

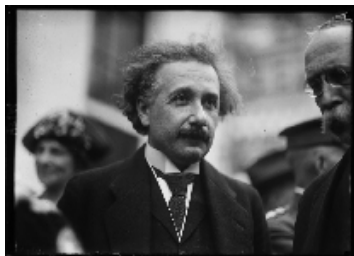
On the temporal gap between the world of knowledge and public policies

Rui Vilela Mendes
Academia das Ciências de Lisboa

March 2022

Who has the greatest influence in the fate of their fellow men?

- *Not the best educated men, nor the most creative. Never in their own generation. Their work and inspiration may, many years later, have an impact on society, but only after many mistakes and lost opportunities.*
- **Einstein created special and general relativity:** Together with quantum mechanics, are the basis for all industrial gadgets that we use and cherish. What did he say in 1931, before madness took hold of the world?



*" There is enough money, enough work, and enough food, provided we organize our resources according to our necessities rather than be slaves to rigid economic theories or traditions. Above all, we must not permit our minds and our activities to be diverted from constructive work by preparations for another war. I agree with the great American Benjamin Franklin, who said that **there never was a good war or a bad peace**"*

Great intellects of the third and fourth decades of the XXth century

- The third and fourth decades of the twentieth century were a period of major breakthroughs in science leading among other things to a new view of the universe and the microworld and, in medicine, to the isolation of insulin and a first influenza vaccine.
- Banting, Best, Hubble, Schrödinger, Heisenberg, Pauling, Bethe, Kapitza, Meitner, Krebs, Chadwick, etc.
- Do these great people, living in the 20/s and the 30/s, have had a sizable impact on the lives and destiny of their contemporary fellow earth inhabitants?

NO!

- It was **Adolf Hitler**, an uneducated corporal of the first World war, an aspirant painter twice failing the exam to the Academy of Fine Arts in Vienna, hired as a spy for the german army to report on the nationalistic groups, that finally had a 80 million deaths impact on the immediate destiny of his fellow men.



The pattern goes on and on to the future

- Modern society is the information society. Computers, automation, data mining, etc. pervade all domains of contemporary life. This is well known and appreciated by all men nowadays.
- Less well known is the fact that the basis for this evolution was established by a very small number of people, among and foremost by Alan Turing.



Was he appreciated or considered an intellectual inspiration by his fellow contemporary men? After being used in the second world war to help in deciphering the german secret codes, he was later condemned for being homosexual, forced to chemical castration and led to suicide.

The wide separation of social governance from the world of knowledge

- Is quite apparent in the shallowness of current political debate.
- Taxes should be lowered to foster growth,
- Taxes should be raised to improve redistribution and through consumption foster growth,
- State intervention is essential to insure economic justice,
- State should disappear from all sectors to avoid stagnation,
- There is no economic improvement without growth,
- Continuous growth is incompatible with sustainability, etc.
- Or even emptier words without context, words like trust, confidence, progress, stability, change, reform.
- Political slogans repeated at exhaustion without explanation or sound models. Simple words, the politicians would say, simple words for the common people to understand. But do they know any better?

An example of the gap: Climate change and the energy

- In the modern world as well as in the past, living standards of mankind are dependent on the availability of energy.
- Since the industrial revolution, energy is mostly provided by burning fossil fuels.
- Now, the burning of fossil fuels is endangering the climate and eventually destroying all the comforts that the available energy provides.
- Therefore, stop burning fossil fuels. But how?
- Drastically reducing consumption, going back to a preindustrial society, the punitive ecologists would say.
- Who would be ready to do it? And what about the enormous world population increase since the industrial revolution? And the 20% or more of humans in the planet that are hungry and living in miserable conditions? Should we say, sorry you come too late, there is now no chance for improvement.

Climate change and the energy

- The politically correct alternative is: *use renewable energy sources.*
- *Hydroelectric sources being essentially used in the world, solar and wind energies are proudly announced as the marvelous, wonderful gifts of Nature for the radiant tomorrows.*
- But except for the papers of the informed scientific literature (the world of knowledge) nobody mentions the enormous mining effort and ecological impact of obtaining all the materials (metals, rare earths, etc.) that are needed for a full scale implementation of these energies.
- *Already today, ecological and human disasters are happening connected to this mining. But as long as it is in Mongolia, Chile or Congo, nobody that matters cares much about it. Do it please, but not in my backyard, not in Canada nor lithium in Trás-os-Montes.*
- Solar and wind energies are very inefficient and intermittent. To compensate for the intermittency a backup of fast start installations of equivalent power are needed. That may be one of the reasons why oil companies are becoming enthusiastic about these energies. It is their guarantee that they will sell gas for many years to come.

Climate change and the energy

- *A badge of honour of political heads is the closing of coal energy plants. Coal is indeed a great source of green house gases (GHG). But why not profit from the coal plants to start (at the source) carbon capture and sequestration (CCS) pilot projects. CCS will be needed in the future, all sound scientific studies say. It is better to close the coal plants and then import energy similarly produced. Let others do it!*
- A second badge of honour, in Germany for example, is the closing of nuclear plants, compensated by a strong investment in solar and wind energy. In winter, with no sun or with sun and the solar panels covered by snow, energy is imported from France, nuclear energy of course, also gas from Russia. Gas, a fossil fuel, but with a better political reputation.
- *The real enemy of fossil fuels is nuclear energy.*
- France and a few other countries are proposing to scale up their nuclear programs as a way to a zero emissions future. Is this a sound decision well informed by the world of knowledge?

