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Lecture given at the opening of the European Forum Alpbach: 16 August 2017

How Virtue was Born

The Universe came into being some 14 billion years ago, with a bang that still resonates through space.

The solar system is one third as old. Some 4 billion years ago, the Earth had chilled out enough to be covered with water. Amazingly soon, life moved in. Chemistry became animated.

Lipids formed tiny vesicles, the forerunners of cells; nucleic acids boosted reactions, hoarded information and passed it on; and amino acids provided the building blocks of life. Even today, they are raining from the space down to Earth, riding on meteorites.

With life, the struggle for life was on. With life, conflicts spread over the globe.

Bacteria keep their hold on the planet since 3.5 billion years. Early bacteria lived in the primordial ocean. They covered their energy needs by means of sunlight. They needed iron and phosphor.

Especially phosphorus was rare. The world ocean became the theater of a planet-sized conflict. This bottleneck stifled life for half a billion years. It only relaxed when cyanobacteria managed to split water molecules.

This was the most hard-to-get and the most important chemical reaction ever found by evolution. It was invented only once. The patent rights belong to the cyanobacteria. All plants depend on it. Oxidative photosynthesis.

Cyanobacteria, in that era, were a minority just like every avant-garde. Their strange activity led to a waste product: oxygen. The cyanobacteria produced oxygen and the Earth absorbed it. For geo-chemistry, it was just another global equilibrium. But for biology, it was an oxygen cure, and a game changer.

Indeed, as the continents formed, the removal of oxygen slowed down – and some 2.4 billion years ago, the equilibrium suddenly shifted, real quick. It gave way to another one, with thousand times more oxygen in the air. For the bacteria of the old régime, the iron in their cell walls was literally rusting away. The cyanobacteria had established a new world order.

This opened up new possibilities. Again, something unique happened. One bacterium swallowed another, without digesting it, or destroying it in any other way. It offered instead a new home. Both bacteria multiplied, in unison.

They helped each other. One lived within the other. Scientists have a word for it: endosymbiosis. Probably the most radical switch from conflict to cooperation.

The bacterium that was swallowed kept its trade: it used oxygen to burn sugar and produce energy. Thus this au-pair bacterium became the mother of all mitochondria.

The bacterium that swallowed the other, or incorporated it, became the ancestor of all higher cells. They have a nucleus containing chromosomes, that is, alignments of genes. The fortuitous rearrangement of these genes became the turbo-engine of evolution.

Some 800 million years ago, oxygen increased for a second time and reached its present value. And now, some organisms became large enough to be seen by the naked eye.

Of course, there were no eyes around at the time, but these didn't take much longer to show up. Evolution constructed eyes dozens of times. Light particles had been around for 13 billion years: now light was seen. The endless play of mutation and selection found spectators.

In the Cambrian period, life forms exploded such as never before or again.

Communication took off, using ever new mechanisms to convey information. From the nervous system to human speech it took merely another few hundreds of millions of years.

It goes without saying that there are plenty of species which communicate, through sounds, signs or smells. But this has little to do with a complex language, capable of transmitting an infinitude of meanings by a limited number of signs. „Infinite use of finite means“, said Wilhelm von Humboldt.

With language, the door of the digital world stood unlocked. But first, this was hardly noticeable. For thousand centuries, merely subdued whisperings around tiny dots of light, widely spaced through the night – the camp fires of a species of naked apes.

Then, on several continents, independently of each other, in eerily unison: territoriality, agriculture, metallurgy. Calendars, priests, pyramids. States, wars, genocide... It was as if the Feeders of the Fire had given each other the signal. The word!

In principle the nucleotides, of which our genes consist, do also allow to store and transmit an unbounded amount of information. Computers could be based on nucleotide chains. But up to now, genetic information is only used for the instruction of one generation by the preceding one. And this information merely summarizes the experiences of their forebears – experiences purchased by an agonizingly slow learning process called natural selection.

With language, fictions can be communicated as easily as facts. The possible can be described as well as the actual. Sheer mental constructs – such as rules, values, conventions, myths – become as real as the ground we are walking on.

Biological evolution had acquired a dangerous rival – cultural evolution. It is based, not on genes, but on knowledge, knowledge that can be passed on.

Admittedly, many other animal species can learn, and in this sense, one can speak of a cultural evolution of macaques or of sparrows. But cultural evolution really took wings only with humans, due to our propensity, not only to learn but to teach. The sum total of knowledge grew at a dizzying pace.

And with our knowledge, our power grew too.

So much that today, we have seriously to worry that cultural evolution may destroy our planet – or at least throw it back to pre-Cambrian times.

For indeed, much as culture has accelerated our evolution, it seems unable to overtake our human nature. It is as if the fast lane were blocked by a fairly pleasant but pig-headed fellow who won't give way, a hunter and gatherer, a talkative primate who still acts as if a life-long camping trip. As if it could move on whenever things turn unpleasant. For a long time, this was

indeed possible. But now, today, this would require leaving Earth.

It becomes increasingly obvious that the true bottlenecks, here on Earth, are not caused by lack of energy, scarcity of resources or deficits in information, but rather by our own behavior. Our grip is on the whole planet, and risks to strangle it. Climate change, destruction of the environment, atomic cataclysms ... By cultural evolution we have pushed ourselves into a tight corner, through the unfettered growth of our knowledge, of science.

This is why the former president of the Royal Society, Lord May, has stated that the only science capable of still saving us is the science of our behavior.

The reason why man is becoming a threat for the entire planet is his admirable gift for cooperation. Some other species are also very good at cooperating: ants, termites, bees for example. But all this cooperation occurs between closely related individuals. The worker bees in a hive are all sisters. Human cooperation, by contrast, works not only between closely related individuals. We manage to find business partners well beyond the family enterprise.

