

# GLOBAL WARMING BETWEEN SCIENCE AND FICTION

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## Abstract

Author of popular bestsellers, some of them also successful movies, Michael Crichton with his last book *State of Fear* contributes to heat the debate over Global Warming, a long standing debate recently exasperated by the USA's refusal of ratifying Kyoto protocol. Crichton's last techno-thriller is an interesting literary experiment, because the author inserted in the text graphs coming from excellent research centres. The book contains footnotes where quotes from scientific articles are used to validate the story. The bibliography is a long list of references to scientists' works. An analysis of how science has been used in this context will lead to more general considerations. The scientific community is claiming at large that Global Climate Change will lead to more frequent extreme events. Can the fiction help citizens to get aware of the role played by science in this context, getting them also involved in the problem solving? Rather than considering the fiction as conceived merely for entertaining, we suggest to consider it as an intriguing tool to promote a debate between people and the scientific community. In the past when human beings were facing a violent planet, without the help of science, myths and tales have saved lives. In the same way, we should welcome stories as a way to involve people in scientific issues of vital importance for the contemporary world.

**Keywords:** Science, Fiction, Story, Global Warming

## 1. Introduction

When I was a student at the humanities, I would have liked to end my university courses with a thesis on the English writer Charles P. Snow and his essay on "The two culture and the scientific revolution". Even if addressed to a professor of Anglo-American literature who was also the wife of a renowned Italian physicist, my proposal was refused. So I turned to a thesis on W. Shakespeare last play: *The Tempest*. It was in that occasion that I captured something very important for my future activity in science communication. Prospero, the protagonist of that play, half magician and half scientist was the expression of a period of transition. In the Elizabethan Age, the newborn scientific disciplines like Astronomy, Chemistry, Physics coexisted with the fashion for occultism, magic, cabalism, Astrology and Alchemy. A literary critics, C.Clark explains that even if there were sceptics and doubters because this was an Age which saw the beginning of what are today established sciences – for instance the Copernican school of Astronomy was questioning the rules of the astrologers while the pioneers of Chemistry were challenging the claims of the alchemists – some of the neo-scientists adopted an attitude of extreme tolerance towards ideas they knew to be non-sense. The reason, concludes Clark, is that "dry scientific facts did not of themselves win that support and help without which progress was impossible" [1].

In this paper I would like to motivate why we need an Earth education not merely based on dry scientific facts. I do believe there is no better way to educate people if not stimulating their imagination, fantasy and creativity. Stories are a powerful tool in this sense and the last techno-thriller of the American writer M. Crichton offers a valid example of how they can be used to stimulate a passionate debate on scientific issues of vital importance for the contemporary world.

## 2.The seductive power of a story.

If our attention is fully captured it is because we are following a story. The more the story is unusual, complex and full of suspense and the more we are involved in it. Stories are a powerful communication tool. In a book devoted to motivate how storytelling ignites action in knowledge era organisation S. Denning enumerates a series of positive traits inherent to stories. Stories are natural, easy, entertaining and energizing. They help us understanding complexity. Stories can enhance or change perceptions. Stories are easy to remember. Stories are inherently non-adversarial and non-hierarchical. They bypass normal defence mechanism and engage our feeling. At this point Denning cannot avoid to wonder why all this potential had such little recognition. And the answer is that in the age he was living storytelling was suspect. Scientists derided it. Philosopher threatened to censor it. Already Plato identified poets and storytellers as dangerous fellows. Moreover, concludes Denning, the antagonism towards storytelling may have reached a peak in the twentieth century with the determined effort to reduce all knowledge to analytic propositions, and ultimately physics or mathematics [2].

