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INFORMATION STORIES

of physics, biology, law

Rastko Vuković

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Растко Вуковић
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Preface

Almost all of these texts were published weekly in the column of the “izvor.ba” portal, starting in March 2019 for two years. It was a challenge behalf me to try to adapt a very professional topic to readers who do not know theoretical physics or mathematics. Sometimes oversaturated, and sometimes thinking that this attempt was naive, in the meantime I prepared other texts and books for a more informed type of audience. This ultimately proved useful here as well.

I literally transferred the original contents from (my) three books listed in the bibliography, except for some minor corrections. That is why you will find seemingly unnecessary repetitions, because the texts were not originally written in order to have an insight into the whole, and then into unusually retold “proof” similar to the exact ones that arose in attempts to present considerations in ordinary language instead of mathematical symbols, formulas and methods. I did not change the italics of the highlighted words that were indexed at the end in the originals, and are not here.

A lot would not have happened without the (free) help of the portal editor and books publisher. I would not have the opportunity to reconsider and present critical sections on information theory, I would not have this level of accuracy of views, and there probably would not be these writings.

However, these stories are intended for people who are not too interested in such topics, or have not dedicated a significant part of their lives to being able to follow them more carefully, and there are no unnecessarily burdened parts with logical and technical intricacies. On the other hand, I know that the presentations are not simple again and I recommend them not to rush with understanding and not to hesitate to read the parts several times, sometimes even after long periods of time.

Author, 2020.

Content

Introduction

These are not stories about the classic information theory of Shannon, Hartley or Gibbs. I dealt with them earlier[1], much earlier. These were created at the suggestion of the editor of the portal "izvor.ba", my friend who somehow knew that I had something new to say and that I might be able to write it popularly. He found me and interested me at the time of completing the extensive "Quantum Mechanics", which is why I made so many reviews of this difficult field of physics.

The information theory I present here has been elaborated formally in books [1], [2] and [3], the only ones listed at the end in the bibliography, but also in many of my other public and private texts. Reading them again, these stories which are there in the same order as introductory to mathematical presentations, it seemed to me that they could stand alone, in one such these popular collection.

The central place of the problem that I deal with in those texts was not mathematical formalism, it was not here, as much as its interpretation. The idea was to imagine some "universe of information", according to which space, time and matter would be information and only information, and then eventually find some contradiction and explain it. Even today, that beginning is much harder to understand, because we no longer live in the time of deterministic ideology, when the complexity and perfection of relationships everywhere around us seemed "obvious proof" that nothing happens by chance in this world.

I am talking about the beginnings of public presentation of my ideas "information theory", which happened mostly some ten years before the first of these texts. Even then, there was an opinion that information was the equivalent of uncertainty, but that uncertainty was not the one I will tell you about here. It was the kind of do not knowing the causes, although they exist. Here, the uncertainty is such that an attempt to assume the existence of ultimate (unknown to us) causes would contradict the theory itself.

[1] Rastko Vuković: ''*MATHEMATICAL THEORY OF INFORMATION AND COMMUNICATION*'', Republika Srpska Mathematical Society Banja Luka, 1995 (in Serbian).

1. Physical Information

In the first book [1], the issue of the law of information conservation was to be discussed. This is the "physical" part of it, according to which mass, energy or spin are also the physical phenomena of this world. Closed in a system their total amount remains constant while they can be transformed from one form to another. In that sense, "data" is what is transformed, and "amount of data" is the information.

The most difficult goal of that book was to get some mathematical expression, not far from Shannon's, for which the law of conservation the information would apply, which at the time seemed impossible to my colleagues and me. However, it turned out that such an expression exists and that these introductory stories in those formulas that I do not cite here, have a deeper meaning.

1.1 Freedom

Have you ever wondered what *freedom* is without having to search through some political or philosophical vocabulary? To take it simply, as "two plus two is four", without delving into some deep epistemological or cognitive meaning? Freedom can also be seen simply as something that has more when there are more possibilities.

