Plastic-free oceans: a cognitive bias?

Pier Francesco Moretti – 24 May 2018

Plasticity

Although the term "plasticity" is used predominantly to indicate the characteristic of a material to be malleable, it can have different meanings. For example, brain plasticity refers to the ability to modify the structure and its functionalities in response to environmental stimulations, traumas and processes of evolution.

In short, being "plastic" takes on a positive meaning.

At international level, the term polymers is suggested to be adopted instead of plastics. However, they refer to organic materials and produced mainly from substances derived from petroleum. Plastics have very competitive characteristics for the production of artifacts, such as the ease of processing, economy, colorability, sound, thermal, electrical, mechanical (vibration) insulation, resistance to corrosion and chemical inertness, as well as water repellency and unassailable by mold, fungi and bacteria. Often they are also very light when compared to other materials with comparable characteristics (from a few percentage to about 2 times the weight of water). Plastics, on the other hand, are often attackable by solvents (especially for thermoplastics) and acids (especially for thermosets) and have poor resistance to high temperatures. Plastic waste disposal is implemented usually through recycling or storage in landfills: in fact, almost all plastics are non-biodegradable even if recently there is a great development of bioplastics obtained from corn, wheat, tapioca, potatoes, etc.

In short, plastic is a very competitive material.

An emergency?

Recently, we are witnessing a global environmental warning campaign referring to plastics, in particular related to the marine ecosystem: it calls to arms towards a "plastic-free ocean". Newspapers, voices from high-profile personalities in political contexts, scientific journals and communication campaigns at global scale are claiming we are facing the "plastic emergency".
For many years the concern about the impact of plastics on our seas has been grown. This has been mainly driven by plastics deposited on the beaches or images of fishing nets or birds or fishes full of waste, including plastic. But this concern, which should indeed trigger an analysis and understanding of the possible dimension of the problem, the damages, its causes and possible solutions, has triggered indeed a kind of spasmodic hunger for a sort of "final decision".

Without entering many details, it seems that at the government level, the level of attention has been raised by the first initiative coordinated at European level by the JPI Oceans, when the first research projects were launched to structure and standardize the scientific approach to the analysis of the impact of plastics at sea. We are in 2012 when this first decision was promoted by Germany (http://www.jpi-oceans.eu/ecological-aspects-microplastics), accompanied by funding that, though certainly not relevant in budget, was indeed strategic. In 2015, the G7 began to promote the first debates on "marine litter", during the German presidency for then focusing on plastics also at the level of United Nations (http://www.nowpap.org/data/G7%20on%20marine%20litter/ANNEX%20to%20G7%20LEADERS%20STATEMENT.pdf, https://oceanconference.un.org/commitments/?id=20788).

Then, we faced a continuous proliferation of initiatives at very high level, maybe for emulation or still under specific lobby, e.g. promoted by the intergroup of the European Parliament (SEARICA, chaired by a German member) or by the European Commission. This process synthesizes also in a proposal of the Commission for a funded mission in the next framework programme for a "zero plastic in the oceans", strongly promoted by the commissioner for research Moedas, the commissioner for maritime affairs Vella and through experts involved by the Commission itself (e.g see the Mazzuccato report). This, presumably, will lead to large investments to address the problem of the plastic at sea. Rumors say that a G7 group for science and future in the seas will soon release a document, where plastic has been identified as a priority issue and indicate paths for solutions. It is interesting to note that these solutions are mainly addressing a transformation in the design and production of plastics, and less on aspects related to the sea.

It is precisely in the European context, and in particular in the Brussels scenario that accompanies budgetary decisions and future investments for boosting jobs and growth, that the need for decisions based on evidence of facts and the support of knowledge is strongly recommended. It is well known that when uncertainties on the knowledge of a system or on the consequences of an intervention are high, at the political level the problem is often postponed or adopted within a precautionary approach. This results in late remediation intervention or no intervention.