Fortunately, stories survived as a product of our imagination and they still have a wide and passionate public. Stories can be half true and half invented or be totally inspired by real life. As a result, stories have another important

characteristic: they can be forged for our goal. Why then not considering them also a great vehicle of scientific information? Recent studies have demonstrated that fictional stories can be used to convey science to the general public in an accurate, memorable and enjoyable way [3]. J. Bruner conceptualized the two modes of knowing: the paradigmatic or logico-scientific and the narrative mode. The two, though complementary, are irreducible to one another [4]. Then, science is not the only way in which we learn about and understand the world. Moreover, I do believe that what is commonly called “fiction” doesn’t have to be always associated with something totally invented, in contrast with scientific facts. One can choose to base a story on real scientific facts, whenever he can check science in a reliable way. Some Sci-fi movies for instance had a scientist as a consultant. Some outstanding scientists are also appreciated novelists. M. Crichton himself has a scientific background: he graduated at the Harvard Medical School. Other scientists even if devoted mainly to their scientific career are respectful towards science fiction. The outstanding scientist S. Hawking in a public lecture about “Space and Time Warps” remarked that “today’s science fiction, is often tomorrow’s science fact.” [5]. If not a scientist, today a sci-fi novelist can count on interesting initiatives such as the newborn “Sci-Talk”, a website born to promote dialogue between scientists and writers [6].

Finally, there is another aspect I would like to consider that has important implications for science and society. Even if the scientific method is the best tool to investigate reality, it is no more than a tool. At the same time, scientists are no more than “actors” in a social context, as any other man. What follows is about the experiment performed with his last book by M. Crichton who has considered this possibility.

### **3. Global Warming: a story invented by environmentalists and supported by scientist?**

When I bought this book here in Italy, in July 2005, 300.000 copies of it had already been sold, and the paperback version wasn’t still available. On January 2005 it was the third best seller in the Usa. Very probably it has reached millions of readers and it will reach tens of millions in the next years and, who knows, probably it will become a movie. I think it is enough to consider it from a science communication perspective. If Crichton has communicated his point of view to such a wide public, scientists’ point of view has mostly remained confined within the scientific community. I do believe that scientists should take occasions like the one offered by Crichton to spread their knowledge with the help of journalists. *SoF* has contributed to heat the debate over GW inside the scientific community itself [7]. Even if I am not one of the readers completely convinced by Crichton’s point of view – for reasons I will say later in this article– at the same time I should recognize that GW is a good example of what I wrote before. Scientists are “actors” in a social context. *SoF* should be welcomed for having dramatized this aspect drowning the attention on politicized science. As a consequence, it would be inappropriate to find an answer if GW is real or not. Neither M. Crichton pretends to do it if he decides to report his opinion apart at the end of the novel, in the “Author’s Message from *SoF*” introduced in this way: “A novel such *SoF*, in which so many divergent views are expressed, may lead the reader to wonder where, exactly, the author stands on these issue...” [8]. The importance of this thriller is that it imitates real life, even if dramatizing it: the truth is always very difficult to obtain.

#### **3.1 GW supporters and GW sceptics**

In the book, the characters are often in troubles when asked for a definition of global warming. This is a literary device to dramatize the fact that GW is no more than a theory. We will use the one from Wikipedia: “Global warming is an increase in the average temperature of the Earth's atmosphere and oceans. The term is also used for the scientific theory of anthropogenic global warming, which attributes much of the recently observed and projected global warming to a human-induced intensification of the greenhouse effect...”. In *SoF* the GW considered is the anthropogenic. A good starting point but not a solution would be to consider how many scientists are convinced that GW is forced by human activities. There is scientific consensus on climate change. I do refer to an essay published on *Science* where it is reported that the hypothesis of a consensus was tested by analyzing 928 abstract, published in referred scientific journals between 1993 and 2003, and listed in the ISI database with the keywords “climate change”. The result is that “remarkably, none of the papers disagreed with the consensus position” [9].

Scientific consensus doesn’t mean the truth. Oreskes recognizes that scientific consensus might be wrong. And I do agree with prof. J. Hansen, the father of GW, when he writes “scepticism thus plays an essential role in scientific research, and far from trying to silence sceptics, science invites their contribution. So too, the global warming debate benefits from traditional scientific scepticism” [10]. Even if a minority, there are scientists who disagree with the idea that human activities are dramatically forcing GW. R. Lindzen, prof. of Meteorology at Mit is a traditional greenhouse sceptic. Another one is C. Landea, one of the world leading hurricanes researchers. Other sceptics are S. Ballunas, an astrophysicist, P. Michaels, R. Balling, D. Lee Ray, a marine scientist. In Italy, an engineer, R. Vacca, has recently summarized in an article the story of Climatology and explained why he doesn’t believe that GW is a urgent problem [11].

