In Search of Scientifically Trained Political Decision Makers

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"Computers are not smart. They only think they are", goes a familiar statement about the wonders and failures of the machines that appear to be our masters and slaves, at the same time. Unfortunately, the same diagnosis applies to scientists, and, more dangerously, also to politicians and to other prominent decision makers.

Scientists are trained to think quantitatively, to solve difficult problems and to ask new original and penetrating questions, but most of them do not appreciate the full impact of their findings on the real world. At the same time, almost all decision makers do not understand mathematics and science, even in a rudimentary level. They rarely ask the relevant basic questions, either because they do not know enough to ask, or because they are reluctant to expose their ignorance.

Both camps refuse to admit their failings and very few people can translate the thoughts, deliberations and conclusions of one group to the other.

We live today in a world, which features, among other problems, catastrophic or moderate global warming, dangerous or oversold swine flu, airports paralyzed by Icelandic ash, nuclear issues ranging from energy production to terrorism, ethical issues in biology, and a financial crisis partly induced by a clever and greedy creation of mathematical derivatives.

In this science saturated environment, a new important profession is missing: Scientifically trained political decision makers. Good scientists, lacking the overview gained by management experience, cannot fulfill such a role. Smart politicians, with no scientific training, are unable to spot trouble, if its detection requires scientific thinking. We certainly have no use for leaders who are neither good scientists nor smart politicians, but we need people who have both qualities.

Do we advocate that all or most politicians and other business and community leaders should be scientists? Definitely not. Such a suggestion would be totally impractical, and it might also create an unwanted technocracy with a different set of undesired features. But a generous infusion of scientific methodology into the ranks of major decision makers, perhaps at the expense of the abundance of lawyers, might be refreshing and

rewarding. A basic training of non-scientific professionals in certain standard aspects of scientific thinking might be a great contribution to the improvement of public policy and to problem solving at the highest levels of government.

Remember the menace of the swine flu? We have almost forgotten it, but only a year ago it created scary news. We used to read frightening daily reports about the number of swine flu deaths in Mexico City. Most decision makers never bothered to ask how many people died, in the same period, in the same city, from the results of an ordinary "standard" flu. The answer was that the "normal flu" deaths outnumbered those of the "alarming swine flu" by a very large margin, meaning that the immediate danger was virtually non-existing. You did not have to be a medical expert in order to ask such a question, and the approximate answer could have been secured after a five minute search in the internet (just find the total number of flu deaths per year and compare). Anyone trained as a scientist, would first ask this question.

Does that mean that the swine flu posed no threat? The danger was (and still is) that it might mutate into a more lethal and incurable disease, something that apparently has not happened, so far. But a few illuminating headlines noting that, at that time, the ordinary flu was killing many more people than the swine flu, even in Mexico City, might have put the problem into a reasonable perspective and would have saved many governments from making wrong decisions. Alas, it would have also sold fewer newspapers.

It is remarkable that the recent Icelandic ash crisis, which practically grounded all aviation in Europe for almost a full week, and the major financial crisis, which peaked in the fall of 2008, and is still with us, have much in common.

"Financial engineers" created complex mathematical instruments, neglecting to emphasize unavoidable assumptions they had to make. At the same time, senior bankers and regulators did not admit that they had no idea what these papers really meant, and never asked whether there were undisclosed hidden assumptions, lurking behind new quick ways of profiteering. In many boardrooms, all around the world, management groups discussed whether to invest in such financial instruments, with no one in the room daring to ask, or being able to explain, what are the precise "ifs and buts" of such acquisitions. The mathematically minded creators of the certificates did not make technical mistakes, but they were not able to foresee a few moves ahead, regarding the impact of their little mathematical wisdom on the real financial world. It was a clear case of cross sterilization between two disciplines.

In the case of the Icelandic Volcano, theoretical model builders convinced authorities that the ash cloud is here or there, without bothering to measure anything, while no one asked whether the computer model was based on realistic assumptions. The model was probably correct in following the movement of the ash cloud, as a result of the wind direction and velocity, but it did not include many features of this allegedly dangerous cloud, such as how its density is diluted by numerous mechanisms. Scientists are trained to ask, when they see the results of model calculations: Do we have experimental evidence that the model is correct? Does it take into account all factors? Does it assume

oversimplifications that may render it quite useless at distances beyond a certain range? The obvious answer to all of these questions is: Please make actual field measurements! Government aviation authorities needed almost a week in order to be enticed to accept this simple scientific dogma, and when they did, the sky opened up.

