



the world of tomorrow

*Robert Vichnevetsky**

introduction

Those of a certain age (the undersigned included) cannot resist talking about the fact that life has become more difficult than it was when they were young, decades ago. A number of new problems, material as well as societal have appeared with no commonly agreed

Most significant among those changes is undoubtedly the large increase in mobility, in transportation capacity that came after the last world war: the armada of the 1940's led to the flotilla of cargo ships we see today, and likewise for ground and air transportation. Part of this included food and people that could now be transported across the world, leading to populations flourishing in many places, some in regions that had so far been inhabitable. As a result, today's world population is about ten times what it was when the industrial revolution began, much of it depending on food coming from elsewhere. Such an increase has inevitably not been without bringing major changes to life on Earth, and to new problems that did not exist before.

the Club of Rome and the question of population

That this was on its way to becoming excessive had come to be of concern, among others to a community known as the Club of Rome that was initiated in 1968 by Aurelio Peccei, an Italian industrialist and followers in Europe who had engaged themselves in a project called The Predicament of Mankind, later joined by others in the US, the UK, some in Japan. It is within that international community that substantial contributions took place, first at the MIT, Cambridge-US and funded by the Volkswagen Foundation, then by a group at Princeton (to which I participated) funded by the World Bank.

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The significant difference over preceding studies was that dynamics, rates of change with time were included. Variables chosen to describe the world included population and industry in mathematical models now expressed with differential equations. The procedure had been initiated in an entirely different context by others, including Professor Jay Forrester^{1,2} of the MIT. Solving these equations demands enormous amounts of calculations, something that had only become possible with the appearance of sufficiently powerful computers that had seen the light with world war II, in all creating a new discipline known as computer simulation.

Those studies were otherwise in the same vein as those of Malthus some two centuries earlier, but they could now avail themselves of mathematics, ample real data and computers instead of general theories that were right in principle but were only theories with little data. And in all, many thousands of participants, were now involved, worldwide .

This was brought to the general public's attention in articles and books, in particular that by D. Meadows et al. appropriately titled *The Limits to Growth*³ (1972). That there was at the time a worldwide interest and concern on the subject was illustrated by the fact that the book was translated in 30 languages, that 30 million copies were printed. And every journal and magazine (including Playboy !) almost worldwide published an article or a commentary on the subject. The New York Times Review of Books had to devote a special issue to this abundant literature (February 1972).

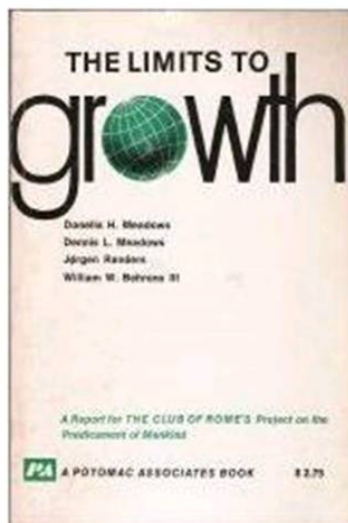


fig 1
This book (1972) reporting results and predictions of the Club of Rome studies was translated in 30 languages and had 30 million copies of it printed.

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¹ Jay W. Forrester 'Industrial Dynamics' The MIT Press. (1961)

² Jay W, Forester 'World Dynamics' Wright Allen Press, Inc. (1971)

³ D. Meadows et al. *The Limits to Growth* Potomac – Universe Book (1972),

Other than for showing the importance of including change with time, the dynamics in analyzing what goes on in our inhabited world (something that had been impossible before anyway), the gist of the outcome of those studies was in the form of a warning, namely that if the increase in human presence, the increase in population and industry were not stemmed, were not reversed, then we would in the near future be affected with major problems seriously affecting society and human life on Earth not facing the problem .

But little took place in response to this warning. Human nature, the result of our past , has it that it is simply not feasible to motivate, to convince populations to agree to mandates imposed for the benefit of others far away on the planet , others they do not know or for the benefit of future generations they are less interested in than with their own (more on this later on). I like in that respect to quote from Christian de Duve⁴

for the past hundreds of thousands of years hominids were distributed in small groups of ten, twenty or thirty individuals wandering in African forest and savannahs in search of food. Two traits were important for the survival of the individuals in those small groups and for their reproduction - cohesion inside the group and aggressiveness with respect to other groups. And it is these traits, giving an advantage to certain groups over others , have privileged them.