The evidence of facts and figs: a problem of spatial and temporal scales

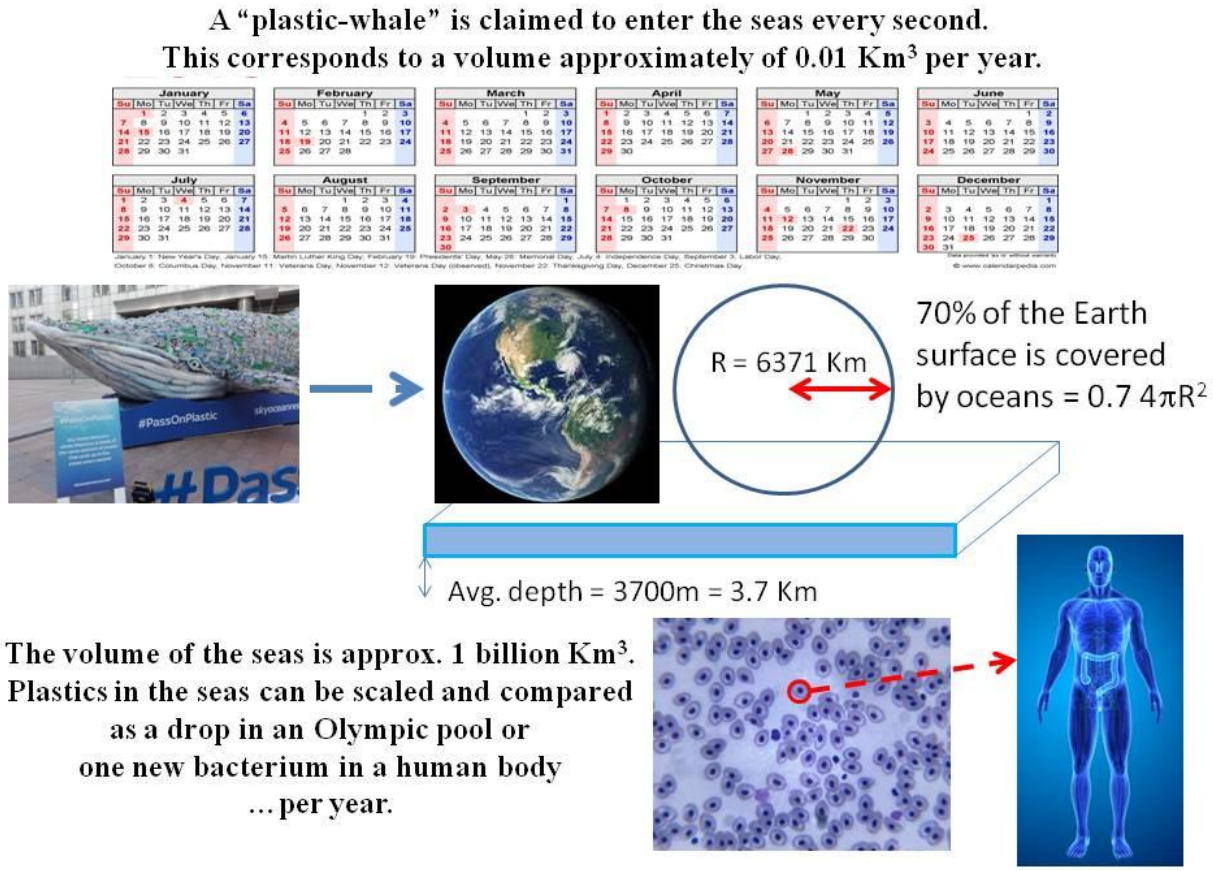
Now we see the numbers of the plastics at sea, and we start from the first and simplest one, often brought as the evidence of a problem that is resulting in a planetary tragedy, that is: how much plastic we have in the sea? In April and May 2018, a communication campaign had deposited a plastic whale to the public in front of the European Parliament to raise the awareness of such this problem, indicating that every second a volume comparable to that whale ended up in the seas.
It seems a lot. It seems…

Let us compute therefore what volume of plastic, in numbers, enters the seas and compare with the total volume of the seas itself.
The volume of the whale is approximately 15 cubic meters, which when multiplied by the 86400 seconds in a day and the 365 days in a year results in a 50 million cubic meters of plastic per year. Scientific

studies report numbers of the same order of magnitude, mainly around 10 million cubic meters per year (that is 0.01 cubic kilometers).

The volume of the seas can be found trough many sources of information. It can also be easily computed from other estimates: 70% of the Earth surface is covered by seas, the average depth of seas is approximately 3.5 Km, the radius of the Earth is approximately 6.5 thousands of kilometers. This means that the volume of the seas is approximately 1 billion cubic kilometers.

So: 100 billion years are need to fill the seas by plastics, at the same rate of disposal we have today. More useful is to scale these dimensions to other examples (i.e. within an heuristic approach): plastics in the seas are as a drop in an Olympic pool or as a bacterium in the human body. What s important is that…this occur in one year! The real question seems to be if this "one plastic-bacterium per year" is toxic in the body, where it is accumulating, if the body is capable to remediate the damages. In practice, what we need to know is the impact and the numbers do not suggest this will become a tragedy, as it is communicated.



Cognitive biases

Research projects are welcome to understand the accumulation of microplastics, their degradation and the estimation of toxicity in the food chain, as well as the initiatives to clean up beaches and plastic islands floating in the oceans. The precaution must in fact be accompanied by initiatives aimed at increasing accuracy in estimating the impacts and the adaptation of the system. But shouting to the environmental emergency related to plastic in the oceans ... this could be interpreted as a distractor if compared to other environmental disasters probably less visible to public, or a lobby aimed at the transformation of certain industrial equilibria.

Or, more simply, this is a clear example of a series of cognitive biases (which are usually grouped into 5 categories) that have spread to the level of decision-making at the planetary level:

- violation of probabilistic rules in favor of more representative and more available options (called representativeness bias, if only representatives of the community that could confirm a thesis have been engaged),
- desire to decide (called wish bias, in order to affirm the role as decision-makers),
- the distortion of the value of costs and losses (called cost bias, if the costs of the global interventions for the transformation and replacement of the material are greater than the local damage or remediation interventions),
- the influence of the context (called framing bias, if confirmation has been searched in what has been believed to be relevant).

Probably, only the so-called Anchoring bias, which consists in the bias introduced by the influence of a reference point on the decision is missing at the beginning of the process. This bias could have occurred later, when anyone trusted in the process adopted by G7 or high level political boards.

The need to increase the knowledge of the distribution of plastics and their impact on the marine ecosystem is evident. At the same time, a wave of awareness based on aspects not yet properly scientifically demonstrated or otherwise communicated in an alarming way, do not predict decisions that will take into account the viable alternatives, without causing collateral damage in other sectors: such as employment or balances in the supply of raw materials and their processing, which could imply an even greater social and environmental impact. The global socio-economic system is now deeply interconnected, both geographically and between industrial sectors and thus through close links between producers and consumers. An anti-plastic tout-court campaign could in fact trigger behaviors and legislative acts resulting in irreversible and sudden transformations in the job market that do not take into account the timescales of adaptation and resiliency. Space and time continue to be variables that are often forgotten…