# A Contribution to the Philosophy of Futurology – Part 2

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*January 2021*

## Intro

*Where is a wish there is a way.*

A definition, and a rationale for introducing the philosophy of futurology are summarised in [1]. The Part 2 presents several attempts to break through some mental deadlocks that arguably prevent the scientists to advance faster in the fields such as astrobiology and futurology.

The notions such as 'biological contingency' and 'the infinite and eternal cosmos' can conveniently be extrapolated into 'cosmological contingency'. Yet, Men have repeatedly succeeded to extract the "laws of nature" classified within a number of scientific disciplines. There is no problem with making the decisions in accordance with these "laws" whenever the targets were met repeatedly and within the acceptable tolerances under analogous circumstances; indeed such knowledge resting on these "laws" satisfies the definition** discussed in [2].

The problem appears when in the search for possible solutions, an option is aborted because of an apparent conflict with some 'well established' natural "law".

There is abundance of such scientific obstructions, For example, due to the "fundamental laws" in chemistry confirmed with the results of numerous experiments, carbon is declared to can bond with only four other atoms, because it has four valence electrons. However, a pyramid-shaped carbon molecule that contradicts this has been discovered. It contains a carbon atom that bonds to six other atoms instead of the four. This bond exists only at low temperatures inside acidic liquids, Fig. 1 [3].

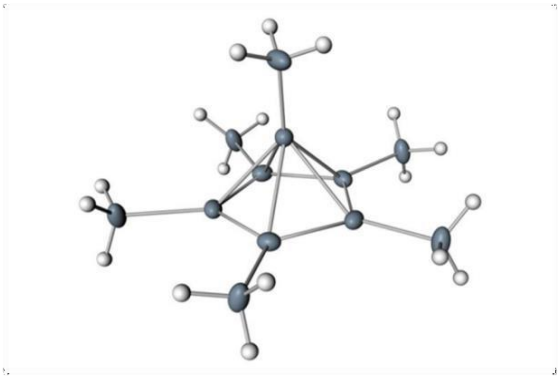

Fig 1: Carbon atom bonding with six other atoms [1]

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**) Knowledge is an intensifier for the probability of realizing the intended (planned), or understanding the observed process [2]. Here a 'process' is a generic term that denotes a very wide spectrum of cases where one form of matter is changed to another; the duration of the process can also vary across a very broad time scales. The term 'understanding' means 'becoming able to define interactions between a reasonable number of the factors, included in the observed process, and the consequences of the factor variations.

As another example, even today the sources such as The Mystery of Matter: Search for the Elements (funded by the US National Science Foundation,) teach us that the long and fruitless quest to turn Pb into Au is "a search for impossible". This source teaches us that "Thanks to modern science we now know that matter comes in more than 100 varieties, neatly arrayed in the Periodic Table, and that most of these elements (all but the radioactive ones) are fixed and unchanging: lead is lead, and gold is gold, and you can't turn one into the other." [4]

However, with the dawn of the 21st century, the transmutation of elements became possible. Nowadays, nuclear physicists succeeded in transforming one element into another. Nuclear scientists at the Lawrence Berkeley National Laboratory in California produced gold from bismuth.

Even the mass of the elusive photon that is announced to be massless is the object of dispute. If the photons have mass indeed, as suggested in the growing number of references such as [5-7] to list just a few sources, this triggers the questions that require re-examining the current theories of gravity.

Disregarding some option based on a wrong interpretation of the applicability of some "natural law" can have detrimental consequences. The abundant examples can be found in the Sci-Fi literature. In this discourse, a focus is on the impact that the ignoring the possible interactions has on the creativity potentials and education. What would happen if Nikola Tesla did just applaud to the 'science' taught by a demonstration of the Gramme machine ─ a device that was revolutionary at the time ─ during his study at the Polytechnic Institute in Graz, Austria? Not to mention what would happen if Tesla has succumbed to the influence of 'authorities' such as Edison, who is still glorified as America's greatest inventor. Or, if the contemporary scientists such as Geoff Marcy accepted the verdict by the renowned academics and funding agencies: in the final decades of the twentieth century, the consensus was that looking for extrasolar planets was beyond the reach of science, if not a pure Sci-Fi fantasy.