The essential traits he mentions, cohesion inside of one's group or community and aggressiveness toward the others are still with us, going against what would be needed to become a global community, against solving in common the problems brought about by our having become too many and depending on vital relationships between populations that do not know each other. They may also explain what is, inappropriately I believe, sometime called 'racism' today, simply the persistence of a far past aggressiveness between separate groups , separate tribes.

Anyway little took place, and in the absence of visible changes or visible action, interest in the subject declined with the media, as well therefore with the general public. Talking about population became a taboo, a global taboo that is still with us today. Not much different from what psychologists call motivated forgetting for individuals, also related to what is called the nothing can be done about it syndrome by Tom Fenton in his book entitled *Bad News, the Decline of Reporting, the Business of News and the Danger to Us All*⁵ .

⁴ Christian de Duve 'Genetique du P  ch   Originel, le poids du passe sur l' avenir de la vie' Odile Jacob (2010) translated as "Genetics of the Original Sin : the impact of natural selection" Yale University Press. (2010) He was a colleague of mine in Belgium, received the Nobel price in 1974. See also the journal *Le Soir*, Dec 17,18 -2009

⁵ Tom Fenton (2005) '*Bad News, the Decline of Reporting, the Business of News and the Danger to Us All*' ReganBooks.

It is not that that the essential problem, that of population size was forgotten by all. The United Nations had organized a series of big conferences, one every 10 years beginning with Stockholm 1992 and called World Summits on Sustainable Development. A significant expression of reality came prior to Johannesburg 2002 when W.Lutz and M.Shah, research scientists with IIASA (a reputed international research center-think tank located in Laxenburg, Austria) wrote a letter to the journal Nature. We read in its first paragraph: *Population as key component of sustainable development should figure prominently on the Johannesburg agenda. Yet, after four preparatory meetings for Johannesburg 2002, the topic is still absent*".

The letter was published by Nature (22 August 2002), together with the journal devoting its own Editorial repeating the message. But in the end the subject of population was not included in the agenda of the conference. Nor was it included in the agenda of Rio 2012, the next conference in the series, in spite of the fact that the world's population had grown from about 5.5 to over 7 billion since the Rio 1992 conference, and that of the World global GDP, a measure of the increase in industry and the exploitation of natural resources contributing to environmental damage and pollution, from \$24 to \$71 trillion.



With about 50,000 participants including state delegations and heads of state, the agenda of Johannesburg 2002 consisted of mostly papers devoted to proposed solutions to the problems (hard living conditions and diseases in developing countries, pollution, exhaustion of water resources, etc...). Working on these problems is what "sustainability" in the title of these conferences had come to mean, with nothing said about curbing the rise of population and industry.

golden years and the price we pay

Independently of those debates, advantage was taken by all of the new technology and large manufacturing capacity that had come as leftovers of world war II. What the world knew were golden years that lasted until the consequences of "too much" manifested themselves (five or six decades, maybe). The quality of life increased, but so did the size of human presence Earth that eventually became unbearable. It is interesting to look side by side at representative sectors of this rise, as in fig 2 below

that consists of actual, pretty much global data generated by agencies of the United Nations and the like. Consistency in the growth with time of those different sectors (including population, of course) tells us that they are not independent, that they are interacting parts of the whole of what is called a system.

