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Article

Action acceptor in evolution

The anticipated future in biological evolution

Mit'ka Vyssotski[1-4]

The desired result of any process is represented in an organism by an action acceptor, consisting of two parts: the part which is absent yet and the part that is represented by material reminders of the said action acceptor. The absent part belongs to ideation space. There is no physical time in the ideation space: all entities are given simultaneously. The entities comprise, in general, a computably non-enumerable set – one entity can contain in itself one or more the same or different entities (no conservation laws). This feature provides the possibility to resolve contradictions that are unsolvable in 3D physical space. Evolution proceeds through the interaction of ideation space with 3D physical space by means of action acceptors. The development of each action acceptor precedes the appearance of its positive result by several generations and consists of selection of its material reminders through the self-election of organisms for differential reproduction.

In eukaryotic organisms, the appearance of material reminders of an action acceptor is possible from the pool of dormant genetic loci (or "dormant genes", named so by J.W. Harms in 1929[1,2]) – through the involvement of epigenetic inheritance. The self-selective reproduction, namely reproduction of organisms with better developed action acceptors, can proceed despite possible identical phenotype of all above-mentioned organisms. In other words, even with identical phenotypes (the achieved developmental results), biological evolution can proceed through the differential reproduction, wherein organisms with better developed action acceptors (with higher quantity and quality of the material reminders of the said action acceptors) reproduce better (even when the achieved results of these action acceptors are absent in the ontogenesis of these organisms). Contrary to the differential reproduction, the differential mortality is relatively rare in nature and its evolutionary results are rather limited – in nature the mortality is mainly a statistically random and genotype-independent process, as it was discussed by Nikolai Ya. Danilevski in 1885[3-5].

The existence of an anticipated future is so important for all organisms that it can be used as a definition of life: if an organism has its own anticipated future – it is alive, otherwise it is not alive. Not only animals, but plants, fungi, bacteria and viruses all have their own action acceptors and anticipated future. The interaction between the ideation space and the space of vulgar materialism (our 3D physical space) is important up to the level when it can be used as a definition of consciousness: the consciousness exists only when there is an interaction between ideation space and 3D physical one. There is an unavoidable link between life and consciousness, and evolution of life can be considered as evolution of consciousness, as it was declared by Pierre Teilhard de Chardin in 1955[6].

The statement that the differential reproduction is important for evolution is not new *per se*, however the idea that it provides possibilities for selection of material reminders of action acceptors and, thus, provides possibilities for evolution of the said action acceptors, was not discussed previously. The above-mentioned evolution of action acceptors always goes several generations ahead of the subsequent appearance of the corresponding morphological or other easily detectable phenotypic traits. This in advance development of an action acceptor serves as a basis for the "law of precession of characters" or "nomogenesis", defined as "evolution determined

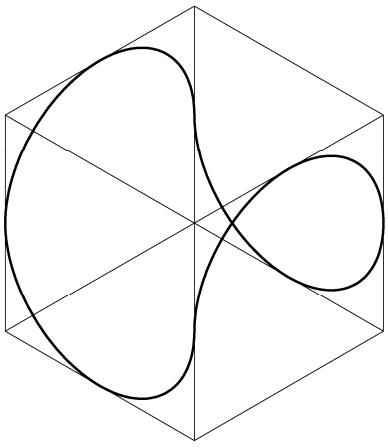

Figure 1 | Problem. Heavy chain or liquid moves without a friction in a narrow tube with speed V_1. The tube is looped in four half-circles around a cube in 3D. What will be the speed V_2 of the said heavy chain or liquid if this contour will be transformed from the said 3D structure into a simple circle in 2D? The total length of tube remains the same. No friction losses.

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by law" by Leo S. Berg (1922)[7]. Morphological evolution of available and extinct *Metazoa* was shown to be going on the basis of law, by means of precession of characters, where characters originally manifested in the young along in the course of time and evolution were displayed also in adult descendants (or supposed descendants) of that organism. Evolution is determined by law. The law is determined by action acceptors.

The term "action acceptor" was introduced by Peter K. Anokhin in 1955[8], however the necessity of this entity was recognized by him much earlier and can be traced back to 1932[9]. At that time typical examples for illustration were taken from the behaviour of dogs. Any activity of organisms can be used as a source of examples for illustration of the role of action acceptors: any foraging behaviour, any predator-prey interaction, any reproductive behaviour, etc. We will start with complex human behaviour, but not with reproductive one. Any reference to reproductive behaviour will block further discussion at the beginning (it is impossible to discuss human reproductive behaviour with humans – neither in folkloristic terms, nor in scientific or medical ones) – the role of anticipated future is self-obvious in human love, especially in human females, but the subject is so emotionally super-charged (a reference to Sigismund Schlomo Freud could be placed here), that we will use other examples to be safe. In addition to the overwhelming complexity of this issue we can refer to the observation of Bernard Shaw[10]: he has mentioned that the said entity [human love] is much rare in human population than humans would like to believe. Bernard Shaw wrote on the 6th of August of 1889 with respect to "Tristan und Isolde" of Wagner (pp. 275-276)[10]: "Tristan and Isolda comes off better than Parsifal by just so much as the impulse to play it is more genuine and the power to understand it more common. To enjoy Parsifal, either as a listener or an executant, one must be either a fanatic or a philosopher. To enjoy Tristan it is only necessary to have had one serious love affair; and though the number of persons possessing this qualification is popularly exaggerated, yet there are enough to keep the work alive and vigorous".

We have chosen the following two examples of human behaviour to illustrate the properties of an action acceptor and the features of ideation space.

Cube

The first example consists of the process of solving some problem in the field of classical mechanics (**Fig. 1**). In the process of solving this problem we would like to find an answer and solution – and the answer and solution could not be taken from our memory or other sources (very difficult situation). However the action acceptor – the desired solution and answer – are directing our behaviour, despite they are not known to us yet. Note that this or similar problem could be equally solved in 1725, 1825, 1925 or 2025. And the solution and the answer remain the same. There is no physical time in the ideation space – everything is given in the ideation space simultaneously – as it was mentioned by Mikhail M. Bakhtin[11] with respect to novels of Fyodor M. Dostoevsky, and we can derive the same idea from the contemporary service (*Mahzor Lev Shalem*[12], *Siddur Lev*

Figure 2 | G. Pruefer large-bore clarinet (s/n 4987, circa 1910, USA). It has articulated C#/G#, Selmer large-bore barrel, "Denman 3+" glass mouthpiece, narrow metal ligature and Vandoren Traditional 1.0 reed.

Shalem[13], *Haggadah Shel Pesach*[14], etc). However, some local physical time can always be introduced, if necessary. Another example of the local time introduction can be found in a human song, when a singer first explains a tragic story in a calm voice and then, several seconds later, when a topic and wordings are switched back to everyday life, the expression of emotions goes up to extremely high level, atypical for the everyday life tasks.

Clarinet

The second example is about playing a clarinet (**Fig. 2**). When we are playing this instrument we would like to have nice and clear sound. All human actions, position of human lips, direction of air flow inside mouthpiece are optimized for this purpose. Reed, mouthpiece, ligature and barrel (**Fig. 3**) are all selected (and sometimes from very large spectrum of these items) in order to have the desired sound. This situation is typical for any interaction of material items with ideation space: sound quality depends on material elements and laws of physics; however these material items have been chosen themselves by a human to provide the anticipated sound and this choice was dictated by the ideation space. Some musicians have hundreds of mouthpieces, dozens of barrels and several clarinets. Sometimes even the whole main instrument is chosen by a musician with a large bore, in order to sound like a cello in its lower register – I mean here the old British clarinets that were praised by Bernard Shaw, namely on the 1st of August of 1894 (pp. 116-122)[15]. One such sample was played by John Denman (famous British clarinettist; the glass mouthpiece from the **Fig. 3** was developed by John Denman for large bore clarinets; the shown sample is called "Denman 3+"). Today all mass-produced mouthpieces are for narrow-bore clarinets or, like "Vandoren M30D", – for mid-bore clarinets like Noblet metal clarinets with "raised diamond", "non-raised diamond" or "raised non-diamond". "G. Pruefer Silver Throat Deluxe", compatible with "Vandoren B45 Dot", also should be considered only as a "mid-bore clarinet", in view of large-bore British clarinets, praised by Bernard Shaw.

Figure 3 | Clarinet parts. Box with reeds, barrel, mouthpiece, ligature and single reed. This reed has strength 1.0 and it is called "very soft". The ligature with one screw is prepared from the upper part of standard metal ligature (with two screws). Mouthpiece "Denman 3+" is made from heavy glass ("crystal glass") and it is compatible only with large-bore clarinets.

Clarinet, as it was known to Bernard Shaw at the end of 19th century, has nothing in common with modern instruments. During the 19th century the leather pads were invented. They provided good sealing without previously annoying leaks. At that moment clarinet was played only by musicians who were able to play nicely even with significant pad leakage. Humans were providing compensation by air flow, optimizing its direction, position of lips, etc. And as soon as all leaks were eliminated, the sound of British clarinets was widely praised. A lot of people wanted to buy and play this instrument after the end of WW1.

And they were unable to do so. Clarinet was a large-bore one, designed to provide outrageously beautiful sound in its lower register, whereas all upper registers were intended to be played... by experienced musicians. Now we have a market-driven economy and narrow-bore clarinets, called "professional", but optimized for lazy kids from wealthy families (the main customers for the most expensive instruments today).

Saxophones have avoided this fate only because they all have exactly one octave between registers and random and unintended jumps between them produce less terrible impression.

Clarinet has one octave plus 7/12 of octave (octave + perfect fifth) between registers. Exactly for this reason the term "articulated C#/G#" means that the same key is C# for the first (the lowest) register, but G# for the next one (called "clarion"). And a random and unintended jump between them makes any lazy kid ridiculously funny. This is the reason for degradation (in terms of sound quality, but not in terms of gross income) of the whole clarinet industry in a market-driven economy.