The discussion presented below is based exclusively on philosophical contemplations. Author hopes that this will not be seen as a repudiation of sciences. On the contrary, the intention is to inspire and encourage those who look for means of better understanding and controlling our future by means of scientific research. The contemplations that emerge after highlighting some questions about the knowledge and life are constructed in conformity with the concepts of philosophy and knowledge discussed in [2].

**Knowledge**

Philosophy (the love of knowledge) includes consideration of hypotheses for which there are no scientific means of testing at the present. Knowledge is an infinitely shareable intensifier for the probability of the consideration truthfulness. Knowledge continues to exist as long as is shared, and this includes an existence in some recorded form.

It is indicative that knowledge can continue to exist even when the intelligent living form which has been using it (and contributed to extending it) has ceased to exist. For knowledge to be used, and/or further extended, there is a need for existence of an organised system. Such system must be capable of making changes, and be able to apply the knowledge by logical combining theories and hypotheses to make or define something.

Knowledge *K(x)* can be measured by using Shannon's definition of information entropy *H(x)****:

$$K(X) = 1 - H(X) = 1 - \sum_{i=1}^{n} p(x_i) \cdot \log_a p(x_i) \qquad (1)$$

***) T Durt proposed in [9] a measure for "certainty" *C* as: *C* = 1-entropy;
where entropy is assumed to represent the degree of uncertainty of the distribution of the random variable.

The meaning of symbols in Eqn (1) is as follows:
*K(X)* is the knowledge about the system *X*, with possible unexpected outcomes $x_1,\ldots, x_n$
*H(X)* is the information entropy; a larger value of *H(X)* means that the system is more chaotic.
$p(x_i)$ is the probability of occurring an outcome $x_i$; $\sum_{i=1}^{n} p(x_i) = 1$
*a* = base of the logarithm.

The scientific conventions (in the theories of information and thermodynamic) propose for the value of *a* three options:
*a* = 2,
*a* = e, and
*a* = 10.

The following discussion is based on a comparison of how much a human and a machine (artificial intelligence, AI) can learn to know about the outcome of throwing a coin. This knowledge is needed to make a decision whether to throw a coin with an aim to obtain the outcome "head". It is assumed that none of them knew nothing about the probability of not obtaining a head in throwing an ideal coin (i.e. a coin that cannot possibly end on an edge) on an ideally flat horizontal surface. The observations from a number of experiments resulted in a statistical inference about the probability 0.5 that a single toss will not result in showing a head.

According to the information theory, in the case of the machine learning that works on the principle of binary numbers, the value *a* = 2 is applicable when machine is expected to make a decision. If the machine is programmed to make a decision to throw a coin if it has learned a sufficient knowledge then in the case *a* = 2, the machine will be unable to make a decision since according to Eqn (1):

$$H(X) = 1 - \sum_{i=1}^{2} \left[p(x_i)\cdot log_2(x_i)\right] = 1 - 1 = 0.$$

In other words, the machine knows nothing about the coin tossing system, and cannot make a decision.

With *a* = 10 => *H(X)* ≈ 0.7, and machine will consider to have gained enough knowledge thus deciding to throw the coin (accepting the risk of 0.5).

With *a* = e => *H(X)* ≈ 0.3, and machine will consider that no enough knowledge is available thus deciding not to throw the coin.

Intuitively, the inferred measure of the gained knowledge should be reflecting the actual risk, i.e.

$$H(X) = 0.5.$$

In the cases when *X* has a uniform probability distribution

$$a = [p(x_i)]^{-2} \qquad (2)$$

which, indeed, results in obtaining *H(X)* = 0.5.

In the case of a non-uniform distribution, the Eqn (2) becomes more complicated, but the relation between the entropy and the measure of knowledge remains as defined by Eqn (1).

A human has observed each of the above options, and concluded that the outcome of the system is an ideally random event following a Gaussian distribution.

The questions that arose from the above discussion is: would AI be able to discover this new Eqn (2) , unless a specific command, and all necessary algorithms and constraint have been programmed by humans?

If, the answer is NO, then the difference between the humans and machines controlled by AI appears obvious: the humans explore the phenomena such as entropy and knowledge beyond the existing knowledge, without being prompted by an immediate need, and without being told and required to do so. On the contrary, an AI driven machine is given a command to do so along with the instructions how to go about it.