We love freedom because we love what we want. Imprisoned without the right to move or prevented from wanting to eat ice cream because the sweets harms us, or in poverty because we have no money, our freedom is then denied by the rule of law, our health, a bad economy. We don't like when we don't have freedom, because "you never know" what we would like to have, so we want it simply because we like to choose. Walking around the shops, living among the challenges, harassing — it's all freedom.

Have you noticed that just because it is pleasant, choosing is hard? The effort of the muscles to work and the changes we make are the consequences of our choices, in the end, they are the result of our freedom. A deeper analysis of the "amount of possibilities" would show that it is in line with the physical action, but I do not mean only that possible inconvenience of doing, but also the reluctance to face dilemmas.

Research will show that the brain does not like uncertainty, at least as much as it loves it. I am thinking here of that feeling of anxiety in front of problems due to options, when it seems to us that there is no solution or that patience will betray us before we find it, and when we would like to let go like a log down the water. We love order when we don't like opportunities.

We seek law and order because of the security they offer, and then because of the efficiency we desire, hoping for even greater security. Like security, freedom is a dual phenomenon because we love it less when we have it more. That's why we like to get organized because we don't like options, and we like options to get better organized. Thus, we come to the notion of freedom as something necessary for development, and then to the need for development in order to have security, also efficiency, in order to have less freedom.

The appearance of freedom is inseparable from the appearance of uncertainty, so then there is no real freedom without fear of development or, on the contrary, without a sense of satisfaction in mastering possibilities. We admire the problem-solving skills, as well as the ease of living, for the same reason.

Because of the fear of freedom, that is, the joy of being able to face it. These are the same emotions that drive the state into dictatorship or development.

Freedom as a “quantity of possibilities” necessarily leads to the conclusion that security is the opposite of freedom. Replacing a piece of freedom with a piece of security is then a loss of both, because by taking away freedom we reduce some dilemmas and become safe from the right to face life. What makes a tiger safe in a cage?

Freedom is the right to options, to development, to the possibility of comfort, not a guarantee. She is such a strenuous phenomenon!

1.2 Liberalism

Liberalism is a movement of French revolutionaries (liberté, égalité, fraternité) on the eve of 1800 for freedom and its protection by the rule of law. It was a battle cry for the liberation of the threatening potentials of equals for the aristocracy and, to the horror of the monarchs of the time, a call for a fraternal struggle of the mob against the hierarchy. We know that every good has its bad sides, but we have not yet taken the demons of liberalism seriously.

One of the dark-bright sides of liberalism will come to us from the knowledge that *equality* generates conflicts. The intensity of sports competitions comes from fair rules, the competition of equals is fiercer, the uncertainties of equal chances are greater, so it turns out that nature does not like equality.

God doesn’t build long straight lines, he can barely produce two equal snowflakes and has never been able to come up with something like Ford’s production line on his own, and he imagines so much! However, people helped him in much more difficult things, so the dilemma remains: will liberalism go to war with that absolute or will it just ignore it, him the poor thing? That's why it's good for him to keep quiet and hide.

In societies of equal, hierarchies emerge more easily because, as we now know, nature does not like equality. We see this in the domination of American democracy by corporations, communism by their lifelong presidents, revolutionary France by Emperor Napoleon, or equals before God by the Inquisition. Hierarchies enjoy equal people. There they are like sharks in a sea of small fish, more ready for further fights with each other.

Because equality suits them, the new hierarchies of liberalism have moved towards a global society, not realizing that the alignment of the world (in their favor) costs more and more, and in return they get less and less, because nature does not like equality. We who do not follow those costs can also notice the growth of *legal systems*. From the definition of a liberal state, which protects the freedoms of citizens, it follows that the state must racketeer citizens, deprive them of their freedoms in the name of freedom.