Fair enough, what Hansen denounces in the above mentioned article seems to be in harmony with the atmosphere created by Crichton. In the book, J. Hansen, who in 1988 was really the first scientist to denounce the risk of GW, is reported to have failed in predicting how much the Earth temperature would have risen in the next 10 years. Hansen was claiming 0,35 C while in truth it has been 0,11. He increased the number of 300 per cent, claims a GW

sceptic, dr. Kenner, a character in the book. Few lines later, Kenner denounces that the 1995 Ipcc report was twisted at the last moment to support the GW thesis.

Hansen from his part in the article denounces that the well-known greenhouse sceptic P.Michaels misused a figure of his, exactly one very relevant for his 1988 testimony to the United States Congress. In this way Michaels supported his thesis that Kyoto protocol was “a useless appendage to an irrelevant treaty”, when he testified to congress in 1998. But this is real life! And what it is intriguing is that it is not so different from some scenes described in *SoF*. At this point it is unavoidable to question if *SoF* is merely a story.

### 3.1.1 *SoF*: merely a story?

As I have already pointed out, it is irrelevant to establish if M. Crichton is right or wrong about the science of GW. I do believe that Crichton’s statement “footnotes are real” is simply a literary device to attract people’s attention and to get the reader more involved in the story. It is like when we start to watch a movie and we read: “inspired by a true story”. I still don’t have an answer for this, but it seems that the more a story is similar to real life the more that story attract people’s attention. Nevertheless, as I have already pointed out in the former paragraph, I do believe that *SoF* is not merely a story. It invites the reader to consider the role of science in the contemporary world. Can science really coexist with politics without renouncing to its own essence: the search for the truth? As an ultimate goal the book invites at not taking anything for granted, even when it is science the needle of the balance. Is M. Crichton right in doing so?

To answer the question, I consider of great interest the analysis of M.Bauer concerning the role of science and technology in the contemporary world. In a recent talk given here in Rome, he remarked that we are at the end of the equation “science and technology = Progress”. The “scientific messianism” – according to which the solution of all world problem is to be expected from and within the remit of science and technology – ha no reason to exist any longer. There are many reason for this, one important is productivity, in the sense that economics assesses the utility. This has implications for knowledge production of science and technology. We are going towards a privatisation of this knowledge and this is supported by data. In many countries, even in Europe, research funding comes mostly from private institutions, these including not only industries but also charitable foundations. This means that science is no longer “a common good”. Bauer foresees in the near future that the logic of marketing of private goods, including advertising and public relations will increasingly be extended to knowledge and ideas, the achievements of science. This creates challenges and risks for science and the public, because we can suppose that privatised knowledge production is no longer oriented towards truth in a universal sense, towards a common good, but serving private interests. A way to minimize this risk is to consider the critical attitudes towards science as a social resource[12]. The question now will be, how to strengthen critical attitudes? I don’t have an answer but I do consider this question of vital importance for a good and responsible interaction with the planet we live on.

## 4. Planet Earth: our common story

“Never before have I lived through a storm like the one this night...One feels as if one is dissolved and merged into Nature. Even more than usual, one feels the insignificance of the individual, and it makes one happy”[13]. These are words written by an outstanding scientist. Today no scientist can prove false Einstein’s physics. Nevertheless, he recognized the insignificance of the individual when merged into Nature. We have to recognize that despite our powerful tools, and I refer to science and technology, we cannot pretend to manage the planet we live on. We are not the owner of this planet. Moreover many aspects of the Earth are still far to be completely understood. Some unsolved questions can be found among the 125 facing scientists today that *Science* considered celebrating the 125 years anniversary of the magazine. One of them “How does Earth’s interior work?” is included in the Top 25 questions and the other 4 concerning strictly geophysical topics are listed in the remaining 100 [14]. As a consequence, we can only interact with the planet respecting it. Unfortunately, this is not the case. I don’t want to join the chorus of alarmist voices. But there are bunch of reasons for neither joining excessive optimism.