Anticipated sound

However, where the desired sound can be found, where it is "stored"? Contrary to usual sound, which can be recorded by a microphone and stored in a digital or analogue form, the desired sound cannot be investigated by means of physics and chemistry, and, thus, it is not material in accordance with definition of vulgar materialism, introduced by Ludwig Büchner[16] in his book "*Force and Matter*" (1855) many years ago, even before the first publication of "*The Origin of Species…*" (1859) by Charles Darwin[17]. The desired sound can be found in the ideation space. Similar ideas were discussed by Henri Bergson[18] in his book "*Matter and Memory*" (1896), because memory is also an entity from the ideation space. The term "ideation space" (but not the "space of ideas") was not used at that time (introduced much later, at the end of 20th century, by Boris L. Zlotin[19]). However it was Bergson who has correctly pointed out to the main feature of the ideation space: ideation space may contain computably non-enumerable sets of objects. One object can contain in itself one or more similar or different objects and their number is unknown in principle. Many known mathematical theorems are not applicable to such space. The number of dimensions in this space is also computably non-enumerable and it cannot be claimed to be 3D, 4D or any other. Contrary to the ideation space, the material 3D physical space contains usually only computably enumerable sets (number of neurons, number of genes, number of synapses, etc). And some known technical difficulties of calculation, which can be present sometimes, do not make those sets "computably non-enumerable" – they are still fully computably enumerable sets, and the vast majority of theorems of the contemporary mathematics is fully applicable to them.

The anticipated future in simple organisms

When we are speaking about "anticipated future" humans have a tendency to imagine *Homo sapience*, or at least some mammal with higher brain functions, but not a mould or a virus. However it was Nikolai Ya. Danilevski who has pointed out in 1885 that the main question of evolutionary theory is not to explain how a monkey has developed from a frog, but how a frog has developed from a mould (and Darwinism can nothing to do in this respect). When we have a virus with its specific receptor for interaction with particular mammalian cell, we do know that this virus is prepared for interaction with this mammalian cell, even if the cell is absent in the vicinity of this virus during given period of time. It means that this virus has its own anticipated future and this anticipated future includes in itself the anticipated interaction with mammalian cell, even if this cell can never be found (both by virus and by humans – we can consider even this extreme example). It means that the anticipated future determines to some extent the behaviour of this virus and it determines to some extent the evolution of this virus. For the virus the anticipated mammalian cell is exactly an imaginary entity (until the real interaction with it in 3D physical world will happen, at least). When we have a regulatory site of dsDNA for binding of specific transcriptional factor (a protein), we may know that this site is prepared for binding of particular protein, even if this protein is absent or cannot be found in this cell and its nucleus during given period of investigation. For a regulatory site of dsDNA the anticipated transcriptional factor comprises its own anticipated future (which will or will not be materialized with some realistic or non-realistic probability). Anyway we should not think about an anticipated future as about something super-intellectual, because even a plasmid has its own anticipated future (because it has sites for binding of proteins and for interaction with cellular machinery).

Reminders

However if there is one computably non-enumerable set in the ideation space and one, presumably corresponding, computably enumerable set in the 3D physical space, there could not be an unambiguous point-to-point projection from the computably non-enumerable set to the computably enumerable one and *vice versa*. The material entities that could be found in brain or genome can have only status of a "reminder" or, even better, a "material reminder" for computably non-enumerable entities from the ideation space.

The importance of "reminder", however with slightly different meaning, more like a procedure than an element, was extensively discussed and investigated with respect to learning and memory at the end of 20th century by Konstantin V. Anokhin[20,21], a grandson of Peter K. Anokhin. Look at the **Fig. 5e**, where we have a short episode of clarinet record – the transition from the first note to the next one from the **Fig. 4b**. Each note, as we can see from the **Fig. 5a**, has its own "the beginning", "the middle" [of the stream], and "the end", and all these three parts do have their own duration and can be played differently, whereas on paper (**Fig. 4b**) each note is characterized only by some frequency of sinusoidal wave and by its duration. In the record we do have very complex signal, which is also sort of periodical, but it is as far from sinusoidal wave as one can imagine – and it

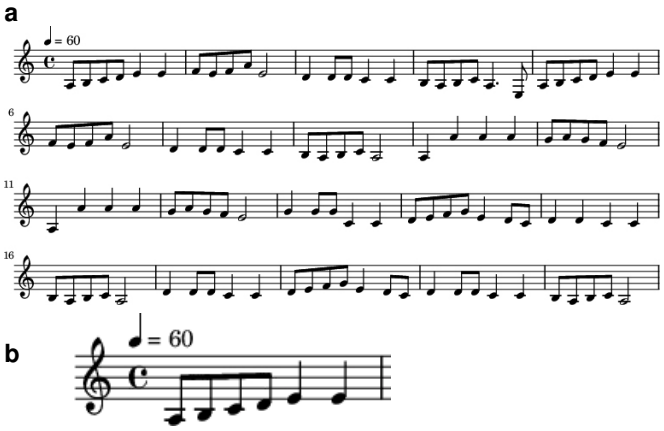

Figure 4 | Musical pieces for clarinet. The lowest note in (**a**) is the lowest one that can be played by this instrument. References to audio files:

http://www.evolocus.com/evolocus/v1/evolocus-01-037-sa1.mp3 – MP3 file, 16-bit, 48 kHz sampling rate – small file, good for listening (3.2 MB) – clarinet sound of the piece (**a**) (recorded by mid-side technique).

http://www.evolocus.com/evolocus/v1/evolocus-01-037-sa2.wav – WAV file, 24-bit, 192 kHz – large file, the same record; the next **Fig. 5** was prepared using "Mid" (the 1st) channel of this file (112.9 MB).

is only a simple transition from one note to another one played by a rather primitive instrument (**Fig. 2**), which cannot play chords, for example, contrary to a piano. However, the phase of the sound wave is preserved here during this transition, as we can see from the **Fig. 5e**; and humans can feel this preservation of the phase as pleasant. This record was done by Warm Audio WA-87 condenser microphone. The signal passed through Neve Portico 5012 preamplifier and after very mild compression by Neve Portico 5043 compressor, placed after preamplifier, it was digitized by LynxTWO-A audio card at 192 kHz with 24-bit resolution (further details can be found in the **Methods** section).

Any notes, printed on paper, are only reminders for music, but they do not contain music themselves. The anticipated sound belongs to a computably non-enumerable set, whereas the already recorded sound contains only computably enumerable entities. A single note can be played by a plurality of ways and these ways comprise a computably non-enumerable set. However it will be an erroneous simplification if we will say that a playing human has some "anticipated sound" and that this player is just "pushing" the "real sound" (that can be recorded by a microphone) towards the anticipated one. The above-mentioned process does exist, of course. However in addition to it, the production of sound using a clarinet or cello involves a lot of procedural memory. And this memory is only to some extent under the direct feed-back-loop control in real time, because it was mainly acquired in advance, during previous self-training. It means that the performance is always slightly out of direct control of a human consciousness, the consciousness of a player. That is why it is so interesting to play music. When we are playing, it is seems to us that the music is played, just a little bit, by somebody else. And this "somebody" can sometimes play even better than we can think about ourselves!

If our performance would be based solely on declarative memory (this is the memory which we are trying to use solving problem about speed during the conversion of 3D movement into

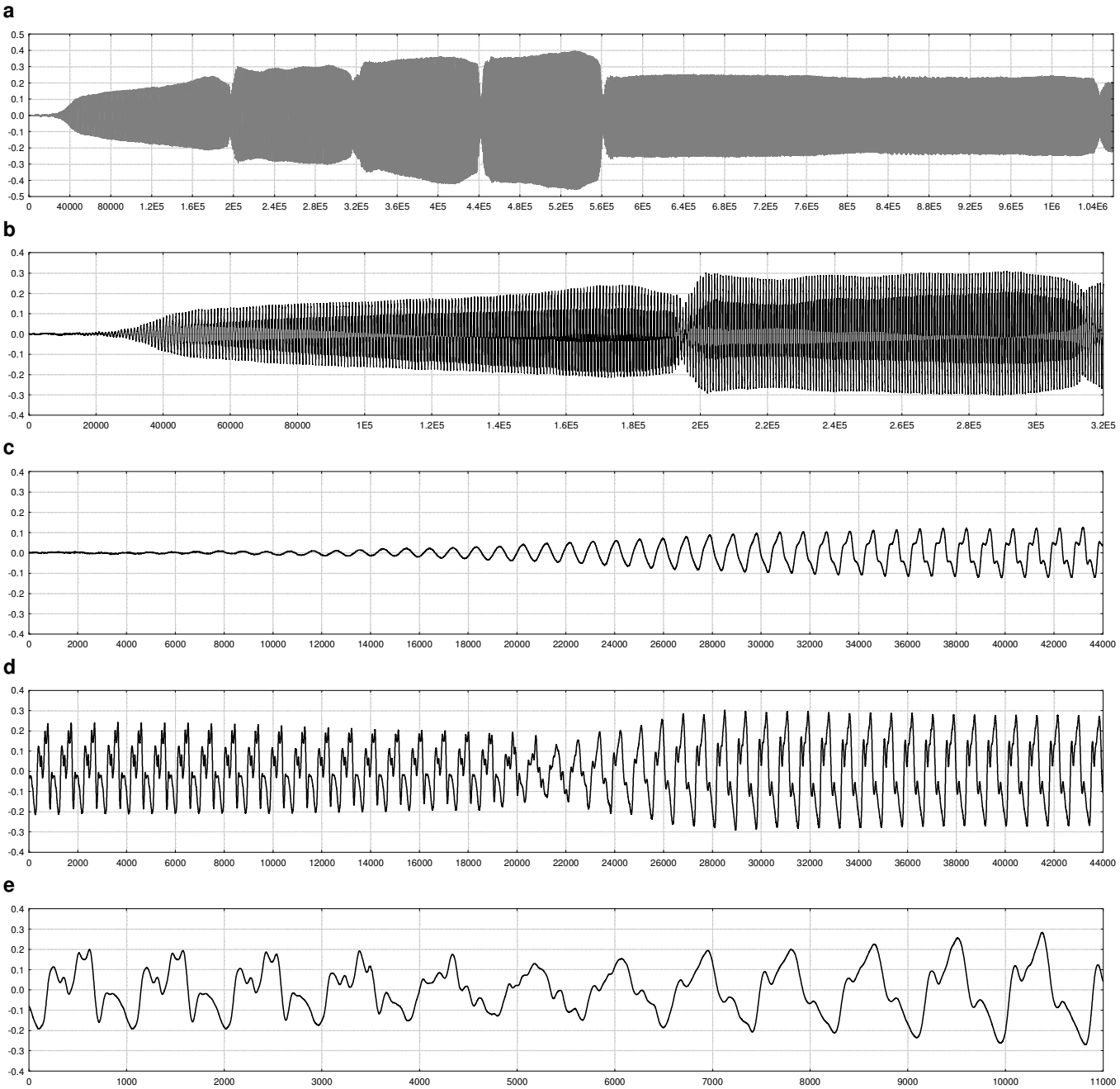

Figure 5 | Clarinet sound records. Abscissa – counts of ADC (192 kHz); ordinate – linear amplitude (24-bit original resolution). (**a**) The first measure (six notes, **Fig. 4b**) of the **Fig. 4a**; it contains slightly more than one million counts of the analogue-digital converter (ADC). (**b**) The first two notes. (**c**) The beginning of the first note. (**d**) The transition from the first note to the second one. (**e**) The same as (**d**), but shown with higher temporal resolution.