It needs more and more repression against the resistance of equality (which generates conflicts), and then more equality as the basic fabric of law. More rights create a greater need for rights in a spontaneous, unstoppable and in that sense stable way. Those most capable of using freedoms become its greatest victims, so the states with the most rights (regulation, administration, bureaucracy) eventually slow down with development.

Over time, a legally regulated state becomes more efficient in protecting its oligarchs, better than any other state in the past. Thus, we get a smaller percentage of those who have an increasing percentage of everything. The unpleasant growing inequality arises, similarly to the previous one, precisely in the course of the alleged equality. This could also be presented as a great conspiracy of nature against small ordinary people, possibly in favor of technocrats lurking on the sidelines.

If liberalism does not stop the mentioned absurdities, nature will continue to pursue its own. States will tend to form tree trunks woven from living cells or some similar complex living beings. What they, and we have in common will be the birth of their own universal individuals who die specialized, who evolve into less free, less smart at the expense of the whole and controlled reproductive.

Law will more easily overcome outdated hierarchies such as family, customs, religion, than new fighters born of liberalism itself. Here, I am thinking primarily of modern owners of money and power who will sooner or later want to master the law. At first cautiously, say with naive lobbies or the occasional retaliation of the rule of law for corruption, when we see it as a conflict of good and evil, then a balance of yin-yang, female and male principle, to eventually become a struggle for life in which we cheer against legal restrictions.

Liberalism is an ideology of freedom which, in the name of liberation, gives birth to the control of the majority by the system and the system by the few. Yet, fearing other trump cards that nature hides in its sleeves, because of the pressure of the powerful, and ultimately because of habit and ignorance, we remain in liberalism.

1.3 Truth or Lie

Some asks me anew how to distinguish *truth from lies* on today's media. The questions of truth and untruth are the greatest secrets of the universe, and every new move in this field reverses the appearance of our civilization. It is not possible to have this “universal key'' for truth unless you are the master of the universe. I think so, but I still say that there are certain ways.

The greatest wonder is that the truth is available to us at all, and this miracle was discovered by the ancient Greeks. They first understood the mystical relationship between the assumption, the implications, and the consequences. For each claim, only two states were established – true or false. No third. They noticed that from the false assumption by (good) deduction both the true and the false consequences result, and from the true only the true one, and it was the beginning of mathematics. When we can prove that a certain claim is both true and false then we have *contradiction*, and when we have it, then the assumption is false. So, the false assumption means that its negation is true. And that is that. Deduction has since been a useful addition to contradiction, but its glow fades.

Therefore, the supreme evidence for the discovery of lies is contradiction. Soft versions are based on suspicion, such as the oppressive ease of “proving''. Others come from game theory. The tools of winning games are a desire for victory, an aggressive move and a lie (cunning). The power of this third decreases with disclosure, which makes it difficult for us to check it, because it is better “packed''. If a competition is in progress, somewhere there are lies, but the player on the compromise, the good-good strategy does not go to victory, and it further complicates things. Lack of lies is the virtue of “goodness''; unlike the “villain'' who could even conquer with lose-lose game (progression by the victim). An aggressive person (institution) in social competitions that strives for success or power is daring, rude, must lie. And that already is something in reveal?

The method of contradiction is not seen daily because it is heavy and repulsive. It's the game for the rare. Mathematics is the body in which such put the claims, and which returns it to us if they are true. We can imagine its abstract body as a robot that repeats only the correct sentences for us. It is clear that in the body of truth there is no room for a “barber that shaves all those, and those only, in its place, who do not shave themselves''? The concerned robot cannot say “I'm lying'', but it can say, “I cannot say a lie''. He can say once, “I cannot say a lie twice'', but this cannot be said twice. If you understand, then you are a talented mathematician and I have nothing to talk about. But if you are not, then you can see how difficult the contradiction method is!

