suck their blood, consequently they could be consider parasites because they are able to manipulate the behavior of the adoptive parents. The young cuckoo is not limited to deceive their guests, they do something more, we talk about the theory of irresistibility: it seems that the red throat of the cuckoo manipulates the behavior of the guests who behave in a manner that goes far from its interest. The red throat of the cuckoo, which has an similar effect on the host nervous system to a drug, has to have originated as a genetic mutation. This mutation has therefore worked on the shape and color of the throat of the little cuckoo. The effect of these genes has direct in the cuckoo and indirect impact on the host behavior. The parasite genes may therefore have effects on the body of the guests not only when the parasite lives inside the host, manipulating it by direct chemical means, but also when the parasite is separated from the host manipulating it at distance.

In all cases in which natural selection has favored the genes of manipulation, it is fair to say that those genes have extended phenotypic effects on the body of manipulated organism. This brings us to the so-called theory of the central extended phenotype: the behavior of an animal tends to maximize the

survival of the genes of that behavior, regardless of the fact that genes are in the bodies of the animal that behaves in that way.

Coming back to the initial question, the problem may be solved using the terms vehicle and replicator. The basic units of natural selection are called replicators, the DNA molecules are replicators, generally they are in group to form large survival machines such as vehicles. The vehicles that we know better are our human bodies. Vehicles do not replicate themselves, but they work to propagate their replicators. The essential quality that it needs to be considered an effective vehicle for genes is having an output channel for all genes it contains.

However, the science of the extended phenotype taught us that is not necessarily so. To this point, there are three fundamental questions. The first, why are the genes combined in cells? You can answer this question by observing how the DNA molecules cooperate in the cells: the DNA produce proteins that function as enzymes which catalyze specific chemical reactions. Each of these enzymes is made of a gene, if you need a sequence of six enzymes for a particular synthetic way, all six genes to produce them must be present. This cooperation happens entirely inside the cell, such cooperation is not limited to cellular biochemistry, cells in fact come together to form multicellular bodies.

The second question is the following, why are the cells united in multicellular bodies? The answer lies in its benefits, in addition to size, the cells of a club can specialize themselves and become more efficient in its particular task. We must not forget that the cells are a clone and that they contain the same genes.

The third question is why are the bodies involved in a life cycle that has a bottleneck? Firstly, you need to clarify the concept of bottleneck: an elephant, even though it is very big, begins its life as a single cell, a fertilized egg. This egg is a narrow bottleneck that, during embryonic development, expands in trillions of cells of an adult elephant. The final goal of an elephant is to produce new cells, the beginning, the end or goal of an elephant begin and end with the production of a single cell, with a narrow bottleneck.

There are three reasons why a life bottleneck tends to favor the evolution of a body as a unique vehicle: when a new organism is born as a single cell, it inherits the ancestral patterns in form of DNA, but not the physical organs of its ancestors. It has to start from scratch and form the bodies of its parents using the same design, probably making some changes. In a life cycle in a bottleneck, each generation goes through roughly the same set of events, proceeds through a life cycle stereotype that is repeated regularly. The third reason is a consequence of genetics, we are speaking about cellular uniformity in relation to the fact that a less or entity has its own genetic identity.

Concluding, the first mover of all existence is the replicator, it starts to exist for the casual meeting of small particles. Once it is born, it is able to generate billions of copies of itself. However, no copying process is perfect, so that the population of replicators begin to understand that many varieties exist. The success of a replicator in the world will depend on the circumstances in which it is located, on other replicators and on their consequences. Therefore, the only entity that must absolutely exist to live is the replicator.

Comments

I found the book very interesting also thanks to the examples that the author uses to motivate his ideas.
The first part is difficult to understand for an unskilled in science like me, but proceeding in reading, and most of all in chapter 12, the theory is easy to understand.
Dawkins in that chapter showed as the prisoner dilemma is played by different species for their own evolution and how to solve it.
Interesting is the example of the English and German troops during first world war that seem to use the tit for tat theorized some years later. (DR)

I think that the title is the perfect synthesis of the author's opinion and theories that Dawkins develops in the text and this helps to individuate immediately the central topic of the book. Anyway what interested me most has been the capacity of the author to explain genetic in such a simple and schematic way, or, to say it better, his capacity to make such a complex topic as genetic understandable for the reader; I must underline that most of the merits go to the lots of examples that Dawkins writes in the text, the presence of examples helps the reader understand phenomena that may result abstruse. Very interesting is the theory that Dawkins exposes about memes and human culture, because i think that in that particular part the author has disclosed form genetic theories, i mean, the author explained some mental processes in a more philosophical then scientific way. (MR)