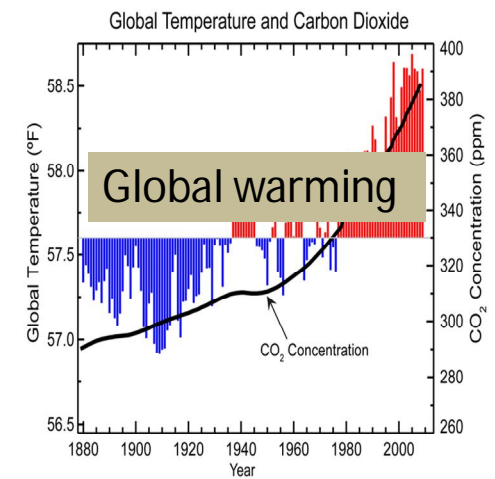
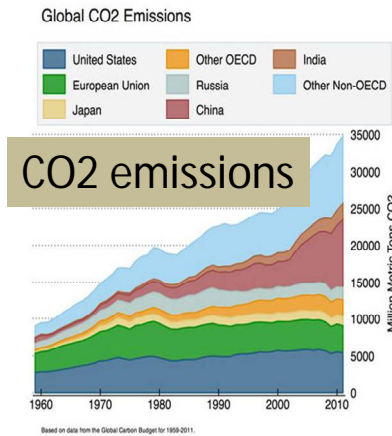
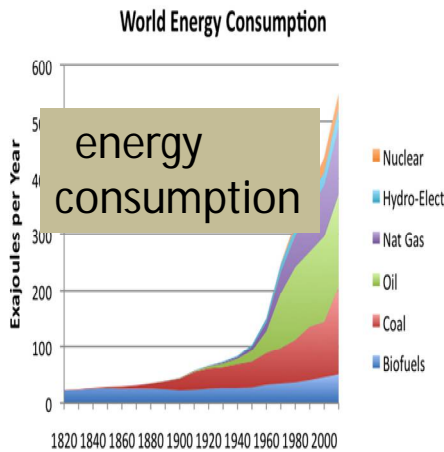
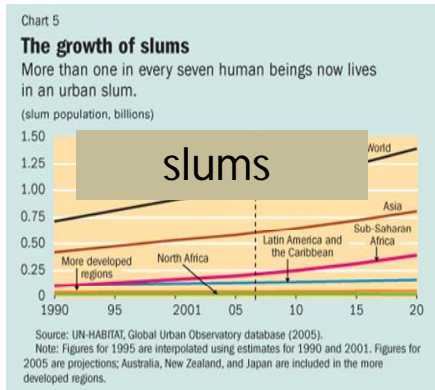
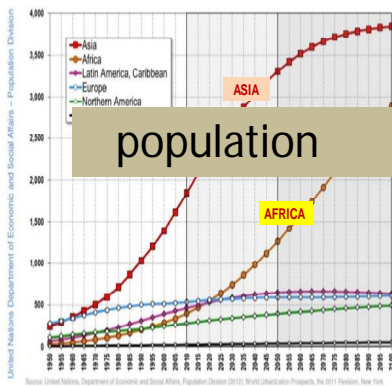


Fig 2

Significant is the absence of visible influence of public, economic, political events, those reported by the daily media and that constitute much of the essence of the general public opinion, the essence of what we may be call the 'official' world. On the other hand that illustrated by the above may be called the 'material' world. In fact, we live in a world that may be looked at from two angles, the official and the material respectively. It turns out that, for historical reasons (see below, E.O. Wilson's, remarks about that) today's world is pretty much run by those in the official world that concerns itself mostly with the short term. But what happens to the material world, that which influences the long term including rates of growth, environmental degradation, climate change, etc.. is something over which the generally accepted public opinion and our governments end up having little understanding of (though a lot of misunderstanding), something over which our governments end up having little real control.

a messy global response

Concerning the visible problems of the material world, it may well be that some believe, and it is often said that 'the scientists will find a solution, they always have in the past'. But that shall not be the case. Our science community (meaning those who do science) has come very much divided in disciplines with little interaction between them. We do not have an entity, a community that understands the world as a whole, even less capable to guide it toward solutions of its problems. Not the United Nations, they do perhaps a good job at documenting what goes on, but not at taking actions. From experience, I was in the 1980' part of one of their committees (with UNESCO- Paris), a committee asked to consider how new technologies from the developed world could be best transferred to the developing countries. Getting our results communicated where it counts turned out to be a sad experience that ended nowhere. In short, the 'they' referred to in the popular expression ... if 'they' can put a man on the moon, then 'they' should be able to..... etc.. simply does not exist (having, after an international scientific career been elected to the Hall of Fame in Engineering, Science and Technology may give credibility to my saying so). As a result, what goes on, what comments we hear about our world is a disparate collection of opinions about programs about one particular problem or class of problems, claiming each their own reason to be, many in fact doing the opposite of what solving our 'too much' problem asks for.

In all it is a mess, humanity has never faced a comparable situation.

It is useful, to help understand the situation to quote (together with de Duve that I cited before) from E.O. Wilson :

...in rising to power, beginning with the invention of agriculture, a scant 10 millennia, ago, we carried along with us the heavy baggage of ancient primate instincts. Today, as a result, we live in Star Wars civilizations ruled by stone age emotions, medieval institutions, and God-like technology.

Of the stone age emotions and traits that we have inherited, that of saving lives must be among the first. Not surprisingly, this is reflected by the number of projects, programs related to medicine, health sciences and the like. For example, we find the following in a communiqué of the World Health Organization :

.... and an estimated 429,000 malaria death. Increased prevention and control measures have led to a 29 reduction in malaria mortality rates globally since 2010."
... which lauds more population... not good....