In examples like these, Bertrand Russell discovered in 1903 the *paradoxes* in the then-so-called naive theory of sets which was later corrected. In 1931, Gödel proved the *theorem of incompleteness*, which says that it is not possible a truth structure (say arithmetic) that could prove all its truths by itself. This further reduced the importance of deduction, as well as the power of axiomatic theories. Shortly, there is no set of all sets, no theory of all theories, and no formula of all formulas. Moreover, even the truth only move us (substance) directly, it can also be made of lies, for example, by negation or implication.

Contradiction is much harder than deduction, and therefore debates are more popular than geometry. That is why we are greatly contemplating and producing statistically significant percentages of wrongfully convicted prisoners, naively trying to fix things in the ignorance that we are actually victims of nature's skimping in providing information. The Greeks have noticed the open door to truth, and we that nature does not give it easily. We recognize its stinginess in the aggressive ease of polemic (from incorrect assumptions), in the greater attractiveness of lies and semi-truths than the truth, in the faster the spread of disinformation on the Internet, or in the fact that it is easier to encode than decode. Because *information* is larger when less likely, more likely events are realized more often. The difficulties with the truth, therefore, are not just our thing, but it is a universal principle.

This universal principle, that nature does not love the truth, even though it is only the truth that instantly initiates, makes life easier for liars, competitors, manipulators. It makes the world more interesting and reveals some deeper links between data, information, action and interaction. But we'll talk about it on some other occasion.

1.4 Feminization

Local and humorous in a private correspondence with colleagues I used the term *feminization* for physical processes that give up of the outside world. Look your own business, and don’t worry for others – commented it they to me in good faith spreading the meaning, but advised me later not to develop ideas and applications. Not to waste time with the nonsense.

The second law of thermodynamics, it is known, speaks of the spontaneous transition of heat energy from the body of higher to the adjacent body of the lower temperature. By Boltzmann in 1905, in the steps from Clausius, Gibbs, and Carnot, this law was observed in the form of a spontaneous growth of *entropy* (disorder) in the uniform distribution of air molecules in the room.

The amorphous, impersonal molecules of gas as if to hide information about themselves, reduces its emissions toward outside and deals with interior arrangement, so it is convenient to say that it feminizes. Try not to understand the same process now as increasing disorder (entropy), but on the contrary – as an increase in the inner regulatory and you have the need for a better term. There is also the discovery of the reverse side of the entropy or disorder.

This can be seen even more generally. Uncertainty before throwing coins, listening to news, accident is realized in the information after. We exchange news with communication, as well as particles the consequences of their interactions. Due to the multitude of possibilities, interactions have no end, but what comes arrives. We think that the information is plastic like energy, so that it also transforms itself from shape to shape, neither arising from nothing nor disappearing into anything, otherwise the proof of the experiment would not be valid.

From this maintenance law, however, follows the finality of each property of the information. Namely, *infinite* is the set that is (by amount) equal to some of its proper subset. From the same conservation (maintenance) law we understand that the uncertainty is kind of information too. When inside is less uncertain than the outside, the editing of the interior is less risky than the outer march, it is more predictable and more meekly. Turning to that side of the unknown is feminization.

If you understand this, then you will be able to transfer “feminisation'' to *living beings* because their main properties are just options and decisions. Population less threatened from the external hazards becomes adapted and feminized. Initiatives of herbivores, collectors or vultures are less rude toward the outside than in the beast.

If it is not in an aggressive environment, the introvert species can evolve towards the optimum when every change would only deprave it. This perfection has its price in lagging and outdated in relation to the dynamic environment. That's why have had overcome the two-sex species, better adapted to complex relationships and environments, with male sex that would take on suffering or success in risk situations?

The question mark stands because this is an unexplored terrain in biology. Nevertheless, we accept that individuals in their youth are in rush for a fall and in acquire for experience achieving its maturity, and that they slow down with adventures in their old age. In this sense the very organizations of living beings are like living beings, so the use of a new determinant reaches, and, say, to social phenomena.