What is a partner, then? The word comes from the Latin *pars*, or part. A partner is someone with whom one part-takes. But that is not all. Indeed, when Saint Martin shared his cloak with a beggar, he was not dealing with a partner. From a partner,

one expects a reciprocation, a give and take, an advantage that one is not willing to be cheated of. If this advantage is not realized, then the partner should not have one either. Serves him right! Yes, “right”. We insist on our right. A partnership is a quid pro quo. No love gift. No charity. No saints. There are not enough of them to go round.

How did such partnership behavior emerge? We have taught it to ourselves during cultural evolution. A kind of self-domestication. Some two hundred years ago, zoologist Friedrich Blumenbach spoke of man as “the most perfect domestic animal”. And Charles Darwin wrote: “civilized man is in many respects highly domesticated.”

Of course, there was no planned breeding effort behind this domestication. A species can unconsciously breed for certain of its traits. For example: the colorful tail of a male peacock, and the corresponding predilection in their females. There surely was no long-term intention behind this kind of selection.

Each domestic species has some trait of economic value. Our human propensity for partnership is precisely such a trait. Nothing is more useful than a partner. Humans cooperate through self-interest.

As Voltaire said, assuredly one can conceive of beings uniquely interested in the welfare of others. And he added:

“In that case the trader would have sailed to India for charity, and the mason would saw stones to please his neighbor. But God designed things otherwise.”

Thus spoke godly Voltaire, and he added: “It is our mutual needs that are the eternal links between men. It is impossible that a society emerges and persists which is not based on self-love.” Impossible!

Many of us are not surprised at all by the evolution of cooperation. It is so obviously a useful thing!

But this is overlooking a small fact. Cooperation is advantageous, but for every individual, there is something even more advantageous than cooperation. This is exploitation: the free riding on the contributions of others, the withholding of the own contribution, the grab for the whole.

Individual optimization does not lead to a social optimum. This is known as social dilemma. How did humans overcome the social dilemma?

The philosophers of the enlightenment said: by a social contract. Men submit freely to a sovereign who protects them from the exploiters.

Sounds like a discredited fairy tale. True, our history books spill over with sovereigns, lots of them: kings, tyrants and despots

who acted as pillars of law and order and who tolerated no exploiter - none but themselves.

But these history books deal only with the last few thousand years. For a much longer time, men lived as hunters and gatherers, and no one took their history down. This is sad, because it was then that human behavioral patterns were formed. But from the few tribes which still hang on today, we have learned that hunters and gatherers have remarkably little hierarchy and no sovereign.

In contrast, most primate groups are dominated by alpha-males (sometimes alpha-females). Of course, homo sapiens also shows inclinations for dominating his fellows; but in hunter-gatherer societies, such fancies are quickly quenched by the community. Camp fires provide opportunities for plotting against would-be overlords. Bullies won't last. Which means that the community itself is the true sovereign.

Even in today's world, small-scale societies of hunters and gatherers, fishers and herders spontaneously form rudimentary institutions to punish free-riders and bullies. The same occurs in jails. Apparently, the mafia was born in a high security prison in Palermo, at about 1850.

In game labs, economists reproduce social dilemmas and observe how after a few rounds players will submit, on their own free will, to an authority. The players opt that free-riders get punished, even if this costs some money to the players.

No big surprise for Jean-Jacques Rousseau: “Man is born free, and everywhere he is in chains.” What he terms “chains” are commitments. Partners commit voluntarily, and safeguard this through the threat of sanctions.

Mutual coercion, mutually agreed upon.

Humans are not always aware that they collaborate through self-interest. Kindness comes so natural to them! We are helping because it is the good thing to do. Even two-year old children help – spontaneously! No other primate would even think of it, neither in a lab nor in the wild.

We people are different. We feel good when we do good. Precisely this feeling of pleasure tells us that we are doing something advantageous for ourselves, like having sex or food. It is the signature of natural selection.

Conversely, most of us are ashamed when they exploit others. Or at least, they feel slightly uneasy. They blush, when they are unmasked to society – the trait of blushing is uniquely human.

Our conscience has been characterized as “the nagging feeling that someone may be watching”. Our ancestors felt continually observed by supernatural beings. And just when this was dismissed as mere superstition, closed-circuit cameras took over. Now we can be really sure of being watched!

Apart from some hard-boiled sociopaths, humans are greatly concerned with their image in the eyes of others. They want to have a good reputation. It is essential for finding partners with whom to cooperate. Economy is based on trust, and trust on reputation.

A good reputation is a capital asset: it gives credit. This is why we care for our good name. The name - word that signifies us to the others. It is not by chance that the same species that invented language also brought morality onto Earth.

From the gossip in school yards to the „likes“ and „feedback forums“ in the internet, we exchange information about each other, mostly by praising and blaming. The word “praise” is related to “price”. Praise makes us more highly prized in the market for partners.

As Darwin wrote: “Man’s motive to give aid no longer consists solely of a blind instinctive impulse [as with the social insects] but is largely influenced by the praise and blame of his fellow men.” We help to be praised – it makes us more likely to get helped in turn. „Help, and you will be helped”, says the Bible.

Some view this as a base motivation. Can ethics be grounded on utility? Immanuel Kant wouldn’t appreciate. But moral norms – from the exterior constraints imposed by society to the virtues residing in our innermost – moral norms are the tools developed by a hominid species to facilitate cooperation.

To summarize: Without conflicts of interest, we would need no morals. This morality, by boosting cooperation, has opened the door to a new era in the history of our Earth. We do not know how sustainable that era will be.

But if we want to save the Earth, it will only be by increasing cooperation still further. There is no other way “to make our planet great again”.