

# "Social vs. Scientific attitude"

## **Antonio Ruiz de Elvira**

During a very long time of man's evolution the attitude with respect to Nature (including into Nature also the human beings, that are part of it) was one of mystery and respect. Man assigned to non-human beings (the gods) many of the things he didn't understand.

Following a very deep ingrained genetic mandate of survival, human beings discovered a series of behavioural possibilities and coded them into moral and religious codes.

I do not want to enter today into these codes, save to say that they reflect very old ways of promoting survival of closed groups.

What I want to do today is to signal that these codes are old, imperative and impervious to doubt.

These codes form, for many human cultures, a very deep, ingrained and, as background, not criticized basis of thinking. For a majority of human beings, they are a certainty. As human beings crave certainty, these background ideas form a support that produces the needed assurance.

Following the work of Tycho Brahe, to try explaining the motions of heavenly objects, and failing to do that, Kepler and Galileo decided (unconsciously, or implicitly) to change the axioms of the problem. Galileo introduced a new method, based in deriving truths from the observation upwards, instead of trying to adjust observations from thought models.

Until Galileo and Kepler, the model was of an Earth in the center of things. The motion of the planets and stars had to, **-had to-**, be around that center of the Universe, and everything, be it as involved as it might, had to comply with the model.

Galileo started with no previous model. If the data indicated that the Earth was moving in the sky, then it was moving across it

A fully new way of looking at the world was born. But this new way was (**and is**) accepted by only a very small number of persons. This new way is, very deeply, based on the idea that it can be changed as soon as new data obtains that changes the perspective. Following Galileo, Newton produced a dynamical theory of the heavenly bodies, based on an idea of time and space that was changed by Einstein. The method of science, based on the permanent feedback between observation and theory contrasts powerfully with the method of fixed codes that cannot be changed, or with the free play of the constantly renewed neuronal connections that produces art.

Science was very successful, and a derivative of scientific method (not of science) was the prodigious development of engineering.

Science, until the last decades of the 20th century was, and engineering still is, linear and dedicated to simple systems.

For a very long interval of time of man existence and memory, he has been working under two different codes, but both of them emphasizing certainty and assurance. Moral codes were fixed and unchangeable, things were always **-so-**. Scientific codes, that were modifiable, were also, nevertheless, designed for sure forecast.

One of the many criticisms against the reality of climate change is that the models used cannot

forecast the future with 100% exactitude. One of the lures of the LHC and similar apparatuses is that they promise uncertainties of the order of  $10^{(-10)}$  (for example).

Society craves assurance, and its managers promise it, although they are well conscious that they cannot provide it.

Laplace was wrong and laboured under the moral codes delusion: He explicitly declared that he was able to exactly forecast the future, at least for what concerns the motion of bodies. Science needed to wait for another 90 years, until Poincaré, to acknowledge that exact forecast is impossible for the motion of objects, and that the same applies to any other physical, chemical or biological evolution.

We know now that Nature is not predictable in detail. The 500 years old controversy between Erasmus and Luther is solved and we know that a considerable degree of freedom is open to any of us as it is open to any body in Nature. As we cannot, **-cannot-**, screen away the astronomical number of interactions that act (with feedback) on any system in the Universe, and as these interactions are non linear, the possibility of exact forecasting is negated.

**So we, as with the climate problem, can only aim to know some trends and statistical information about the systems in which we are interested.**

Society must learn from science that there is nothing sure, nothing fixed in nature, as opposite from the world of machines, built with the strong bonds to be simple and linear.

Many of the problems in today's society stem from the disenchantment of many people with the false promises of a badly understood scientific method.

## LANGUAGE

Language has evolved during thousands of years from the craving for assurance, and in the last 400 years, from the ideas of a linear, simple and predictive physics, as well from the triumphs of engineering. As a simple example, there are still many people proposing crazy ideas based on the world of machines to solve the real world problem of climate.