Each of about the 30 well-known civilizations that feminized, previously were in the expansion, often brutal. Feminization did not mark the end of every one civilization, but it never happened the other way, that it signifies the imperial rise of some. We recognize the greater chances for drastic changes through external uncertainties, and internal editing as a reward and pacification which was not worth without the first part.

Consequently, we see Suleiman the Magnificent (so-called Lawmaker) as the turning point of the rise of the Ottoman Empire and the beginning of the “sweet fall'' of that later the “empire governed by women'', as well as other successful civilizations that through their voracious rise and enrichment arrive on safety at their end. Further, I wonder if the working term “feminization'' may not only be a homonym to the one known in everyday speech?

The questions are actually much more. Is the recommended useful work some of the most useful things that we could do, what would practice without good theories, do (legal) reductions of aggression really build a better future?

1.5 Life

Here's what is life (I quote an elderly lady): you enter one door, you go out on another, and that's all! Could it be said on some more exact way? It certainly cans, but for the start, forgets all about the usual debates about the meaning of life and “science'' about it.

Life can also be defined by means of communication and alternatively by means of action — multiplying energy and duration. This second is in science more familiar, so let's consider it first. There is no part of the known matter without at least some energy and duration, and yet nature is as if it wants them as little as possible. For every well-known trajectory of physical movement the *principle of least action* is valid! It is the basic tool of theoretical physics and still without significant further application.

Waves move through the middles in different speeds, reflecting or refracting, constantly spending the smallest possible time intervening the two places on the road. Particle interactions with the environment are in the least possible energy exchange. This stinginess is confirmed by the famous Euler-Lagrange equations (1750), from which we then perform geodesic lines of movement in various fields of physics, including relativistic and quantum mechanics. The various minimalisms are regularly confirmed by the experiment. It is precisely this need of a substance to not-work, its selfishness, however, which allows it to possess excessive actions.

The substance proves its existence by action, but on the other hand by communication. The exchanged information is bigger as it is less likely, and less likely is the rarer happend, so the previous logic of minimalism of the action is now being repeated with the information. Natural savings of information becomes a newly discovered principle that triggers the accumulation of information as well.

The substance with a surplus of action and information that we do not call physical, called the “living being'', in contrast to the one that does not have that surplus. Dead matter has minimal actions and communications, and then it means that living beings have them more: the living cell contains more information than the non-living substance it consists of, it has more options available and makes more decisions. It is revealed by the motion beyond the solution of the Euler-Lagrange equations.

From the new principle – that the nature is stingy with the emission of information – we come to the definition of living beings with information in excess. It would be easier for its surplus for the life to reject them into the surrounding, if the substance is not filled already, and therefore it must be solved by the interaction on rates, even by organizing. It is not possible anyone to communicate with everyone, and that fact leads the substance to the association among suitable.

Similarity is an opportunity for "organizing'', and that is actually an abdication of personal freedoms, of surplus options, of information and action overbalances. The collective is created by taking accumulated individual accessions. We renounce part of our freedoms for the benefit of the rule of law, for the sake of safety and efficiency, as living individuals sometimes evolve into a higher structure. The individuals are embedded, limiting themselves to the benefit of the collective, and consistent with the new definition of life, we say that the very organization of living being is also some kind of *living being*.

The similarity of the living tissue goes to the initial universality of living cells. Growing ones specialize, contributing to the efficiency of living tissue. It is a replica of the principle of minimalism. *Intelligence* is the ability to use options (revised definition), so better organized may also be less intelligent. This is expected by the evolution of the organization.

For the complex organism the obedient is better, also those in the narrow segment of jobs, that is, the specialized cells which are less autonomous, no more unpredictable scandals are required, nor some too smart, but also those that can uncontrollably reproduce. In this direction is the development of social systems going?

