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The Devil's Bridge to Science and Technology

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Abstract: We are used to celebrating science and technology, for its success in explaining the world, and for its practical benefits. However, we should keep in mind that there can also be a downside to it, since its methodology is not linked to the criteria of ethics.

In the region of Uri, in central Switzerland, there is a legend of the 13th century about the “*Devil's Bridge*”. For the transit to Italy, a bridge over the river Reuss was needed. However, the rocks were so steep that people failed to build it. When the magistrate exclaimed: “Let the devil build this bridge!”, the devil showed up and offered to do so, under the condition that the first one to cross it, will be his. People agreed happily, but when the bridge was there, they couldn't use it. At last, somebody came up with the idea to first send a goat. The devil got angry, and launched a huge rock to destroy his bridge, but he missed it, so it is still there.

The message of this legend is that technology can facilitate our life a lot, but this is not for free: it comes with a price, symbolized by a “*pact with the devil*”. There are risks attached to it, which can be hard to control; nuclear centers could be a modern analogue. Here we comment on the impact of science and technology on society, and on the responsibility if something goes wrong. In general the problem cannot be solved as easily as it was the case in medieval Uri.



Drawing of the historic Devil's Bridge in the Swiss Alps.

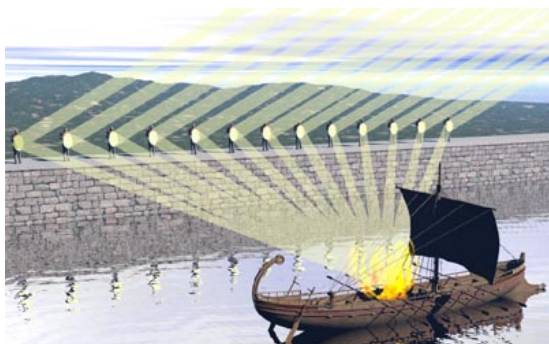
The background is a driving force of the human race. Like other species, it had to fight for survival, and to develop a peculiarity: walking on two feet freed the hands to use tools, along with reasoning to control the fire, hunt animals with traps etc. Ever since this *driving force of invention* seems to be deeply rooted in the human mind, the survival instinct entailed reasoning and systematic observation. In structured societies some people could devote full time to it, while others (often slaves) did the physical work for them. Thus a more and more advanced level was attained — an evolution which is still going on, in particular at our universities.

Apparently there is no way to stop it, at least not permanently. In the European Middle Ages cultural development was indeed frozen for centuries, until the barricades against it collapsed in the period of Renaissance. The subsequent *scientific revolution* has changed society drastically, regarding production, transport, communication and so on. This evolution still continues, recent example are the internet and cell phones. We all benefit from modern technical achievements in our daily life.

So why should we worry about this evolution? In contrast to other disciplines (like philosophy), science has relatively clear criteria for its methodology, *i.e.* for something being correct or not: logical consistence and compatibility with observations. This enabled a substantial progress — with respect to these criteria. However, they are disconnected from *ethics*, and it is far from clear if scientific progress comes along with ethical progress. This happened sometimes: the quest for objective evidence and rational investigation has been established in the judiciary, overcoming the inquisitorial methods. Also overcoming wrong dogmas about the world represents a progress of society, famous protagonists were Galileo Galilei and Charles Darwin. Last but not least, we all appreciate a much longer life expectancy than the biological cycle would require, thanks to the advances in *medicine*, which became possible after obstructing dogmas were discarded.

