

How to act in front of a major disaster ?

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Abstract

From the example of a bolide that can collide with the Earth, we study on one hand the possibility of a direct space action and on the other hand the possibility of no action in front of the threat. In order to "welcome the meteor", it is necessary to construct a more robust society where ten years investment or more has a great place in order to allow the technology to be eventually degraded.

1) Welcome to the meteorite.

Sixty five millions years ago and nearly ten years ago (in 1994), two comparable cosmic events occur : the collision of a bolide on a planet. Sixty five million years ago, a meteorite, ten kilometres in diameter, broke up on Chicxulub (Yucatan, Mexico), creating a two hundred kilometres [crater](#) now under the surface of the Atlantic ocean. This impact transferred to the "Earth system" an energy equivalent to the one dissipated by the union of oceans, atmosphere and active volcanoes during a period of one thousand years (!), quickly stopping the secondary era and killing finally a total of seventy % of living spaces, including the dinosaurs in less than one generation. In July 1994, the Shoemaker-Levy comet crashed on Jupiter. This event made the first page of the newspapers and the reader can still consult the web site at [http : //www.jpl.nasa.gov/s19/](http://www.jpl.nasa.gov/s19/). It was a major ecological cataclysm for the atmosphere of this giant gas bubble. A "natural" question which must be considered is the following : did (eventual) living spaces survive ? or in a more abstract way : "what are the physical, biological and relational characteristics of possible living spaces to survive to such a disaster ?" or in an equivalent manner : "what would have been occurred if the Shoemaker-Levy comet would have fallen on Earth instead of Jupiter ?

The first idea that comes to mind is to avoid such a situation for the future of the Earth. We live inside a delicate world that has to be protected. Moreover, the menace for our planet to be victim of such a meteor or comet impact has a physical reality. Observation programs are into development since less than five years, as for example the "Linear" program of Massachusetts Institute of Technology (see *e.g.* the web site [//www.ll.mit.edu/LINEAR/](http://www.ll.mit.edu/LINEAR/)). These studies show for example that the object WO107 discovered during the year 2000 will pass at the third of the Earth-Moon distance the first of December, 2140. So we have some time to act in front of such a major disaster. And in a manner analogous to the one devoted to missile and anti-missile systems, we can imagine a "military" defence system to protect the Earth from a space aggression. The first author of this communication proposed in the past some directions to think about (1997 congress of the International Astronautic Federation, paper number [IAA.97-IAA.6.4.09](#)) re-inventing three years after a remarkable synthesis proposed by the US administration in November 1994 (Spacecast 2000, Preparing for Planetary Defence, Detection and Interception of Asteroids on Collision Course with Earth, "Briefing to Industry"). As a consequence, the American military lobby swamps us with anticipation movies (Armageddon, the fifth element, *etc.*) where heroism and violence triumph from Nature forces. American military administration proposed also to "test" bolide deviation systems on small stones that orbit near the Earth in order to develop the *ad hoc* technology. We have to look in a clear

manner of such proposals : it is first a corporate effect of a human community which, since the end of Berlin's wall in 1989, is lacking of "customer" and looks for new fields of development, in order to re-active his political influence.

The second idea, first proposed in march 2001 by the second author of the communication, is to welcome the meteor, to accept the Nature in the position it has, and in the position it will be concerned in the future without the temptation to imitate the gods and to transform the world at a cosmic scale. It is probable (but has to be confirmed by future scientific works !) that the set of human Beings, considered as an animal species will survive in a first period as a Chicxulub or Shoemaker-Levy type disaster, but as we say as a provocative joke : "it will be the end of capitalism, and of Christianity too!" Is it so clear ? The difficulty of such a question does not permit for us to propose to day any beginning of response. It concerns any of ours, as a social being and the entire Humanity, in such a way that it can react in a coherent manner. We can only propose here some comments, and leave for the future a systemic reflection of elaborate.

Look a while our "after eleven September" world. The terrorist and ideological disaster has for consequence a psychic trauma for six billions of human Beings, a fear for travelling, a reduction of exchanges, a crisis inside the aeronautical industry. The shock wave has not to day finished to turn several times around the economical world to reach any actor everywhere in the world. Diminishing of the technological effort of development, less motivation for applied research, less need of education, more influence of superficial media on fragile persons, and so on.