2D, **Fig. 1**), we will be able to hear nothing new, nothing unexpected in our own music. However due to the procedural memory (it is called sometimes, especially in the field of neuro-linguistic programming (NLP)[22,23], a "kinesthetic memory") we can hear sound as it would be played by some "other", by another human being. And this is a miracle! And there is one more complexity on the top of this: when we are playing music, it represents not our spirit, but a soul of another person, the soul of a character of this musical piece. So, it is not only feels like music of another human being, but it is officially and *de facto* a representation of another soul. A human "soul" is always a representation of human spirit in a consciousness of another person (or G-d, as it was mentioned by Mikhail M. Bakhtin[24]). All published articles of Bakhtin are strictly secular; however he was definitely familiar with religious thought-style [*Denkstile*, after Ludwik Fleck[25]], contrary to many contemporary scientists.

As soon as we have a computably non-enumerable set, we automatically do not have in this set any conservation laws, such as physical laws of conservation of energy, conservation of impulse, conservation of the moment of impulse, conservation of

charge, etc. We can speak, for example, about "psychic energy", if we would like to do so, but there is no "law of conservation of psychic energy", because the psychic energy, being mostly an entity from the ideation space, can appear from nothing and it can disappear without a trace in the middle of nowhere.

Contradictions

Biological evolution rather often proceeds through differentiation, when something (one entity) is splitting into something different (two slightly or significantly different entities). In many cases the differentiation is driven by a contradiction. However, in a living organism something remains always unknown or hidden from us. It is easier to understand the role of contradictions in differentiation using evolution of technical systems. Technical systems are basically known for humans, because they were constructed, but not discovered. A contradiction between positive effects and cost factors is among the most popular ones. A contradiction between performance and efficiency is not rare either. When we are trying to improve something, something else is going to be disrupted, degraded or just will not be good anymore. Let's consider two examples.

Performance cores and efficiency cores in processors

In the evolution of processors (CPUs) the first central processing unit (CPU) had only one core. Then, processors with two and four cores were introduced. In a stationary system, with mild limitations of power usage, all cores can be perfectly identical. However in a mobile system, like in a phone, which should not be in a completely "off" state, the requirement of lower power consumption and high performance are in contradiction with each other: it means that when we would like to increase performance, we will increase power consumption, and when we would like to increase efficiency, we will disrupt performance. Some optimization is always possible, even with a single core or with a plurality of identical cores, which will have slightly better performance and slightly lower power consumption. However, the above-mentioned contradiction was in fact resolved, when the first processor with two categories of cores was introduced. The most remarkable example had two "performance" cores, optimized for the best performance, and two "efficiency" cores, optimized for the best efficiency. It was so called "A10" "Fusion" processor, developed for "iPhone 7" by "Apple" company at the beginning of 21st century. It was using either two "performance" cores or two "efficiency" cores, but "performance" and "efficiency" cores were never active simultaneously. Later processors, like Intel processors for desktop and laptop computers, were able to use "performance" and "efficiency" cores simultaneously, but we will not discuss their further evolution here. In order to avoid a simplistic conclusion, the second example is always necessary.

Honda VTEC engine in cars

At the end of 20th century the first mass-produced combustion engine with VTEC ("Variable Valve Timing & Lift Electronic Control") was developed by Honda, and we will use some version from the year 1989 as an example (**Figs. 6-8**). A combustion engine, in addition to crankshaft with pistons,

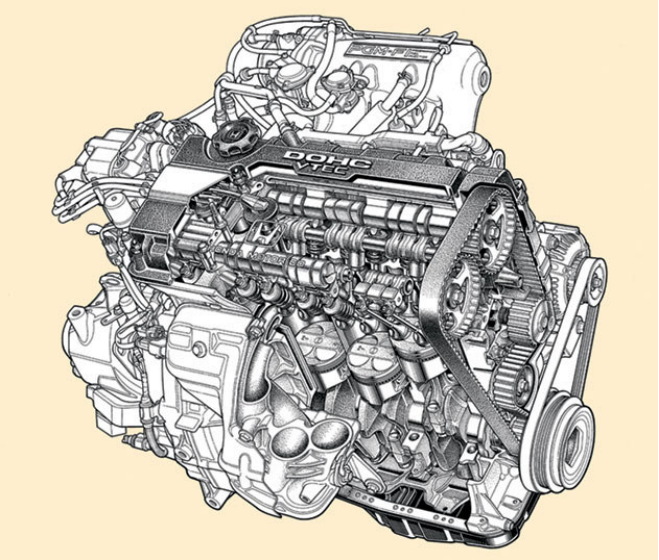

Figure 6 | VTEC engine. VTEC (Variable Valve Timing & Lift Electronic Control) engine was developed by Honda and introduced in 1989 in mass production. Note 3 cams (1 central & 2 peripheral) for each two valves.

always has at least one camshaft which opens and closes intake and exhaust valves by means of corresponding cams. A form (a profile) of a cam can be optimized for given speed of crankshaft and camshaft rotation, taken into account air flow and its properties; it can be optimized for the best performance – the highest possible torque. However when the speed of crankshaft and camshaft rotation goes up several times (let's say from 2000 RPM to 6000 RPM), we need to open valves wider and for a longer period of time, in order to have the highest possible torque at the highest possible rotation speed. It is obvious that one single cam, one single profile, cannot be optimal for both high and low speed of rotation simultaneously.

This contradiction cannot be solved with single cam profile. That is why it was invented a camshaft with two different cams (with two different profiles) for a given valve, and a special mechanism, manipulated by oil pressure, was developed in order to engage one or another cam to handle this valve. At the level of the whole engine it was one set of cams of camshaft to be in use at low rotation speed and another set of cams of the same camshaft to be in use at high rotation speed. The first VTEC engines were optimized by Honda for the highest performance (highest torque) for both high and low rotation speed, and were very good for cars with manual transmission (I still remember "Rover 623si Sport" with Honda engine (2.3L non-turbo) that was able to reach 220 km/h between Zürich and Bern and 230 km/h between Zürich and Rome, at some parts of the way). Later, taken into account an automatic transmission, it was possible to optimize cams for low rotation speed for high economy, whereas cams for high rotation speed – for high performance, and several other steps were possible, but we will not discuss further evolution.

If we look at any technical system or living organism – it contains only computably enumerable set of elements. In our previous example it is either old engine with one single cam per valve or new Honda VTEC engine with two different cams per

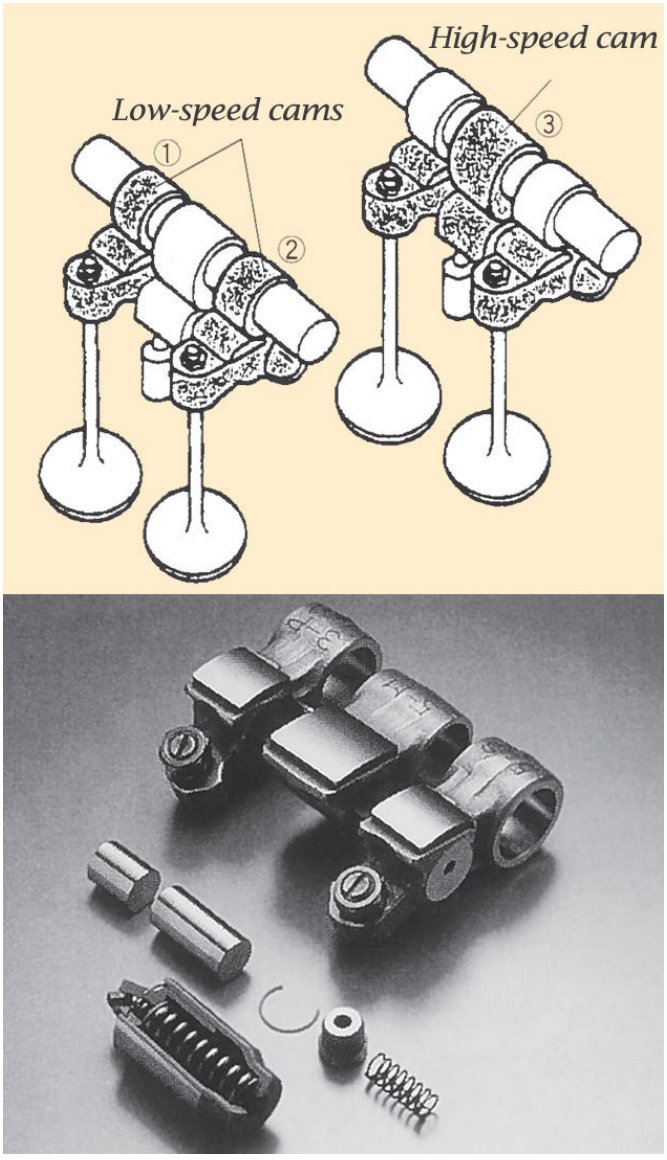

Figure 7 | VTEC schema & photograph. Two cylindrical pins are moving (↔) by application of different pressure of engine oil by a control system.