Climate change and the energy

- *Not really. They are proposing a network of small modular nuclear reactors, easier to install and presumably with improved security.*
- **But small is not necessarily better.** The french proposal and similar developments in the USA, the non light water nuclear reactors (NLWR), are all based in the uranium cycle. And among other things, the extremely long lifetime of the nuclear waste in this cycle is an as yet unsolved problem.
- *How to justify or warn the earth inhabitants a million years in the future about our nuclear garbage? Or not to care and expect they will solve it*

Not to speak of proliferation and the terrorist interest in these nuclear fuels. Even when they do not handle plutonium, partially enriched uranium is an appealing commodity for diverting and further enrichment. The security of an extensive network of small reactors is a security nightmare. Also the proliferation of many small reactors makes the handling of nuclear waste even harder.

Climate change and the energy

- Fusion energy by magnetic confinement being still far in the future, a scientifically sounder investment in fission nuclear energy would be in the thorium cycle. Probably in the thorium molten salt reactors (TMSR).
- *The nuclear waste would have much shorter lifetime and be much less interesting for military uses. Many scientific studies and some pilot units have demonstrated the viability of this cycle and also the superiority in many aspects of this cycle.*
- Technological problems might have to be addressed before reliable consumer units could reach the market. And, of course, changes and adaptations in the industrial processes.
- *After years of nuclear stagnation, the nuclear industries would not be willing to invest in a long term program of technological development. Also, it would not be compatible with the short term political agendas of the governments that would be called to financially support it.*

Climate change and the energy

- With already established technologies and a small investment, the uranium cycle small modular nuclear reactors are a sure and profitable way to revive the nuclear industry. Therefore the current drive towards small modular nuclear reactors **is following the nuclear industry agenda, not an agenda of the "world of knowledge"**.
- No future for thorium as an energy source?

Climate change and the energy

- With already established technologies and a small investment, the uranium cycle small modular nuclear reactors are a sure and profitable way to revive the nuclear industry. Therefore the current drive towards small modular nuclear reactors **is following the nuclear industry agenda, not an agenda of the "world of knowledge"**.
- No future for thorium as an energy source?
- **Yes, there is. In China. China is developing a thorium reactor at Wuwei.**

Climate change and the energy

- With already established technologies and a small investment, the uranium cycle small modular nuclear reactors are a sure and profitable way to revive the nuclear industry. Therefore the current drive towards small modular nuclear reactors **is following the nuclear industry agenda, not an agenda of the "world of knowledge"**.
- No future for thorium as an energy source?
- **Yes, there is. In China. China is developing a thorium reactor at Wuwei.**
- *The chinese reactor is a modern version of a project developed in 1969 at Oak Ridge in the USA. Had science prevailed, the thorium cycle is the path that the nuclear industry should have followed.*

Climate change and the energy

- With already established technologies and a small investment, the uranium cycle small modular nuclear reactors are a sure and profitable way to revive the nuclear industry. Therefore the current drive towards small modular nuclear reactors **is following the nuclear industry agenda, not an agenda of the "world of knowledge"**.
- No future for thorium as an energy source?
- **Yes, there is. In China. China is developing a thorium reactor at Wuwei.**
- *The chinese reactor is a modern version of a project developed in 1969 at Oak Ridge in the USA. Had science prevailed, the thorium cycle is the path that the nuclear industry should have followed.*
- **However the Oak Ridge project was abandoned. Among other things thorium is not so interesting as uranium for military applications.**

Climate change and the energy

- With already established technologies and a small investment, the uranium cycle small modular nuclear reactors are a sure and profitable way to revive the nuclear industry. Therefore the current drive towards small modular nuclear reactors is **following the nuclear industry agenda, not an agenda of the "world of knowledge"**.
- No future for thorium as an energy source?
- **Yes, there is. In China. China is developing a thorium reactor at Wuwei.**
- *The chinese reactor is a modern version of a project developed in 1969 at Oak Ridge in the USA. Had science prevailed, the thorium cycle is the path that the nuclear industry should have followed.*
- However the Oak Ridge project was abandoned. Among other things thorium is not so interesting as uranium for military applications.
- **It is a welcome development that China, the greatest emitter of GHG's (10.7 Gt in 2020) is investing in this less problematic nuclear energy.**

- Was there finally in China the triumph of the world of knowledge? Not necessarily. This is a project that perfectly fits the 2049 agenda when, as stated, they pretend to be *the biggest player in the history of the world*.

- Was there finally in China the triumph of the world of knowledge? Not necessarily. This is a project that perfectly fits the 2049 agenda when, as stated, they pretend to be *the biggest player in the history of the world*.
- Short term political agendas are of no concern for the chinese rulers. No concern also with a public anti-nuclear opinion as in the West. The West is not investing in this technology. So much the better for the 2049 agenda. Already it was announced that 10 more such thorium modules will be constructed. For exportation. When time comes they will own the market.

- Was there finally in China the triumph of the world of knowledge? Not necessarily. This is a project that perfectly fits the 2049 agenda when, as stated, they pretend to be *the biggest player in the history of the world*.
- Short term political agendas are of no concern for the chinese rulers. No concern also with a public anti-nuclear opinion as in the West. The West is not investing in this technology. So much the better for the 2049 agenda. Already it was announced that 10 more such thorium modules will be constructed. For exportation. When time comes they will own the market.
- **Is not science, but political ambition that drives this development.**

In conclusion:

There is at any instant of time a wide gap between the knowledge in the scientific community and the application of this knowledge to the contemporary problems of society. Will the Academies be able to narrow this gap?