We relativize also our reflection : the "eleven September" is only an infinitesimal perturbation compared to a menace of the Chicxulub type! The impact of a bolide on the Earth will first imply a total destruction of the human activity inside a perimeter of some kilometres to some hundreds of kilometres, and will have mid-term consequences on atmosphere and climate activity. We can imagine a multiplication of natural disasters such as earthquakes, or France December 26, 1999 tempests. The problem must be considered in the **long range period** and **certainty of event**. We know that comics hero [Vitalstatistix](#) invented by R. Goscinny and A. Uderzo (1961) *ne craint qu'une chose: c'est que le ciel lui tombe sur la tête, mais comme il le dit lui-même, "c'est pas demain la veille !"*. We must here first insist on the certainty character of such a future disaster with a cosmic origin. The Earth planet has been victim before today of five major cosmic disasters during his history and will suffer others. The best hope that can have Humanity is to be still present for the next one, his biggest desire would be to survive to such a disaster.

The question of a future disaster must be present **now** in our economical action. If astronomers convince us that a dangerous meteorite will impact the Earth in, say, two hundred years, this information will be well known all around the world and the military defence will be envisaged, with as a consequence a very important space war investment. If at the contrary a comet as Hale Bopp (1997) of forty kilometres in diameter (*i.e.* four times the size of the bolide at the origin of the Chicxulub disaster) impact the Earth in two hundred years, we will know it only two years before and it will not be possible to have any direct action against the menace. If in a future of two hundred years all the volcanoes in the world find again their activity, if the number of cyclones is multiplied by a factor of ten, if hurricanes as the one in France of December 1999 occur every week, the nature of the economical activity will dramatically change and the exchanges between human beings will decrease. But the intellectual and artistic exchanges could be maintained ? Will the technical memory survive ? Will we get new computers ? Will the law survive ? What type of chaos will be present on Earth ? Lot of open questions...

Bolide interception seems to be out of possible for long term dynamical system reasons. In fact, if the solar system is well ordered for the big planets (Jupiter, Saturn), we know since the scientific discovery of J. Laskar (see *e. g.* "le chaos dans le système solaire", *La Recherche*, vol. 232, p. 572, 1991, or the study "une histoire des conceptions du système solaire" proposed on the web site at [//www.discip.crdp.ac-caen.fr/phch/culture/syst_solaire/CONFSYSO.htm](http://www.discip.crdp.ac-caen.fr/phch/culture/syst_solaire/CONFSYSO.htm)) that at a time scale of several millions of years, the motion of the telluric planets as Mercury, Venus, Earth and Mars is chaotic. Some scientists even imagine the possibility of some collision between Earth and Mars in the future ! We are in consequence in front of the same chaotic situation for the small stones that orbit around the sun near the Earth and risk to collide with our blue planet. The environment of the Earth is unpredictable at a time scale of some millions years. We can not to day imagine the "control. at the

lowest cost, of the solar system " as mentioned as a joke by an eminent mathematician. Even if Humanity succeeds in his project to intercept a dangerous meteorite, it would be at an economical price of a war for all the nations. Moreover, we have no certitude that this particular action will induce or not other effects of the same type in long term future. In consequence, the rational approach is precisely to imagine and to construct this "control at the lowest cost of the solar system". But it must be first designed from a theoretical point of view and we do not have to day at our disposal the adequate mathematical theory that could model such a process. It is possible to search the order of magnitude of the impulses and energies that are necessary to "stabilize" the system of telluric planets. No doubt that it has a fantastic level and is far over the possibilities of our nuclear present technology !

We can invest now an amount of our economical power for very long term future in a "civil defence" to prepare the life in a world where the technology could be **degraded**. The only certainty to "welcome the meteorite" is first to imagine a social world that could be much more robust to external variations and to act right now to construct this robustness through variety and solidarity.

2) **An other point of view...**

Two remarks are proposed and developed in the second section of this communication : *(i)* the state of things, that we can call the information at a given time, can not be reduced at his "accounting" measure, and *(ii)* the fact and event engage different perspectives as vernacular language retains them as signs. The reader is referred to the French version of this text.