Then, concerning the industrial-economic establishment, much of it is run by institutional rules that also date from the past, private companies as well as governmental institutions still pursue larger volume as a main objective.

At the closing of the 2018 G7 meeting in Quebec, we heard Christine Lagarde, at the time manager of the International Monetary Fund say something like :

“ the world’s economy is not doing so bad. In spite of difficulties we may nevertheless expect an increase of 2 or 3 percent of the global GNP next year....

.... but this lauds more industry...not good...

As for the Paris 2015 - COP21 agreements aimed at solving global warming - and as had been the case for the 2002 Johannesburg conference, population was not included in the list of factors contributing to the situation either. But an estimate based on actual data shows that the rate of increase of greenhouse gas emissions brought by the continuing increase in human presence may well be larger than the expected reduction of emissions - if the Paris 2015 agreements were universally applied, which is doubtful anyway.

Other than that, we see a multitude of articles, books where, in the absence of guidance, in the absence of peers in the matter anything goes. I like in that respect to quote ‘Enlightenment Now’, a book by Stephen Pinker (2018) that was brought to my attention by a friend. We read in the blurb : .. *Stephen Pinker urges us to step back from the gory headlines and prophecies of doom. Instead, follow the data in a persuasive text and seventy five jaw dropping graphs Pinker shows that life, health, prosperityand happiness are on the rise.*

But he is a psychologist (nothing to do with understanding the material sciences). The data he shows include such things as the number of countries that have legalized homosexuality, the decrease in the sense of isolation of college students, the frequency of appearance of the word sustainability in the news no hard facts and little if anything said about the variables that describe the material world, those shown in fig.2 . Nor about growth in the increase in the number of deaths in regional wars, the millions living in urban slums (over one billion... and increasing..see fig 2), nor that of migrants leaving their homeland that cannot provide them with a livelihood any more.

Is that *prosperity and happiness on the rise* ?

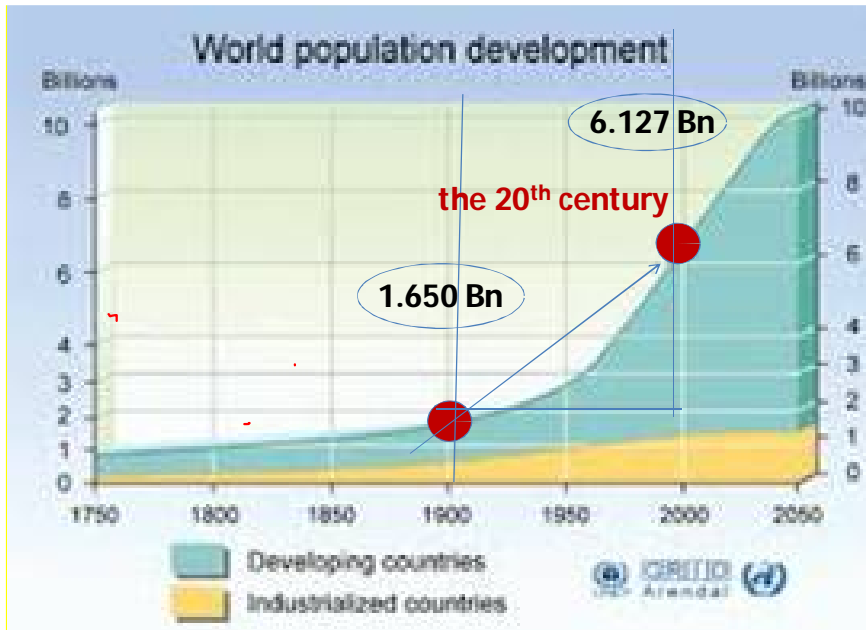


fig
3

It shall have been during the 20th century that life on Earth has come to a major turning point, human presence (population, industry) having come to go in size beyond what our host, planet Earth can materially support, beyond what we humans seem to be able to manage as a global society. Available data shows that some growth had been with us even before the beginning of the industrial revolution, but unsustainably so only as of late, after world war II.