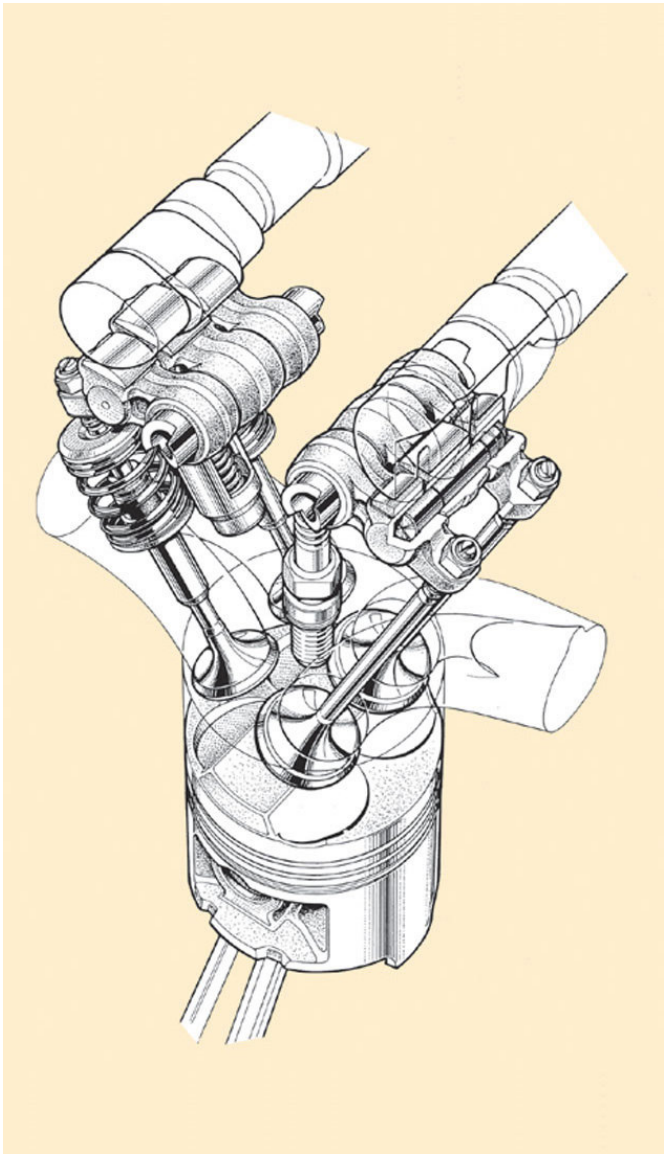

Figure 8 | VTEC drawing. One piston is shown with four valves (2 intake and 2 exhaust valves) and two camshafts (intake & exhaust camshafts).

valve – it is always a computably enumerable set in 3D physical world. There is no splitting or emergence of two different cams from one cam and no splitting or morphing of one processor core into two different cores in our material world. Cams of different types and cores of different types are manufactured as different pieces from the beginning of their technological process. However the above-mentioned splitting, emergence, division or morphing was done in the ideation space, where it is technically possible, due to a computably non-enumerable set. The solution was found in the ideation space, where the entities are not computably enumerable. Only afterwards the same solution was materialized in computably enumerable set in 3D physical world.

Ideal functional system

Contradictions are always present in evolution of any technical system and in evolution of any functional system of a living organism. And if those contradictions would be handled only by means of optimization, but not by means of resolution (which is possible sometimes only in a computably non-enumerable set), the results of evolution would not be so impressive, as we can see now, both in the field of technical progress and in biological evolution. The similarities between technical progress and biological evolution exist due to common driving factor: a drive towards ideal technical system or ideal functional system of an organism. The ideal system is a non-realistic system that contains only positive effects/results, whereas all negative effects or cost factors are equal to zero. Ideal system has no weight, it cannot be broken, it does not require any energy, and it does not require any time for its ontogenetic development, however it produces the desired positive result/effect where and when it is necessary. And because an ideal system typically cannot be found anywhere (it is an idealization *per se*), any real system can evolve further through not only its own optimization, but through

resolution of contradictions between its positive effects and cost factors, those always can be found. And in order to resolve contradictions, we have to go to the ideation space. Ideation space is in use by all organisms, which do have their own anticipated future and remembered past, *i.e.* by animals, plants, fungi, and by all unicellular organisms and viruses.

Action acceptor and hopeful monsters

An action acceptor is necessary for two purposes: to resolve a contradiction and to materialize in ontogenesis the result, the solution of the contradiction that is already resolved. The role of action acceptor in resolution of contradiction is similar to its role in solution of any problem with atypical appearance, like problem from the **Fig. 1**. Thus, it is a rare event and a field of "hopeful monsters" of Richard Goldschmidt[26,27], who has entitled his book as "*The Material Basis of Evolution*", keeping in his mind that there is also "a non-material basis of evolution", and it is even more important than the material one (Goldschmidt has received traditional education; that is why we are sure in our speculations). Now we do know that biological evolution always goes through the interaction of the ideation space with the space of vulgar materialism. And our current task is to show how exactly it proceeds in very different species, just from the beginning of life, literally.

Differentiation in ontogenesis

Ontogenesis of animals, plants and fungi, and *Metazoa* in general, was always known as a rather stable and canalized process, where the final functionally (useful phenotype) can be achieved despite unexpected mutations, sometimes mechanical damage or chemical poisoning, detectable or experimentally introduced during ontogenesis. When a single group of cells is going to be differentiated into two different ones, one of them is typically can be named "new", whereas another one remains mainly "old". In order to be a successful differentiation, it is sufficient that at one time point all "old" cells, without an exception, were trying to convert into "new" ones, but only the successfully converted cells will send a feedback to the rest of old cells that will stop their further conversion. See Supplementary Fig. 9[28] & its discussion[28]. In early experiments with morphogenesis such feedback was shown to be a diffusible substance (in some cases) and the term "embryonic inductor" (and in the earliest publications – "evocator") was associated with this process. Thus, the "old" cells, those have received this feedback, being morphologically the same as at the beginning of this process of differentiation, are not in the same state.

In old times humans were saying that the "embryonic inductor" has changed the state of these "old" cells, directing them to some other route of differentiation, not towards already achieved and quantitatively sufficient population of "new" cells. We would like to say about the same process that each cell at the beginning of this process of differentiation has an action acceptor, the activated action acceptor at the beginning of this differentiation, and as soon as the desired result is achieved, the cell produces a feedback towards the rest of similar cells, and this feedback "says" to them that this result is already achieved to some minimal extent. Taken into account statistical dispersion, both temporal and spatial, among any group of cells, we can see why ontogenesis can be so well canalized. Nothing can be done really "simultaneously" in early ontogenesis, and the discussed variability at the cellular level, being completely random, is not a disrupting factor, but an absolutely necessary factor of ontogenesis.

In order to have an evolutionary new group of cells it is sufficient to have an activated new action acceptor during ontogenesis of one old group of cells and it is absolutely necessary to have a feedback and a reception of this feedback by the old group of cells, the reception that will stop their further conversion/movements towards the new group of cells, because it is absolutely necessary to suppress such conversion. And whether this suppression will be specific or barely specific, or even general, depends on evolutionary stage of this new cell group. If the cell group is really evolutionary new, may be the only general mechanisms of suppression are readily available (like immune system can suppress cancer cells in adult healthy mammals), whereas the specific feedback is always preferable, if available, from the standpoint of the efficiency of ontogenesis (like in a classically known case of "embryonic inductor", which is a feedback from the morphologically achieved result, as we have discussed earlier).

Early evolution without replication

At the earliest stages of evolution, when not only all multi-cellular organisms (*Metazoa*) were absent, but any cell itself it was impossible to find, and replication of any heritable material (known today as RNA and DNA) was possible with so many errors that any propagation of any lineage was technically impossible, the action acceptors played an important role in collecting of more or less acceptable variants of replication or pseudo-replication (pseudo-replication – because it was often impossible to say, which lineage has produced given molecule or a "piece" of expected molecule – it was just available or "found" in the environment). We do not know "how" these molecules or semi-molecules were collected, but we know that the only way to have a self-propagated process, keeping very low reliability of replication, was to use simple and "short" (in a molecular sense) sequences to collect (and "select") from the environment the sequences that occurred to be by chance more or less good-replicated or seemingly "good-replicated", because at these early stages they could be just randomly born in the environment due to unknown and may be irreproducible sequence of events ("unknown" not only to us, but unknown to any living entity during these early stages of evolution) – it could be just in a vast majority of cases the result of some statistically random processes. But they were selected in a non-random way by simple (at that time) action acceptors. Those action acceptors had very simple task: just "keep and hold" what has been found useful or seemingly useful by them. We all know that DNA was discovered as a structure due to its ability to "crystallize" or to form long-range order in a semi-crystal (see "*The Double Helix*" by Jim Watson)[29] – and the same ability may be was used many millenniums ago to collect and to "keep together" more or less similar pieces of DNA, when replication in modern sense (as a "covariant reduplication") was technically impossible (no DNA-polymerase, no RNA-polymerase – nothing useful for this purpose was available)! The old human idea about "self-replicated" molecules at the earliest stages of evolution is false:

such molecules were never available. The action acceptors were self-collected and self-selected as a whole and "in pieces" and the first "reparation" was done to fill out the holes between available and collected pieces. It is self-obvious that the mechanisms of reparation were introduced in evolution many-many billions of generations before the invention of the first very primitive mechanisms of replication. The replication has evolved on the basis of reparation, but not *vice versa*.

And cells also, at the beginning were randomly organized foam particles (bubbles). They were randomly formed and randomly destroyed, wherein the genetic material, more robust mechanically in general, was holding necessary components together, when the foam or envelope was temporarily destroyed. Then, instead of random and semi-stochastic disruption, the sell "division" was introduced as an anticipated facilitation of stochastic disruption into the two semi-equal pieces. See Fig. 6[28] & discussion[28]. And the nucleus was introduced even later, when chromosomes were so long, that they were difficult to distribute during cellular division or "anticipated disruption" as we have said earlier – it is the same process. And with the introduction of nucleus, or may be a little bit later, the dormant genes were introduced and widely spread in all eukaryotes and especially in all *Metazoa*, as it was discussed buy Wilhelm Jürgen Harms (1885-1956), known also as J.W. Harms, before the Second World War. The existence of *Metazoa per se* was impossible without dormant genes.

Action acceptor and its propagation in population

Dormant genes were immediately recognized as an important resource for both material reminders of further action acceptors and for building of solutions for formulated problems in the form of action acceptors that have been developed earlier. In all eukaryotic organisms dormant genetic loci should be considered as a primary source of genetic novelty, in addition to traditionally considered mutations. In the **Fig. 9** it is shown the appearance and propagation in population of some action acceptor and its corresponding solution, the solution of this local evolutionary problem. An action acceptor always consists of some material part (that we describe as "material reminders" of this action acceptor) and another part, which belongs to the anticipated future and it is not material yet (it cannot be investigated by means of physics and chemistry). Thus, we can describe the propagation in population of a new action acceptor as a propagation of material reminders of said action acceptor.

Said material reminders can be registered by scientific means, but they do not bring to the organism any positive effect. They are propagating in population only because their carriers do have subjective drive for better reproduction than others. When a component of the desired morphological trait randomly appears in population (as a classic mutation or as a dormant gene that is brought out of dormancy by epigenetic means), said action acceptor detects this event and makes particular organism more happy than others, and by such subjective way it becomes self-elected for further reproduction.