We speak continuously of **-final solving-** of such and such problems. As I have insisted in my former talk, system evolution changes system boundary conditions, and sometimes also the model of the system.

An evolving system needs evolving partial solutions, or never ending approaches to always changing boundary conditions. Problems are dynamic, and we cannot say that we have **-the-**solution to any of them.

As soon as we acknowledge this simple fact, we can start working on perfectly possible approaches to continuously changing partial solutions to old problems and to the new ones we continuously create.

For instance, we speak of curing malaria. It is doubtful we can cure malaria, but it is a sure thing that if we could eradicate the *plasmodium falciparum* new parasites would grow to fill up the niche left empty by that living being.

Nature is a continuum in interaction, and we cannot, **-cannot-**, destroy a part of it without endangering the rest.

The many times expressed opinion that we have to modify the Earth to satisfy human wishes (as in

the case, for example, in Spain, of bringing river water to Murcia to grow horticultural products, instead of using the land surface to collect solar energy without the need of water) stems from these very deep ingrained codes, derived from the genetic survival imperative, of dominion over the Earth and over all of its living creatures.

We speak continuously of this dominion, instead of cooperation with nature.

We speak of winning, of foreign people, of customs and visas. I remember some years ago that it was the trade union UGT the one that objected most strongly to the possibility of Moroccan tomatoes passing through Spain on its way to the European markets.

In Spain, instead of finding ways to become only one people, some of us insist on differences, on keeping distinct. In Europe instead of choosing only one language, we keep separating people by insisting in the differences. We keep the deep mistrust of one of another that is meaningless, not because any deterministic code, but simply because it does simply doesn't work.

During 1500 years the history of Europe is one of continuous fighting for nothing. No group of people obtained any meaningful advantage over any other group of people by insisting on different language, religion or culture. The history of 1500 years of Europe is one of similarity in the welfare of its population, very low until this 1950. No country became richer than any other by waging war among themselves, on the contrary, Spain empire became lost in the war against the Low Countries, France's wealth became spent in the long wars of Louis XIV in the Rhin, etc.

But in 1957 we discovered that by cooperating we would become orders of magnitude richer than by fighting. I always remember two forts in opposite banks of the Guadiana river, one in Spain, the other in Portugal. Centuries of pointing the guns to the "enemy", which was not such, but simply an "other", brought no advantage to any of them. Today we have a beautiful bridge over the river, nobody cares if you go over it in any direction and everybody is friendly to the other persons.

In Spain, when I was a child, the histories told to us were about heroic deeds performed by killing others. One example was that of the small town of Numantia, in central Spain, that resisted its romanization by fighting the romans during 20 years of sporadic fighting and 13 months of siege: The books spoke of "*An example of freedom and courage that has been remembered until today*". It is difficult to understand what this last phrase wants to convey, save the difference between separate tribes of primates. Italica, near today's Sevilla was also an Iberian town that decided to cooperate with Rome. It became rich, and from Italica and nearby towns came three emperors to Rome.

We have to change the language, from one of conflict and competitiveness, to another one of cooperation. From a language of sure things to a language of probabilities, of different scenarios, of different strategies to confront daily changing situations.

Let us think of the past: Spanish people were **-sure-** protestant people were the devil. Or to put it in a more comic context, that the people that ate butter were so bad you would get pardoned if you killed one of them (Galdos).

Here are two examples of language being derived from background deterministic ideas from the classical and not so classical physics, to be **-sure-** .

And the distinctness derived from a badly understood genetic mandate: Other, you are **-other-** .

Today we have a global problem, climate change. In Spain there is no broad consensus that we have to work hard to control it. Not more than 4 weeks ago the ex prime minister of Spain declared that he was convinced that the climate change was a hoax, and some days later the present governor

of Madrid, Ms. Aguirre, agreed with Mr. Aznar. I receive insults daily because I am **-other-** because I write communicating data about this change.