However, there are also numerous examples for the *downside*, the price that the “devil” requests for his pact. These aspects become particularly worrisome when technology enables powerful destruction. Modern production and transport

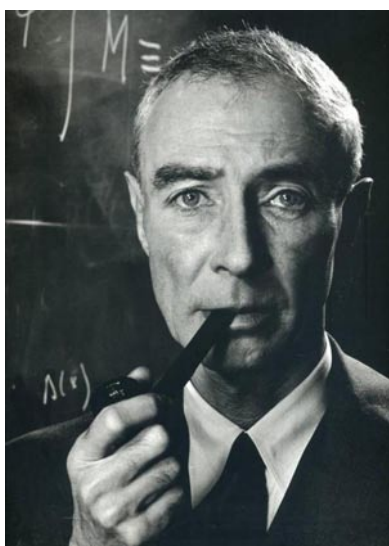
are harmful for our environment, key words are global warming and ozone depletion; ignoring it might be symbolized by the ocean liner Titanic. Another problematic example is genetic manipulation, but we will focus on the most obvious case: the development of more and more powerful *weapons*.



An illustration of Archimedes' alleged plan to defend Syracuse by using mirrors to set Roman ships on fire.

This issue is not new at all: already Archimedes (supposedly) suggested the use of mirrors reflecting sun light onto one point to put hostile ships on fire. In China of the 2nd century B.C.E., sophisticated kites were invented, which could carry a person — and which were used for military goals like spying the enemy's position before a battle. Leonardo da Vinci was not only a painter, he also designed an early prototype of a (man-driven) tank.

A completely new level was reached in World War I, with tanks, war planes, machine guns, poison gas and submarines, which were all quite new. World War II pressured scientists again to new innovations with an incredible speed — this includes jet fighters, radar, rocket technology, and finally the *Atomic Bomb*.



Julius Robert Oppenheimer in 1958, five years after being suspended from classified research.

The leader of the Manhattan Project, Robert Oppenheimer, was fascinated by the new technology based on nuclear fis-

sion, and very proud when his bombs worked in Hiroshima and Nagasaki. Years later he became more critical, and he showed little enthusiasm to contribute to the next level, the Hydrogen Bomb. At last, court banished him from classified laboratories. His Soviet counterpart, Andrei Sakharov, also transmuted from a national hero to a dissident; having led such a project is not easy to digest.

An interesting case was Ettore Majorana, a brilliant young Italian nuclear physicist, who mysteriously disappeared in 1938 from a boat near Sicily. There have been — and still are — wide-spread doubts about the official version of a suicide; rumors claim that he hid in a monastery, or fled to Argentina. Mussolini's troops searched for him — unsuccessfully — in monasteries, assuming that he could be useful for military projects (in the same year, Enrico Fermi had defected to the USA). We still don't know what really happened to Majorana, and if his disappearance was related to worries about the dangers of nuclear technology, in particular in the hands of a fascist regime.



Advertisement by the family Majorana in an Italian newspaper from 1938, asking for information after Ettore had mysteriously disappeared.

With the existence of such powerful weapons of mass destruction, humanity faces a new situation: the possibility of an instantaneous auto-extinction. This is a shocking consequence of our superior intelligence, being applied without ethical orientation; it reveals that the pact with the devil can well get out of control. We don't really know whom to blame: the scientists, economic leaders (taking profit from weapon industry), politicians (interested in power), or military officers? Or is it a matter of the entire society, which passively accepts the absurd accumulation of disastrous weapons? Neither do we know a simple solution, like the goat in Uri.

What could be done about it, if boosting science and technology is our basic instinct? In any case, the issue does not just depend on individuals. Technology with only peaceful applications sounds fine, but is difficult to

implement. Once it becomes feasible, it is hard to avoid that somebody will construct disastrous weapons, somewhere in the world, sooner or later. So do we have to live with this *sword of Damocles*?

We repeat that we all enjoy technological achievements every day. Trying to suppress them in general does not make sense. However, we do not have any magic recipe to pro-

tect us from negative excesses; this dilemma is manifestly complex. We can only encourage people — not only scientists and engineers — to remain conscious of the problem, to consider not only technical possibilities, but also their consequences. It takes caution to benefit from technology, while beware of its diabolic side, as reflected by a Russian proverb: *“If you want to eat from the same bowl as the devil, then you need a very long spoon”*.

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