Let's consider for the sake of simplicity only one material reminder in one locus. Let's assume that there is one organism or very small group of organisms which has one new mutation or one previously dormant gene that has been taken out of dormancy by epigenetic mechanisms. Note, that because is it just

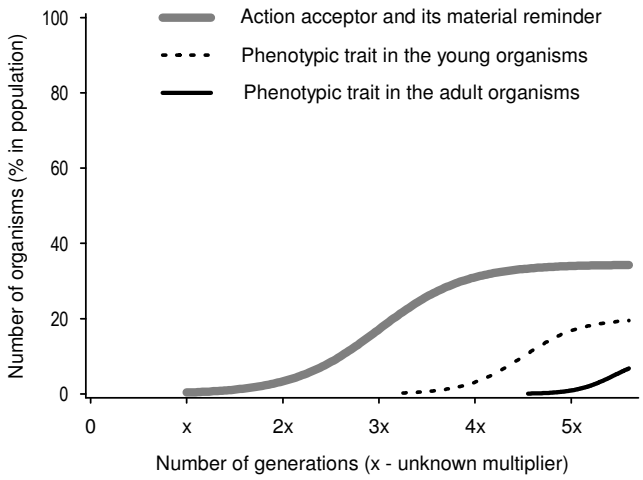

Figure 9 | The propagation of an action acceptor and, then, its desired phenotypic trait in population (schema). The appearance of an action acceptor in the form of its material reminder(s) always precedes the development of any complex morphological trait in population.

a reminder of action acceptor, it does not have any effect on detectable phenotype – it is technically invisible for an external observer. The phenotypic trait, corresponding to this action acceptor, may appear many-many generations later. And at this time point it will be visible in phenotype. Let's consider multi-cellular organisms. First, this phenotypic trait will appear only in very young organisms, those are too young for reproduction, and then this phenotypic trait will disappear in ontogenesis and will not be detectable in adult individuals, those are good for reproduction. And only many generations later this phenotypic trait will be present in both very young and adult organisms, *i.e.* it will be found in both non-reproducing and reproducing ontogenetic stages of these organisms.

It seems to humans that they do know how a phenotypic trait can propagate in population (their opinion is erroneous, but we will discuss this later). However, how a material reminder of an action acceptor can propagate in population? How an entity that has not any impact on phenotype can propagate in population? Humans usually are saying that such entity can propagate only "randomly" or "by chance", see, for example, book of Eugene V. Koonin "*The Logic of Chance: The Nature and Origin of Biological Evolution*", published in 2011[30]. The random propagation is an important process. However this propagation can be not only random, because the abilities of an organism are more diverse and stronger than the abilities of an external observer. We shall explain it right now.

Natural selection

"Natural selection" can be considered in at least two different ways: as a trademark of Darwinism or Darwinian thought-style, expressed in such books as "*The Origin…*"[17] and "*Autobiography…*"[31], and as a combination of two independent words, namely "natural" and "selection". If we consider these two words literally, we see that any event that was observed or could be observed in nature can be called "natural" and we see that there are many processes of selection in living organism(s),

including, but not limited to, processes of selection in immune system, processes of neuronal target selection in early ontogenesis in nervous system, the survival of the fittest in population genetics, selection of germ cells during reproduction, selection of neuronal groups during behavioural episodes (see Gerald Edelman)[32,33], and may be there are many more even undiscovered yet processes of selection in living nature. To call all these processes "natural selection" is counter-productive (it is a sort of idolatry), and we will use the term "natural selection" only as a trademark of views, explicitly expressed by Charles Darwin in his published materials, including all his books.

Then, even the full title of Darwin's the most famous book comprises an erroneous statement (in its second part): "*On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life*"[17]. There is the preservation of favoured races and there is the struggle for life, but they are irrelevant with respect to each other and the last one has no direct relation to biological evolution.

"*Autobiography…*"[31] of Charles Darwin is a compact book about historical events, including explanation of the role of Thomas Malthus population theory (p. 40)[31]. Humans were impressed by excessive reproduction and limited resources for survival, including food, that along leads to survival of some portion of all organisms. Many organisms should be born and many ones should be found dead during different periods of their lifespan. Humans were glad to see how an inanimate external change, let say change in climate, *e.g.* towards low temperature, leads to evolution of living organisms, in our example – to survival of the most cold-resistant creatures. And, in addition, such natural process did not require any participation of Creator or G-d and, thus, it was fully compatible with all prerequisites of vulgar materialism – it was considered as a complete defeat of all vitalists and religious fundamentalists. However, aside from the last two categories, there were naturalists who were not completely agreed with common joy.

Geographical landscape

Nikolai Ya. Danilevski has demonstrated in 1885 in his book "*Darwinism: A Critical Study*" that Darwinian evolution is fake. *I.e.* it is a fake explanation of biological evolution. We will take only three examples. In Darwinism the attention is traditionally focused on selection by means of differential mortality. What is the main reason of death among organisms in nature? Believe it or not, but it is interaction with a predator or other relevant consumer. The lifespan of a mouse is determined by an interaction with an aerial or terrestrial predator. And the same can be said about the vast majority of animals. The end of an individual is consumption by a predator. Plants, like grasses, are consumed, for example, by goats and donkeys. However the consumption by a predator in real time depends more on geographical landscape and relative position of a prey and predator in this landscape than on the prey phenotype and genotype. And positions of prey and predator are typically statistically random and, thus, just due to this reason they are genotype-independent. The death of a prey depends more on the random location of the prey in geographical landscape with respect to the random position of its predator, than on genotype and phenotype of this prey. This is the first example.

The second example will be about the change of climate, when the temperature becomes colder and colder, and it is a favourite example of Darwinism, applicable to both animals and plants. What will be with plants if the temperature becomes colder and colder? Some of them will be killed by frost, of course, but which ones? Observations in places like Siberia have shown that the plants that a frozen to death can be found only in places where the level of snow is relatively low, whereas in the nearest areas with a lot of snow all plants can be found intact. It means that the survival of a plant depends mainly on its local position in geographical landscape that determines the level of snow during winter. The position of any given plant in local geographical landscape is typically independent of its genotype. The death is random.

The survival of such primitive mammal as hedgehog in Russia during winter provides similar example. It is the third example. If the winter is mild (warm), the population of hedgehogs rises up, if the winter is cold – the quantity of hedgehogs goes down. Someone can speculate that the survival of hedgehogs depends on individual cold-resistance. Hedgehogs are hibernating (sleeping) during winter. And the survival of each individual hedgehog depends on place (warm or cold) where it was sleeping (hibernating). Someone can say that the winter position of a hedgehog is determined by its own behaviour and that a clever hedgehog can choose potentially better (warmer) place for its hibernation. That is correct, but it is not a "cold-resistance". And the ability of a hedgehog to predict the temperature in a given place can be realized only with some probability, because there are always too many statistically random factors that determine the temperature in given place. And the death appears once again genotype-independent. And once again the geographical landscape was found to be more important for individual survival than individual phenotype or genotype.

Misleading correlations

A lot of classically known examples that were told to "confirm" natural selection in evolution are based on really existing strong correlations which are providing an illusion that natural selection is really working as a factor of evolution. For example, when predators are consuming unhealthy and relatively weak prey, humans are commonly saying that this is an example of natural selection. However it is another way around, because when an animal is obviously unhealthy or weak, it is already out of the process of reproduction and its death or consumption by a predator is irrelevant to evolution. Here the strong inversed correlation between the [low] probability in participation in reproduction and the [high] probability to be consumed by a predator provides a false impression that the high probability to be consumed by a predator is a reason for the exclusion of given genotype from further evolution.

Another popular group of classically known "confirmations" of Darwinian evolution consists of examples of effects of infectious diseases and/or small parasites on population. Here humans prefer to talk about survival of the most tolerant individuals with respect to given disease or parasite, whereas the increased mortality among the rest serves as an "obvious confirmation" of natural selection. Here again we have strong inversed correlation between the physical health, important for

participation in reproduction, and the probability to be found killed by given infectious disease. This correlation could be very strong. However once again, the probability to participate in reproduction and the probability to be killed by disease, being strongly and inversely correlated, provide an illusion that the probability to be killed by a disease is the most important factor of evolution during this evolutionary episode. Despite the existence of said strong correlation, the provided human explanation is a fake one, because, in fact, not the mortality-related probability, but the reproduction-related probability determines the course of evolution.

Erroneous additional presuppositions

There are at least three silently introduced presuppositions that are not often discussed in evolutionary literature, but they are always in use in statistical calculations. The first presupposition is: all organisms do have the highest possible reproduction rate – the maximum possible speed of reproduction (sometimes humans are adding the following remark here: the speed, limited by food availability). The second presupposition: all organisms would like to reproduce with maximum speed (humans do not provide any remarks here, because for them this statement seems self-evident). The third presupposition: all organisms with sexual reproduction have statistically random mating (here we have an interesting paradox: humans are happy to speculate about sexual selection – for them it is an example of natural selection, but as soon as we are looking at any related statistical procedure – we can see only random mating, always introduced "for the sake of simplicity", because it is seemingly the only one doable statistical idea). All above-mentioned presuppositions are false.

Instead of them, the following three statements are correct.

1. Different organisms in population have always different rate of reproduction, even if we suppose (erroneously) that they all have the same motivation for reproduction.
2. Different organisms in population always have different motivation for reproduction, even those that have physically identical "maximum possible reproductive rate".
3. All mating events in nature in any population are not statistically random, and statistically random mating events can be organized only in laboratory (under artificial conditions).

Why all these statements were if not completely rejected, but silently ignored, during at least the early days of Darwinism? The answer is clear, if we look at the elements that were highly praised in Darwinism. In Darwinism all creatures were considered as passive objects of selection, conducted by inanimate or practically inanimate natural conditions. Even in the case of sexual selection a partner or potential partner of an animal was considered as a passive object of selection, conducted by the said animal. That was the basis that provided full compatibility with materialistic thought-style, depicted many years ago as "vulgar materialism" (Ludwig Büchner). At that time it thought to be very important.

If we are starting to think about selection at the level of reproduction, about self-selection for reproduction, or even about self-election for reproduction, we will arrive and occur very soon at the position when we will discuss "animal wish", "plant anticipated future", "fungus hope", and we will be one step from the acceptance of ideation space as a reality – as some real entity or a set of real items (but not as a "material entity" or "material items", because they are not such), however as an entity that is real for all living organisms. And from the acceptance of ideation space (first – as a reality, then – as a driving force of evolution) there is literally one single step towards religious thought-style. The above-mentioned sequence of events would be a complete defeat of materialistic thought-style and an indisputable victory of the thought-style, whose name the vast majority of contemporary scientists are afraid to pronounce in public.