In both cases, decision makers, with good training in standard scientific thinking, could smell trouble immediately, even if they knew nothing about financial derivatives or volcanic eruptions. The fingerprints of a sophisticated pyramid scheme should be obvious whenever one claims that he can always make a profit, and a "killer cloud" that no one can see, affecting an entire continent, based on no actual measurements, should have raised any intelligent pair of eye brows.

Not all scientists are trained in the same way. At the risk of generalizing, good mathematicians excel in solving well posed problems, and are less proficient is asking surprising new questions. Physicists are good at quantitative thinking and in getting directly into the heart of the problem, but they often believe that everything emanates from a few simple principles, a dangerous proposition in real life. Biologists are used to deal with complex problems with many variables, but many of them are weaker on the quantitative side. There are also new breeds of interdisciplinary scientists, who try to have the positive features of several disciplines, with some success, but also with the danger of falling between the chairs. There is no single formula for scientific thinking, but basic routines are common to most fields of science: Thinking quantitatively, believing a theory or a model only when it is supported by actual measurements and looking for an adequate "control sample" when trying to relate cause and effect.

Risk analysis is a flourishing field, for medicine, investments and many other areas of activity. But here, again, common sense and a scientific way of thinking help to distill the meaningful conclusions from the ocean of information. If your doctor tells you that your chances of full recovery, with a certain medical procedure, are 40%, he bases his statement on a large statistical sample. But your case is not the general case. You are interested in the recovery chances of a nonsmoking, 200 pound, 60 year old diabetic Asian male, in excellent physical shape. There is probably no meaningful statistics for such a subgroup and you have to realize it, when you are informed about the statistics of an entirely different sample. In that case, you are the decision maker, and the decision "only" concerns your personal health, but it is still advantageous to apply scientific thinking to the issue.

Quantitative thinking also helps to illuminate nonscientific issues. An amusing unimportant example occurred several decades ago, when leading U.S. newspapers noted that a large number of death notices of Soviet Generals appeared in Pravda, probably signaling a new Communist purge in the Red Army. Speculations flourished, and the topic was in the news for a few weeks, but a simple calculation, estimating the total number of such Generals, their age and their life expectancy, would have shown that, on the average, several Russian Generals must die every week. Their deaths have no relation to any purge. They have to die, sooner or later, like all of us, and the expected average rate was approximately the rate observed in the obituaries. Not surprisingly, a similar

number of American Generals died in the same period, of natural causes, a fact that went unnoticed by the headline makers, who created big news out of a routine part of life (and death).

A less amusing, but equally simple, quantitative observation, should have been made by President Obama's aides, when he said in his famous 2009 Cairo speech that World War II led to enormous suffering and the Palestinians have also suffered. Both facts are correct. But it turns out that the total casualties of the Palestinian Arabs, in one hundred years of conflict with the Jews, are smaller than the average casualties in one week of World War II. Even the Egyptian losses, in fighting to help the Palestinians, exceeded those of the latter, a fact that was left unmentioned in the speech delivered in the Egyptian capital. Perhaps such quantitative considerations would not have modified the President's text, but the decision makers should have been at least aware of them.

Until the industrial revolution, most citizens were illiterate. It is now taken for granted that decision makers must be able to read and write. Less than two centuries later, well into the "information revolution", the general public is still scientifically illiterate. The ash cloud, the financial derivatives, the swine flu and even the Soviet Generals and the Cairo speech, are all teaching us the same lesson: Scientific arguments are not the only considerations and numbers are not everything, but quantitative thinking and understanding very basic scientific facts have become part of the intellectual baggage needed for making decisions. Our deliberations should include these elements, and if they do not, we are likely to blunder, making costly mistakes. It should soon dawn on us that rudimentary scientific literacy is necessary, when we deal with current issues and determine our future.

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