As Eduardo j. de Mulder, the former IUGS president, said during the proclamation of the “International Year of Planet Earth”: “Around the shores of the Indian Ocean, some 230.000 people are dead because the world’s government have not yet grasped the need to use geoscientists’ knowledge and understanding of the Earth more effectively” [15]. From his part, M. Crichton, last November presented a speech at the Washington Center for Complexity and Public Policy at the Washington DC. It was a speech about “Fear, Complexity and Environmental Management in the 21<sup>st</sup> Century”. Most of the speech was devoted to show how many past alarmist predictions didn’t come true. Examples include future Chernobyl-related illness and deaths, predictions of future global cooling (in contrast with the present GW fear), Paul Ehrlich’s population bomb. After having considered many cases of false predictions and showed how they didn’t come true, he also considered the destruction of Yellowstone Park as an example of how we don’t know how to manage wilderness environment. He then introduced the concept of complexity. He argued that complex system management demands humility. And finally he concluded, referring to natural hazard: “tornadoes, hurricanes, earthquakes, is this the end of the world? “No, this is the world”[16].

What if we do the reverse reasoning? How many times the alarm has been given and people didn’t pay attention? Sometime the alarm is minimized probably for the same reasons for which in other occasions there is an excessive

alarmism. The recent tsunami disaster occurred in the Indian Ocean can be an appropriate example. Before the disaster American geoscientist K.Sieh was already implementing an education program in collaboration with the Indonesian Institute of Science (LIPI). In an article posted to *Time Asia*, talking about his experience with the Sumatra's islanders, he was underlining the complexity of convincing people to be worried about big, powerful geologic processes that may happen in the near future or in ten's generation's time [17]. One may think with Sieh that it is hard to convince people of poor countries because they have a tough job finding time to get their daily chores done. In truth, despite a long list of very successful commercial movies that have made the hazard of our planet familiar, also in developed countries the reaction of people to the real natural hazardous events can be inadequate. In Italy, people sleep quietly on the flanks of one of the most dangerous volcano in the world, the Mount Vesuvius [18].

Does this mean that what Crichton claimed in that occasion (false predictions) is false? Not at all. I just want to argue that reality is never completely black or completely white. If in many cases there was a dramatization of the risk, this doesn't mean that from now on we better relax because "this is the world". Expressions as "risk assessment", "risk management", or "mitigation of natural hazard" show that it is not necessary to fully understand complex systems in order to deal with the hazard of our planet. We don't need to wait that GW is validated by science to change our attitudes towards the planet we live on. GW it is a crucial theme because it has strong political implications. It is connected to the world energy strategies and the conflicts to it related. It is then a good example of the difficulties scientists have to face to coexist with the logic of productivity. A real climate market is born. We hear about "Carbon fund" and "Carbon credits". The reduction of carbon emissions has become profitable and even in the car market the use of the term "ecological incentive" has become a must. I do believe that the approach towards the scientists' work in this context should be different. Other than considering scientists investigating GW to find a conclusive answer to the question if human activities are dramatically forcing it, we should start to consider their studies as an important monitoring of our interaction with the planet.

Nevertheless, scientific results remain useless if not accompanied by an appropriate Earth education also able to transmit values as the respect for the planet we live on. An appropriate Earth education should also transmit the idea that the Earth is a common good. Some environmental problems will remain unsolved if governments won't renounce their nationalism.