Differential reproduction

Nevertheless, despite somebody is afraid of something, the evolution proceeds through the differential reproduction, but not through differential mortality, because the cost factors of differential reproduction are significantly lower than the cost factors of differential mortality. If we do have a differential mortality, we should have an excess of newborn animals, in order to eliminate some of them during different stages of their ontogenesis to obtain the desired evolutionary shift in the frequencies of alleles, keeping at the same time the size of population at the more or less stationary level.

And such excess of newborn animals is not required at all in order to receive the same evolutionary shift in allele frequencies in the case of differential reproduction. If we imagine two populations: one of them is evolving solely by means of differential reproduction and another one is evolving solely by means of differential mortality, which one will be evolving faster or in more efficient way? Of course, the one which is not spending resources for production and further long-lasting support of additional animals (those will perish anyway). The answer is self-evident to the extent that allows us to assume that the population evolving solely by means of selective mortality could never be found during the whole history of life (both documented and undocumented). Such model of evolution is an example of profanation and obscurantism.

In folkloristic terms we can say that the organisms may be self-elected for reproduction not because they are “strong”, but because they are “happy”. And this “happiness” may include in itself a lot: memory about individual ontogenesis, current state of action acceptors, action acceptors’ state during different periods of ontogenesis, the state of development of some barely developed action acceptors, the anticipated future of all kinds. Some of these entities can be investigated by means of physics and chemistry, and some others are not accessible for materialistic investigation, being mainly in the ideation space, where only their material reminders can be investigated objectively, – but all of them are important for organism's self-election for reproduction or for self-exclusion from reproduction.

Opportunities

The self-election of organisms for reproduction provides opportunities that were not evident previously.

1. Organisms with brains automatically become capable of faster and more efficient evolution. Brain is an instrument of evolution, as it was proposed in the hypothesis of evolutionary brain by Boris L. Zlotin & Alla V. Zusman in the article “A natural brain for intelligent design”, published in 2005[19].

2. Contrary to selection by a predator, who does not know much about its prey, about its early stages of ontogenesis, about its general health (the predator sees in the prey only a piece of food), the self-elected organism (not only an animal, but also plant and fungus) may know a lot about its own health, including its own health during early stages of ontogenesis. Such self selection for reproduction may be done using information about all previous ontogenetic stages.

3. Each organism, among both males and females, has different germ cells or groups of germ sells available for reproduction during different periods of ontogenesis. And by selecting this or that period of time in its own life for reproduction, an organism can select this or that group of germ cells. The result of this process may be very similar to the one that was proposed by August Weismann in his theory of germinal selection, first published in German in 1896, in the article "On germinal selection as a source of definite variation"[34].

4. The self-election for reproduction helps us to understand the role of sexual dimorphism in evolution, explained by Vigen A. Geodakian in 1965 in his article "The role of sexes in transmission and transformation of genetic information"[35]. The self-election for reproduction and self-exclusion from reproduction are always stronger in males than in females, due to the higher variability (dispersion) among males. However, because this process is not necessarily linked with the increased mortality among males, there could be no negative impact on population size, counting both males and females. The participation in reproduction in males is more sensitive to an external environmental factor than the participation in reproduction in females. Previously, when our attention and attention of Vigen A. Geodakian[35,36] was focused on differential mortality (in accordance with classical Darwinism), it was difficult to understand benefits, provided by an opportunity of a male to impregnate many females, because typically we do not have a dramatic increase in mortality among males in comparison with females: the observed increase is rather mild in the vast majority of cases. However when we do not have a natural selection, but a self-election for reproduction as a main mechanism, the benefits of sexual dimorphism can be utilized completely. We also can understand, why hermaphroditic organisms (like earth warms and tomatoes) are less successful than bi-sexual organisms in evolution: for a hermaphrodite, in order to have the same evolutionary rate as in the population with males and females, the distribution function of participation in reproduction as a male and the distribution function of participation in reproduction as a female should be completely independent (*e.g.* some hermaphroditic organism could be healthy enough to participate in reproduction as a female, but not healthy enough to participate in reproduction as a male; and these capabilities should be completely independent, whereas in the real life they are always correlated to some extent due to simple physiological reasons – because it is the same hermaphroditic specimen).

5. Any disruptive factor, like an extremely low temperature, always acts in population first of all through the differential reproduction and only afterwards and only in some the most severe cases – through the differential mortality also. Even in the cases when we can see significant mortality (a lot of dead animals or plants), like in situations with infectious diseases or spread of parasites, the evolution goes through the differential reproduction. Here the inversed correlation between reproduction and mortality leads to illusion that the increased mortality is a factor of evolution, whereas it is a fake explanation, an erroneous conclusion, because the decreased reproduction always goes ahead of the increased mortality, and mortality *per se* is irrelevant for evolution (in the vast majority of cases). It does not matter how many organisms were found dead, because all of them (and may be many others also) have stopped their own participation in reproduction in advance. The above-mentioned fake "confirmation" of natural selection exists and remains popular since the beginning of Darwinism, and the above-mentioned inversed correlation masks this error very well (during more than 150 years).

6. In any population with sexual reproduction, *i.e.* with male and female organisms (and even with hermaphrodite organisms, like earth warms or tomatoes) there is no random (in statistical sense) mating of individuals. We may say that organisms are mating "at will", but not "randomly". In mammals, females from large litters prefer to mate with males from large litters, whereas females from small litters prefer to mate with males from small litters. This regularity is evident even in humans (replace the term "litter" by the word "kids", of course). It produces effect of "false bottleneck", where using contemporary statistical methods we see that some population has passed throw very **narrow bottleneck**[37], but it was not so. The bottleneck in population size could be completely absent, but the observed canalization and unification of genome was achieved by means of non-random breeding. In some studies the obtained bottleneck occurred to be so narrow that we do know from independent naturalistic observations that such population must be extinct now. This contradiction between the obtained very narrow bottleneck[37] and the observation that populations of such small size do not survive in evolution is an indicator of an error in the model: this is not a "miracle", but we do have an erroneous model of evolution of control population without any bottle-neck (with erroneous assumption of random breeding).

7. The self-election for reproduction may take into account not only current adult phenotype, but the episodes of appearance and later disappearance in early ontogenesis of those traits that will be typical for adult individuals only many-many generations later in evolution. Thus, these traits may propagate in population and we will see with respect to some morphological traits "the law of precession of characters", described by Leo S. Berg in his book "*Nomogenesis or Evolution Determined by Law*" (1922)[7]. This is not a full explanation of the precession of characters, but it is a demonstration of the possibility of such precession.

8. Dormant genetic loci (or "dormant genes") that were brought out of dormancy by an extreme stress or specific drug treatment (neonatal L-thyroxine treatment, adolescent morphine treatment, *etc.* – *i.e.* treatments with known transgenerational effects)[28,38-43], being brought out of dormancy typically do not demonstrate constant expression, but their expression is jumping in time during lifespan of a single individual from quasi-zero level to some relatively high one and back (multiple times) in a semi-random fashion, demonstrating so-called "destabilized" or "unstable" heredity (these terms were introduced by Trofim D. Lysenko before the WW2)[44]. If one such gene is not expressed during given time interval, it cannot be selected by means of differential mortality, but it can be selected by means of differential reproduction, due to the existence of memory, the

memory that is active during individual lifespan (any memory – not only in the sense of animal higher brain functions).

9. The selection and propagation in population of reminders of action acceptors is possible by the self-election of organisms for reproduction. It means that an action acceptor itself for some desired evolutionary result (let say morphological trait) can be developing in evolution during many-many generations before the first appearance of the said desired result at any stage of ontogenesis. In folkloristic terms, we can say that the development of a "question" may be spread in population during many generations before the beginning of the development of the "answer" to this question. For a given action acceptor it will be done by means of development of the material reminders for this action acceptor, the material reminders that will be accumulated during many successive generations. Thus, the "formulation of a problem" will be always developing in evolution before the beginning of the search for the "solution" of the said problem.

10. Evolution of any trait is a complex process, driven by its anticipated future and distributed among many individuals of the same species during a multitude of generations. Due to this reason many closely related species avoid breeding with each other under natural conditions. Simultaneously, sometimes these species can be bred with each other in captivity without visible problems. Narrow nationalism, understood as reproduction exclusively inside given nationality, comprises the basis of human biological evolution exactly due to the above-mentioned reason.

Lamarckism

The described above schema of evolution depicts more efficient process than any known form of Lamarckism (the inheritance of acquired characters; see book written by Leonid I. Blacher in 1971: "*The Problem of the Inheritance of Acquired Characters: A History of a priori and Empirical Methods Used to Find a Solution*")[45]. I have to admit that I was unable to predict that the defeat of Darwinism will be so shameful. It is replaced not by some form of Lamarckism, as it was proposed by proponents of transgenerational epigenetic inheritance (Eva Jablonka and Marion J. Lamb, book "*Epigenetic Inheritance and Evolution: The Lamarckian Dimension*", 1995)[46], but by evolution of action acceptors, wherein not an external entity eliminates bad creatures, but an internal action acceptor gives command for reproduction when the desired result is achieved.

Epigenetic inheritance

However, the transgenerational epigenetic inheritance[38-43,47] itself can be very useful for evolution of action acceptors as well as for evolution of detectable phenotypic results, obtained by the said action acceptors in the course of evolution. On the other hand, it seems that living organisms do have sufficient mechanisms to organize and to promote the inheritance of acquired characters, if necessary, but it was not done yet, just because some other, more efficient, mechanism of evolution has been found.

The solution of evolutionary question

I know that the described above solution of evolutionary question will not be accepted by English-speaking community.

And there are solid reasons for that.

If we look at any organism (even at unicellular one, but let's imagine a *Metazoon*) we will see a lot of parts and a lot of functional systems. We can see a lot of various parts and a lot of various functional systems during different periods of ontogenesis of that organism. What if somebody will choose some part from some functional system from some period of ontogenesis and improve it? Will choose randomly and improve. Will it be good or bad? Let's imagine that some part is really improved and it is not a joke. Will it be good for this organism and population? Let's temporarily ignore that any improvement and any change in general will have some unexpected consequences those can even disrupt something occasionally. Let's say that we do have the positive effect of this improvement only. Will it be important? The answer is, unfortunately, strictly negative: the improvement of a randomly chosen part or a randomly chosen functional system during a randomly chosen period of ontogenesis is useless.