As noted by E.O. Wilson, we live today with emotions and institutions from the stone and the middle ages. Humans were at first living in small to medium sized communities that, for the best or the worst, were depending on their own resources. Nature was controlling their size by leading to the disappearance of populations that could not make it, something that was happening locally, largely unbeknownst to others, not different from what was, still is the case for all other species. We learned later of the 19th century potato famine in Ireland where it is estimated that over one million died of hunger, of a great famines in China, one in 1928-30 that killed an estimated 3 to 10 million people, part of periodic occurrences of same in the past, there and in other parts of the world, including India, where millions are dying of hunger yearly. This natural auto regulation mechanism kept populations in balance with what resources there were nearby.

But in addition to transportation, the 20th century technology also gave us a worldwide, fast communications ability that makes - thanks to the media - everyone on Earth potentially aware, like the next day, of those remote problems, problems we have (now) the material ability to avoid, and emotions (from the past) that would make us feel guilty if we did not do so. So, guided by stone age emotions, we do avoid today starvation situations by bringing food and other supplies from elsewhere, interfering with nature's auto regulating mechanism.

I do remember of an old commercial ad that said : one does not fool with mother nature. But we do fool with mother nature,..... ..and we pay the price.

the world of tomorrow

C. P. Snow's widely recognized "Two Cultures" was concerned with the world of ideas, the humanists and the scientists that cannot understand each other - with no further consequences. Today's global world faces a similar division, one of different cultures, on the one hand that which goes with the beliefs of the official world, short term politics, economics, world affairs documented by the mass media, on the other those of the material world that deals with the long term, population size, natural resources, the environment, problems such as overpopulation leading to conflicts and wars, climate change, migrations are consequences.. Yet, for historical reasons as well as by the functioning of human nature, decisions taken are pretty much those coming from the official world (in the Western World at least, seemingly not so in the South East Asia bloc). leaving those overwhelming problems globally largely unresolved..

We are entering a new era, the increase of population and industry having led to demands that have gone beyond what our planet is able to supply, making us witness new problems, both material and societal. While this was predicted in the 1970's (the *Club of Rome*), the response to it has come in the form of a global escape, away from facing the question of size in particular that of the increase in population. Even talking about it, talking about population has become a taboo. The whole subject is relegated to what is popularly referred to as the elephant in the room.

What we hear of is research centers worldwide, populated with researchers, (7.8 million worldwide and growing, according to the latest UNESCO Science Report, a type of paid employment that did not exist less than a century ago) addressing the problems we are saddled with, some ending with predictions, with advice that may be interesting but that are often of limited significance by the very fact that most address one class of problems at a time, with a lack of coordination with the others, in particular that of the increase in population. None, if any, addresses the real problem, that of reducing human presence on Earth.

In the final analysis, the only way to figure out the future with some degree of reliability is by learning from the past. Looking at fig 2 which shows the ongoing growth, it is hard to disagree with the prediction that the rate of growth we have seen for the 6 or 7 past decades shall continue for a similar period of time, with changes in life on Earth comparable to that we have lived as of late.

About the reality of those changes, and illustrating the speed of their taking place I like to end on a lighter note by quoting from personal experience. When I was a boy aged 10 or so in Brussels Belgium (where I was born), I went occasionally with my mother to what would be called today a laundromat. It was a big hall with copper washing machines along the walls driven with belts and pulleys from a shaft at the top of the hall, said shaft (still !) driven by a big Watt steam engine in the next room. And there were in town, every few miles or so, blacksmith shops open to repair horseshoes. Brussels is today a bustling city, the capital of the European Union, a hub in the air transportation network that spans the world...

...O...O...O...

Robert Vichnevetsky was educated at ULB, the Brussels Free University with a BA in Mathematics '56, MS in Engineering'57, DSc in Mathematics'61, He was in the 1950's, and early 60's with EAI's European Computer Center participating in the introduction of scientific computing to every segment of the recovering European industry, including the development of nuclear power in France and Great Britain, He came to the US in the 1960's to become director of EAI's Princeton Computer Center, engaged in scientific computing and industrial research and development, including with NASA. He joined academia in 1970 as Professor of Computer Science and Professor of Mechanical and Aerospace Engineering, at Rutgers, Visiting Professor of Mechanical and Aerospace Engineering at Princeton. He has throughout most of his career been involved with the international network of professional scientific societies that emerged after the war, has in that context been chair of a working committee of UNESCO, Paris and president of IMACS, the International Association for Mathematics and Computers in Simulation that organizes international conferences and publishes scientific journals (with Elsevier-Amsterdam, World Scientific-Singapore). He was in 1966 elected as an Associate Fellow of the American Institute of Aeronautics and Astronautics, in 2005 elected to the International Hall of Fame in Engineering, Science and Technology.