If the answer is YES, does this mean that AI is a form of life?

**Life**

The discussions about the difference between the living forms and non-living matter continue without reaching a consensus. After referring to Popa [10] who listed about 100 definitions of life, the authors in [8] proposed yet a new definition.

It appears that even the ability for creating new knowledge is not a sufficient criterion for distinguishing the living and non-living form. After all, researchers are advancing well in creating a real-time neural network (an artificial "brain") by passing information between neurons through a synapse. The implications for the future of AI are breathtaking [12]

While the question of what makes the AI decisively different form the intellect of the living creatures has come on the top of the scientific agenda, the actual dilemma is whether AI can seize the control over the human fate, if at some stage acquires the capability of generating its own intentions.

As the Rebecca Gibs highlighted in her book [11], emotions (including the senses) figure among the key denominators characterising the humans (and the long chain of species known to Man). However, the emotional responses can be programmed, perhaps including the unpredictability as well.

The scientists continue exploring the above agenda motivated nowadays furthermore with the finds in astrobiology. The underlying issue, however, must not be lost out of the sight: the humans strive for freeing themselves from the constraints that limit the very existence of not only the individual human but the humanity as a whole as well.

The hope is that by enriching our knowledge we will become able to, not only modify prosperously the circumstances in which we exist, but also continue adjusting ourselves to improve our own attributes and potentials. Our knowledge is supposed to increase the chances that we shall not interfere with our environment adversely, and that we shall interfere with our own evolution in a most beneficial manner.

Both Stanislaw Lem and Arthur Clarke predicted an utmost futuristic projection of a most advanced living form: an out-of-this-world superior intellect pervading the space; independent of the time, location or any other imaginable dimension; knowledgeable beyond the limits known to Men; amiable to the immense spectrum of non-parasitic forms of life.

Generally speaking, not to mention how far we are currently from that level of mind and knowledge, the best of our sciences are carrying us in a right direction. However, both Clarke and Lem envisaged that the presence of such cosmical intellect was required in order to prevent the humans from destroying the existing life forms, including the humanity itself.

It is quite intuitive of the human race, to come up with models of such almighty beings in the form of various gods. Unfortunately, in spite of the best intentions, none of the plead of heavenly deities seems to have had sufficient resources to eliminate the troublesome consequences of the human wrongdoings.

Hence, we shall need to rely on our own wisdom and knowledge. The sparks of such trends are long present in the human history. The list of the great minds and scientific achievements in the history of sciences would require this discourse to be turned into volumes of encyclopedias.

Common opinion leans towards the eco-friendly lifestyles, the vegetarians have already proven that the symbiotic coexistence is achievable, and the despise of accumulating the individual wealth is growing in all social structures.

**The distant future**

One of the fundamental challenges that might become object of scientific focus is the conversion of the dark matter into the baryonic matter, and ultimately into the atoms and molecules.

Baryons are "heavy" subatomic particles such as protons and neutrons; electrons, however, do not belong to the class of baryons). The scientific hypotheses propose that dark matter is non-baryonic and is composed of some, as-yet undiscovered, subatomic particles that do not interact with the electromagnetic field. That is: in accordance with the state of our current knowledge, and the hypotheses derived on that ground.

This knowledge allowed us to experiment with the nuclear forces. The current research into nuclear fusion is well advancing, and the experiments with the tokamak reactors [14] demonstrated reaching temperatures at which the sun – our natural nuclear fusion reactor – operates for billions of years. Once such self-sustaining source of energy is developed, the Man will have open the gates for Astronomical Engineering.

Yet, the definitions of the most basic scientific concepts such as time, mass, temperature and the velocity (e.g. the velocity of the light), are questioned increasingly [2, 5-7, 13, 15, 16], To advance, there will be a need to promote new basic units in the future, and reverse the currently used hierarchy. The concepts such as the rate of the change, entropy, the intensity of the interference and the magnification scale will be used to explain the phenomena we are discovering, but not able to explain.

As our expanding knowledge allows for a more meaningful observations and interactions based on these new dimensions, the fear of the expanding Universe will become meaningless.

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