All periods of ontogenesis have different vulnerabilities, different sensitivities to external disruptive factors and different probabilities of interaction with predators. Even during a randomly chosen period of ontogenesis not all functional systems and not all their parts are equally important. There are a few parts, and sometimes it is possible to localize even a piece of some part, that limits total efficiency or total positive effect of the organism during given episode of ontogenesis. Sometimes the selected part could be optimized further, and the further total improvement could be achieved due to optimization. However there are more interesting cases, where there is a contradiction when an attempt to improve one important feature will lead to degradation of another also important feature, and where their strait-forward optimization is not productive anymore.

The resolution of such contradiction can provide further way of evolution, but we would like to focus our attention upon the previous step in this story: the selection of a period of ontogenesis, the selection of a functional system, the selection of a part of said functional system and sometimes the selection of a piece of said part of the said functional system for further improvement. This choice could not be random. Sometimes humans are saying that the correct formulation of a problem contains 50% of its solution. It is usually said with respect to development of various technical systems. Technical systems are also objects of evolution, but the evolution that is known to humans. The entity or a part of entity that is in the focus of further improvement is not random, but its choice is extremely important.

The formation of an action acceptor, even without any knowledge of possible solution, may take several generations, *i.e.* it could be distributed between several consecutive generations, because it is not an easy task *per se*. An action acceptor for any problem can be formed in evolution slowly, by means of step-by-step collection of material reminders of this action acceptor, and this process can be distributed among several generations. Some material reminders can be distributed in different loci and in order to collect them together and in order to promote and to propagate them in population, the mechanisms of self-election and non-random mating can be used. As soon as an action acceptor is established in population, *i.e.* as soon as it is developed to some extent in some group of individuals in population, it is possible to assume that if some solution or some

even week element of solution will be found, it will not be missed. This element of solution may have no phenotypic effect, or it may have no useful phenotypic effect – for example, it can be so weak, that it will be of no practical importance. However, nevertheless, it will be immediately detected and discovered by the action acceptor. And solely on the basis of this discovery, made by said action acceptor, the said element, which could be very weak at this time point, will propagate further in population through self-election of this organism for reproduction and non-random mating of this organism with similar one(s), if the last one(s) could be found in vicinity. A creature, whose action acceptor has discovered an element of the desired solution, will become the happiest creature, may be not in the whole world, but locally. This happiest creature will be the most suitable for further reproduction.

And what if this creature, let say it belongs to population with sexual reproduction and with males and females, will meet a creature of opposite gender that made similar discovery? It is a rare event, but it is still statistically possible. We will have a happy female creature, whose internal action acceptor has discovered the desired element of solution, and will we have a male happy creature, whose internal action acceptor has discovered slightly similar or very different element of the desired solution. What will we have if these two happy creatures will meet each other? We will have a variety of younger happy creatures. Is it a miracle? Yes and no simultaneously. It is a miracle, because this process is driven by an interaction of the ideation space with the space of vulgar materialism – this process is not a direct consequence of the events in the space of vulgar materialism along. And it is not a miracle, because here we do not have any events that are incompatible with known laws of physics and chemistry.

Here we have an automatic explanation of the law of precession of characters. Some traits are appearing in the young along, and then they disappear very briefly in their ontogenesis. Then, in further generations, these traits can be found not only in the young organisms, but in the slightly older organisms as well, however, nevertheless, they are disappearing before the adult age. And only afterwards, may be many generations later, these traits can be found in the young organisms and the existence of these traits is prolonged into the adult age also. Thus, finally for this evolutionary episode, these new traits will be common for both young and adult creatures of this species. This is a typical picture, produced by an action acceptor, which detects this new trait and promotes it in population by means of the self-election of the carrier organism for reproduction and may be also by means of the further non-random breeding of the said carrier organism. But the self-election for reproduction is enough to obtain this result (**Fig. 10**), even without further facilitation of its evolutionary development by means of non-random mating.

For a material reminder of an action acceptor or for a component of a morphological trait, in order to be selected (by means of differential reproduction), the corresponding genetic change should be dominant. It means that this genetic change is not a suppression of some previously active gene, but it is a new expression of genetic material that was previously silent (non-expressed). For a *Metazoon* (a multi-cellular organism) the typical situation consists of activation of some previously dormant gene or genetic locus. It can be done by genetic or epigenetic means. And we do know from the experiments with

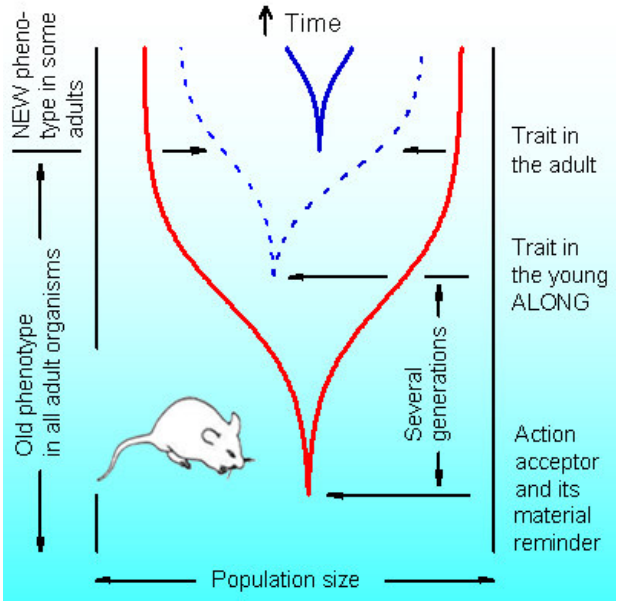

Figure 10 | The precession of characters in evolution. Novel activation of any locus has always its own negative or unexpected effect(s). Many can be compensated separately, though. That is why a previously dormant (and now dominant) gene first of all is activated only during relatively short period of ontogenesis in the young organisms. Later in evolution its expression extends to later periods of ontogenesis, including adult ones.

guinea pigs (Fig. 1[28], Supplementary Figs. 2[28], 3[28]; Fig. 5[43], Supplementary Fig. 3[43]) that such activation is not stable in time during lifespan of a single organism: it some cases it semi-randomly appears and disappears. This flexibility provides opportunities for further optimization in evolutionary time, visible sometimes as the law of precession of characters.

Theory of Inventive Problem Solving

With respect to evolution of technical systems, in the course of human inventive activity, in the previous century, mainly between 1956 and 1985, the Theory of Inventive Problem Solving (known as "TRIZ"[48,49] – it is a transliteration from the Russian abbreviation "ТРИЗ") was developed and introduced through seminars by Genrich S. Altshuller in the USSR, with its main instrument, that is the instrument for thought, known as the Algorithm of Inventive Problem Solving (known as "ARIZ"[50] – this is also a transliteration from the corresponding Russian abbreviation). ARIZ is a very interesting tool. First of all, it is not an algorithm in terms of contemporary applied mathematics, because this algorithm is developed for humans who are capable to work with computably non-enumerable sets, and these computably non-enumerable sets are completely out of the scope of contemporary applied mathematics. We can say that ARIZ contains instructions for humans or human thought. When we are trying to improve some important property of a technical system, we can do it often only at the cost of disruption or diminishing of its some other also very important property. For example, we can make some engine more powerful, but at the cost of its bigger size and weight and at the cost of increased fuel consumption, and this increased fuel consumption will be present through the

whole spectrum of regimes, unfortunately. This is an example of technical contradiction. From the practical standpoint it is often possible to improve situation by means of careful optimization: we can get a not extremely powerful engine, but it will be not extremely heavy as well and with reasonable fuel consumption. Such optimized solution may be practically important, but it is not interesting, because it does not resolve the above-mentioned contradiction. If we take all components of given engine as a computably enumerable set of part, this contradiction probably never can be resolved – the situation will be sort of as in the contemporary applied mathematics: we have a contradiction with given number of components and with given number of components it cannot be resolved. One piece of material cannot be heavy and light simultaneously, for example. However if we imagine that the same engine is comprised from computably non-enumerable components and that each given component may contain in itself several different or identical parts, the situation will be very different, at least in our imagination. But it is enough for us to have it in our imagination only, because we can find the focus of this contradiction, or the most important element, involved into this contradiction, we can split this element into two or more at will and we can resolve this contradiction, because we are working in our imagination with a computably non-enumerable set. At the beginning of this article we have an example with Honda VTEC engine. In this engine we have a camshaft with two different sets of cams, or we can say that each old cam was split into two new cams: one of this cams is in use when the engine has maximum power and maximum rotation speed, whereas another cam is in use when the same engine has low power and low rotation speed. This is an example of a contradiction resolution. If we would not be able to split each cam into two, we will be unable to resolve this contradiction, at least by the above-mentioned way.

There are a lot of peculiarities in TRIZ. One of them is a recommendation to replace special terms by simple words that could be even folkloristic ones. Special technical or scientific terms bring with them an additional psychological inertia, which we would like to avoid during the process of solution of a problem. In this example the term "cam" and "camshaft" would be recommended to replace by something simple, let's say "opener" to indicate just some part of its function. There is also a term "x-element" in TRIZ – just some change, may be not even a new material element in the system, but it should be defined by a human what this element should do. When we are working with unknown yet elements and/or with computably non-enumerable sets, the restrictions provided by our language are more important than in our usual life.

Omissions

One known way to point at unknown yet entity or at the entity or entities from a computably non-enumerable set is to use an omission in human language. Some languages, like Hebrew and Russian, are very comfortable with omissions. In other languages, especially in English, each omission is assumed to be an error that should be corrected as soon as possible. Omissions in general are not allowed in English language. There are some tricks that can be used to introduce an omission in the text using English language, but it is not a trivial exercise and sometimes the desired result cannot be achieved at all. I will illustrate this statement by two known examples.

Example 1. "The Sun Also Rises". This is a title of a book. This phrase indicates that there is an entity, or may be several entities, or may be a computably non-enumerable set of entities, and each of them "rises as well as the sun". The entity or entities is or are unnamed and unknown. This sentence is formally correct. We do not see any error in English language here. However for a native English speaker it is so unusual and confusing – it is looking like some error that should be avoided, if possible. Thus, when this book was published in London, the title was changed to "Fiesta". However, the omission in the original title was introduced by the author intentionally, as well as in the "For Whom the Bell Tolls".

Example 2. "Who brings life to the dead". "Who" is not a question for us – so, we will proceed to the end of this sentence. In English language the word combination "the dead" means only one: "partially or completely decomposed bodies of the dead humans".