## 5. Conclusions

The more technology allows a world- wide communication the more we assist to the triumph of the individualism and nationalism. This is a paradox and the real reason of the failure of treaties as the Kyoto Protocol. No matter what scientific data proves, this treaty as well as other similar treaties that haven't reached a global consensus (the Comprehensive Total Ban Test Treaty (CTBT) is another valid example) remain an important attempt towards a common solution of world wide problems. To encourage a common strategy of approaching world- wide problems, there is the need of an Earth education not based merely on scientific facts but accompanied by an emotional content. In this sense stories are an essential tool as myths were in pre-modern societies. Early human civilizations used myths to organise and convey information for transmitting the wisdom necessary to live in harmony and survive in nature. Today the building of this knowledge pertains to science. But as Gough has argued, even if narrative strategies of modern science have helped to raise our awareness of the origin and the extent of the numerous environmental problems, at the same time these problems may themselves have resulted from modern's science construction of stories in which the story-maker or story-teller is "detached" from the Earth. In them subject and object, "culture" and "nature", are categorically distinct [19].

To conclude, I would like to report what impressed me most during a congress organized in Rome after the 26 Dec 2004 Indian Ocean tsunami disaster. In that occasion a volcano expert showed a graphic reporting the leading causes of deaths in the 20<sup>th</sup> century: wars and human conflicts accounted for the most of them. This means that man can be more destructive than planet Earth. To this atrocity any scientific debate results useless[20].

## 6. Acknowledgment

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## 7. References

- [1] C.Clark, *Shakespeare and the Supernatural*, London 1938
- [2] S.Denning, *How storytelling Ignites Action in Knowledge-Era Organisations*, Butterworth Heinemann, 2000.
- [3] A.Negrete, "Science via fictional narratives: communicating science through literary forms", *Ludus Vitalis*, X-18, pp. 197-204, 2002  
(alternatively: <http://www.pantaneto.co.uk/issue12/negrete.htm>)
- [4] J.Bruner, *Actual Minds, Possible Worlds*, Boston 1986
- [5] S.Hawking, *Space and Time Warps*, retrieved from:

- <http://hawking.org.uk/pdf/warp.pdf>
- [6] <http://www.scitalk.org.uk>
- [7] For more info about the scientific debate inside the scientific community:  
[http://www.scienceandthefiction.com/Scientists\\_and\\_SoF.html](http://www.scienceandthefiction.com/Scientists_and_SoF.html)
- [8] M.Crichton, *State of Fear*, Harper Collins, New York, 2004
- [9] N.Oreskes, “The scientific consensus on climate change”, *Science*, vol. 306, p. 1686, 2004
- [10] J.Hansen, “The Global Warming Debate”, 1999 retrieved from:  
<http://www.giss.nasa.gov/edu/gwdebate>
- [11] R.Vacca, “Riscaldamento globale, effetto serra, clima , futuro: analisi critica”, M!ND, sett-ott. 2005 (alternatively a part of this article can be retrieved at:  
<http://www.robertovacca.com/co2.htm>
- [12] M. Bauer, “The importance of people’s critical attitudes towards science” talk given during a seminar in Rome, Cnr, *Comunicare Ascoltando*, 27 febbraio 2006
- [13] H.Dukas and B.Hoffmann, *Albert Einstein, The Human Side*, Princeton University, 1989
- [14] “125 Questions, What don’t we know?”, *Science*, vol.309, pp. 1-204 (alternatively questions can be retrieved at:  
<http://www.sciencemag.org/sciext/125th/>)
- [15] retrieved from:  
<http://www.yearofplanetearth.org/proclamation.htm>
- [16] M.Crichton, “Fear, Complexity, Environmental Management in the 21<sup>st</sup> Century”, 2006 retrieved from:  
<http://www.crichton-official.com/speeches/index.html>
- [17] K.Sieh, “How science can save lives”. *Time Asia*, January 3, 2005 (retrieved from:  
<http://www.time.com/time/asia/covers/501050110/viewpoint.html>)
- [18] T.Lanza and A.Negrete, “From myth to earth education and science communication” in press in *Geology and Myth*, Special Volume, GSL, B.Masse and L.Piccardi eds, 2006
- [19] N.Gough, “Environmental education, narrative complexity and Post modern science/fiction”, *International Journal of Science Education*, **15(5)**, 607-625
- [20] Information about number of deaths in the 20<sup>th</sup> century can be retrieved at:  
<http://users.erols.com/mwhite28/20centry.htm>
- [21] For Climatology at INGV-Bo info at: <http://www.bo.ingv.it/>