The main argument of the sceptics (that are many, and not only businessmen and politicians, but also former meteorologists holding chairs in the universities or directing museums of science; and young economists) is that we cannot be **-sure-** of this climate change.

To be able to cope with present and coming problems we have to change our language, and in this task the authors and the media have a big role to play.

History shows us that no solution for only a certain sector of society, or for a part of the global society ever wins. No side in any debate has all the correct arguments and we always learn by listening to the other sides. Our language must downplay the word **win** and its derivatives. Instead of winning over, we must say cooperate with. Not because any moral consideration that may exist, but simply because in all history no person, group or group coalition has ever won over any other.

The apparent **-victories-** are only such because the variable **time** is not included into the problem. An example from the same source as before: If Spain had recognized the time variable, and had cooperated with the Low Countries, both would have had vast advantages. By fighting they almost destroyed themselves and Spain lost all the gains of its American adventure. Today, if political parties recognize that no one can win on the long run, all of them can cooperate, each leaving on the side some of its grandiloquent demands, and work together for a common good.

After centuries of mistrust and some fighting, Spain and Portugal, Spain and France cooperate today without any big problem. Are we no longer Spaniards and Portuguese?

The natural, social economic networks are complex non-linear systems for which no deterministic law obtains. The evolution of such systems is full of uncertainties, of sudden turns, of mathematical catastrophes. The word **-sure-**, must be substituted by high, medium and low probability.

Confronted with any problem, the language should say: If we cooperate we have a high probability of finding one of the solutions for it, a solution that probably will demand further work.

We must introduce, explicitly, concepts derived from the idea of entropy and the reality that there is no free lunch. Our children and young must, as soon as possible, re-learn that to get anything you must spend more than its estimated value, and that if you don't work hard and continuously the law of increasing entropy destroys all you have built.

As we cannot be **sure** of any situation in the future, we must work with different scenarios, preparing answers to all of them. Again, Phillip the Second of Spain, **sure** of the support of his god, and of the money his Galeones de Indias were bringing from America, embarked into disastrous wars because he could not conceive other scenarios than triumph. Hitler produced a horrendous destruction in Europe because he was **sure** of his **victory** and he could not consider different **scenarios** and prepare for them.

I would be hugely grateful for a new language on the part of politicians, that would say *"We are not sure we are on the right way, and we would appreciate any cooperation from the people and from any other party, no to support our truth, but to help us to find, dynamically, the best way"*

Last week the terrorists of Mumbai were **sure** of the **final victory** of Islam, with no different **scenario**. But the reality is that no side ever wins in the ecological life. Lions cannot win over zebras any more that Islam has been able to win over European culture, or Greek thought over Asian ideas or Asian ideas over European ones.

As there is no sure result from our actions and we must consider different scenarios with different probabilities, we must use the caution principle and prepare for, at least, some of them. As the evolution of any system in any scenario is **unsure**, we must speak of constant adaptation instead of rigidly following a program established 4 or 14, or 140 years back in time.

The new language must circle around the new words/sets of words:

**Unsure,**  
**fluctuation,**  
**probability,**  
**scenarios,**  
**caution principle,**  
**dynamic preparedness,**  
**continuous adaptation.**

Let us consider the present financial crisis: If in the middle of 2007 our Spanish political managers would have said (in Spain, correct for other parts of the world): *We are not sure of this development, some fluctuation in the buying capabilities may produce a decline on the buying of houses, there is a probability of 70% of a crash, we have three possible scenarios, we are prepared for each of them, if building goes down we can put money for energy, as the building industry can decline we are teaching masons to become solar energy workers, etc.*, we could have adapted dynamically to the financial problems, or rather, these financial problems would not have occurred.

In the same way if we say we are not sure a climate change is on its way, but there is a 90% probability that it is real and that we can develop some scenarios and prepare for them, dynamically adapting our resources for the worst case, we can start building **now** the answer for a problem that if realized, could cost us thousands of years to correct.