This nonsense is a result of translation into English. Originally it is a sentence with omission. It may be written by the following way, the way that is completely prohibited by the rules of English language: "Who brings life to [the] dead [omission]". In this sentence the article "the" is completely removed. And the "dead" entity or entities is or are unnamed and unknown. They belong to a computably non-enumerable set. And we do know that a computably non-enumerable entity cannot be substituted by any set of computably enumerable entities. A computably non-enumerable set cannot be projected into a computably-enumerable one. That is why any word, like "matter", "inanimate matter", "the dead", or any list of specific words, will be an error. Any perceptible entity here will be a complete nonsense. The presence of a specific entity is a requirement of English language. And we need an omission here to depict an entity from a computably non-enumerable set. Thus, this sentence cannot be translated into English without significant deviation in its intrinsic meaning. But why the "dead bodies" are incorrect? First of all, because these bodies would not be found dead, if some one would like to see them alive. Second, we see here a process that is continuous in a non-stop manner, the process occurring with indisputable regularity. This process is given to us not as a rare miracle, but as something that is observable every day and may be even every second.

If we look from the position of our material world at the ideation space, we will see what we can see now. If we look at our material world from the position in the ideation space, we will see what we should see, perhaps. If we are saying about something that it is "alive", it means that we are speaking about an interaction between the space of vulgar materialism and the ideation space. However the side, from which this something is looking, is not specified.

I do know that humans prefer simplistic statements and not like the ones, mentioned above.

Ok, in a few words we can say: those organisms are good breeders that would like to be good breeders, *i.e.* would like to reproduce; those organisms would like to reproduce that do have better state of their own action acceptors, *i.e.* those that are more “happy”.

Some humans will ask: "But where is Natural Selection?" My answer is simple: "In the middle of nowhere!" Natural selection is a fake explanation of biological evolution (and it was shown in 1885 – remark for those who are interested in). Thus, the evolutionary question had knowingly wrong answer during 139 years. Similar to the previously mentioned problem with heavy chain or liquid, moving without a friction in a narrow tube around a cube (**Fig. 1**), wherein some humans are saying that the speed remains the same due to the law of conservation of energy, because the influence from the side of a tube is always tangential with respect to the moving liquid. This is an erroneous answer and a fake explanation as well.

"But why so deep disrespect anyway?" – Someone may ask: "Is it possible to express similar ideas softly?" During previous century we knew many bright and honest naturalists, thinkers and scientists, those were trying to solve problems in the fields of evolution, ontogenesis, behaviour, neuroscience and neuroevolution. And all of them **were honestly thinking** that any acceptable solution in each of these areas should be compatible with principles of natural selection. The life of each of them was wasted for nothing (not completely, sometimes, but mainly for nothing). That's the price for idolatry. No solution exists for the problems in the above-mentioned fields under the assumption of Darwinian evolution. And despite the entity has earned deep and reasonable respect, it must be liquidated.

***P.S.*:** Here we see not only the end of Darwinism as an evolutionary thought-style, but we see the end of vulgar materialism as an exclusive thought-style in natural sciences.

Methods

Equipment for sound recording consisted of NZXT Phantom PHAN-001WT full-tower case (white) with CPU AMD FX-4100, CPU cooler Scythe Kotetsu SCKTT-1000, motherboard Asus M5A97 R2.0 with AMI BIOS 2603 dated 2015-06-26, RAM 16GB (4 × 4GB 1R×8 PC3-14900E Elpida ECC unbuffered EBJ40EG8BFWB-JS-F), video card Matrox Millennium P690 PCIe ×16 MGI P69-MDDE128F (128 MB), Intel SSD 520 Series 180GB + Western Digital WDC WD20EZAZ-00GGJB0 2TB HDD, power supply PC Power & Cooling Silencer Mk-II 750W (with its 135 mm fan facing up), OS Windows 7 Home Premium 64-bit with Service Pack 1 and Convenience Rollup (April 12, 2016).

Four channel PCI audio card LynxTWO-A 24 bit/192kHz was installed in the lowest PCI slot (near power supply); LynxTWO-A has AK5394A (ADC) and CS4396 (DAC), *i.e.* A-D converters are AKM AK5394A with a 123dB dynamic range, while on the output side the D-A converters are model CS4396 from Crystal Semiconductor (Cirrus Logic), with a dynamic range of up to 120dB.

Digital Audio Labs CDX-01 CardDeluxe 24 bit/96kHz was installed as a secondary sound card in PCI slot above LynxTWO-A to provide output compatibility with unbalanced equipment (it has two balanced inputs and two outputs, but they can be used also in unbalanced mode – directly and safely, contrary to LynxTWO-A); CardDeluxe has AK4528 (ADC) and AK4393 (DAC).

Monitor EIZO ColorEdge CE210W (21.1" 1680 × 1050 VA panel; the monitor features a high 1000:1 contrast ratio, a wide 178°/178° viewing angle and a fast 8 ms response time); Compaq PS/2 keyboard P/N 286220-003 RT2156TW, HP PS/2 optical mouse P/N 5188-6230 Rev. B.

Condenser microphone Warm Audio WA-87 (silver) and ribbon microphone Avantone CR-14 with Cloud Lifter CL-1 (CL-1 only for CR-14); all XLR microphone cables were "Mogami Gold Studio", total cable length between each microphone and preamplifier was 18 ft (5.48 m; cables 15 ft + 3 ft); dual channel pre-amplifier Neve Portico 5012; dual channel compressor Neve Portico 5043.

The recording was done using "Mid-Side" technique, wherein Warm Audio WA-87 condenser microphone was used for front ("Mid") recording (Ch 1) and Avantone CR-14 ribbon microphone was placed perpendicular to WA-87 for "Side" recording (Ch 2).

All graphics in the article are based on WA-87 data ("Mid" channel, Ch 1), but Supplementary Audio files contain both "Mid" and "Side" records (Ch 1 and Ch 2, respectfully). Clarinet was placed at approximately 1 meter from the combination of WA-87 and CR-14, wherein CR-14 was placed exactly above WA-87 with 5-10 mm distance between them.

The following settings were used. Warm Audio WA-87 (Ch 1): -10dB – off, filter – off, frontal recording – middle position of the switch.

Avantone CR-14 (Ch 2): the name "Avantone" on the MIC – towards the left hand – side recording. This microphone was working with Cloud Lifter CL-1 and CL-1 was placed between this microphone and preamplifier (Neve Portico 5012). Phantom power +48V was applied from Portico 5012 to both WA-87 and CL-1 (*i.e.* – to both channels; Cloud Lifter CL-1 does not transmit +48V phantom power to the connected microphone, but CL-1 needs at least +15V phantom power for its own operation).

Neve Portico 5012 preamplifier: Ch.1: +48V – ON, Phase Invert – off, MIC GAIN = 54, TRIM = -2, MUTE – off, TO A BUSS – off, HPF – off, but Hz handle – horizontally to the left (it should not be active). "SILK" – off;

Ch.2: +48V – ON, Phase Invert – off, MIC GAIN = 36, TRIM = 0, MUTE – off, TO B BUSS – off, HPF – ON, 120Hz – handle opposite to 20Hz.

Neve Portico 5043 compressor (the following settings provide insight into the term "very mild compression"): Ch.1: IN – ON, Threshold = +2 dB, RATIO = 2:1, ATTACK = 70 ms, FB- ON, LINK – ON, RELEASE = 100 ms, BUSS INPUT – off, METERS SELECT – ON (Ch.B), GAIN = 4 dB,

Ch.2: IN – ON, Threshold = 0 dB, RATIO = 2:1, ATTACK = 65 ms, FB – ON, LINK – ON, RELEASE = 100 ms, BUSS INPUT – off, GAIN = 6 dB.

Data were recorded by the program "Sonic Foundry Sound Forge" (Version 5.0b, Build 162, © 1997-2001 Sonic Foundry, Inc.) at 192 kHz and 24-bit and stored in PCA format (Sonic Foundry Perfect Clarity Audio).

PCA data were imported into the program "Sound Forge Pro Suite" (Version 14.0, Build 33, © 2020 MAGIX Software GmbH), wherein this format (PCA) is called "Sony Perfect Clarity Audio", and saved as FLAC Audio (*.flac) format.

FLAC Audio data were used by the program "Audacity 2.3.3" to convert data into TXT tab delimited format.

TXT tab delimited data were imported into the program "Statistica 8.0" (StatSoft, Inc. (2008), STATISTICA (data analysis software system), Version 8.0, Modules Version 8.0.725.0), wherein all data graphics were prepared.

Figure 1 has been drawn in AutoCAD 2008 [B.51.0 (UNICODE)] 32-bit (Autodesk, Inc.). AutoCAD machine was IBM IntelliStation E Pro Type 6846-31U (originally with PIII-933 Coppermine), upgraded many years ago with motherboard DFI CA64-TC Rev. C (VIA VT82C694T + VIA VT82C686B) with Award BIOS 6.00PG dated 2002-03-26, CPU PIII-S 1.4 GHz Tualatin (SL6BY), RAM 2GB (2 × 512MB PC133 Silicon Technology ECC Registered Buffered SL72R4K64M8H-A75AV [Micron] + 1024MB PC133 Corsair ECC Registered Buffered CM744S1024-133 [Samsung], Memory Parity/ECC Check disabled in the BIOS, because this BIOS option is intended to be used with ECC unbuffered only), video card 3DLabs WildCat VP560 AGP 4x [Rev. D, BIOS Version 3.04, driver 3.01-0852] (64 MB), HDD Hitachi Deskstar HDS722516VLAT20 160GB connected to motherboard *via* Adaptec ATA RAID 1200A PCI card, OS Windows 2000 Professional (5.00.2195) with Service Pack 4.

Monitor IBM ThinkVision L191p Type 9419-HB7 (19" 1280 × 1024 IPS panel; the monitor features a high 1000:1 contrast ratio, a wide 178°/178° viewing angle and a slow 20 ms response time); Logitech Deluxe Plus PS/2 Keyboard Black Y-SW45 P/N 867373-0403, HP PS/2 optical mouse 800 dpi P/N 672651-001 Rev. 0A.

Photographs of clarinet were taken by Vera Vyssotski with a help of Nikon D7200 with lens Nikon DX VR AF-P NIKKOR 18-55mm 1:3.5-5.6G. Pictures and photograph of Honda VTEC engine (1989) are property of Honda (Japan).

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Additional information

Supplementary Audio accompanies this paper at
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