The described view of life is not unknown to biology, but it gives it a deeper meaning here. Darwin's evolution lasts not by accidental selection, which due to the abundance of possibilities will tended to the disorder, but also by the principle of information leading it to the organization. The life of the individual, colony, and species also becomes like a cyclone in the ocean. After the storm shine the sun and everything calms down, as if the tornado was an unwanted disorder, and its calmness was a success, but in addition, we see some attraction in the unrest. The beauty of life moves us.

1.6 Equality

It tells me a colleague to say something about *equality*. It can, but it is known that she, the nature, does not like great leveling in any sense and that we are raping her in that regard. Nature hates equality and will do everything to hinder the ideology of our legal systems.

Barabási, a Romanian-born (1967) Hungarian-American mathematician, since 2000 explored the networks. Internet, power lines, popularity, money flow – are the applications of his discoveries that once established become a universal thing.

Networks become denser by increasing the number of nodes, for example, new users of the web or intersections of roads, and equality is expressed by randomly linking a new connection with already existing ones. Thus, however, stand out centers say *concentrators*, with many links, simply due to the increasing connectivity probability. They are aggregates, monopolies of cash flows, databases, command posts, always small number of them and in the function of saving their network communications. They are characterized by the so-called *power law* distribution.

The *six degrees of separation* rule is the result of Barabási distribution. The free-made acquaintances with someone who knows someone who knows someone and so on in (about) six steps from-to shall connect (almost) any couple of people of whatever great world. The ease of connectivity is again achieved through rare individuals with many acquaintances. Insisting on a different equality, for example by connecting just about every pair of nodes, leads to rapid network congestion, and the attachment of only adjacent, as in the *deaf phones* children's game (with a whisper from ear to ear), to slowdown and unreliability.

Synergy (Attic Greek: συνεργός – working together), a state in which the whole is somewhat larger and different from its parts, now means accumulation of information. The resulting bonus becomes the livelihood of the free development of the network and the spontaneous separation of the concentrators. It may be shown that the same form is followed by *Nash equilibrium*.

This is the theory of John Nash, the American mathematician and winner of the Nobel Prize for Economics (1994), known from the biographical film “A Beautiful Mind'' in the role of Russell Crowe. He worked on equilibrium in games, places of competitors in which the individual participant cannot gain advantage by leaving the group. It is typical for teamwork. Basically, it is a mathematical model, and therefore is widely applicable.

The free market builds Nash's equilibriums like vortices from which companies in the struggle for profit cannot easily get away. The economy is dynamic, so it's attractive spots eventually weak to the complete collapse of the participants or to the creation of a critical mass willing to move for the better. Capital crises have emerged that have been discovered by *Karl Marks* calling them the transitions of quantity into quality. Now we see them as spontaneous organization, network efficiency and savings of information.

The Communists tried to avoid the free market by the Étatism of economy (state-run) by compromises of the desired and possible, thus losing the part of both, which led to a known lag. Only recently, after the appearance of seemingly incompatible models, Barabási and Nesh, we can further understand that the links of the network nodes and strategy games have a common form, and then why and how their efficiency is aligned.

Common to these cases is saving interactions and running away from equality. Let nature leave at will it will work for us as we will not like, it will defy our ideologies and irritate us to remove it from duty. *Equality* costs, and in that cost there is a decrease in efficiency too, so we have more and more lawyers, more state regulations, less freedom and always too many mistakes and abuse of rights as long as we have with what to pay our dogma.

Because we want to believe that the idea of equality is not contradictory or that equality can be approached more and more (which is the same), and in order to justify the work of our legislators, nature would be better if there were equal persons or at least equal conditions. Because the nature has to bow before us, and we are who she has to worship!

1.7 Dunning-Kruger Effect

Dunning–Kruger effect is a cognitive bias in the field of psychology according to which people of lower abilities have an illusion of superiority and are wrongly evaluated as being smarter and more capable than they are.

Charles *Darwin* (1809-1882) once wrote that ignorance generates more self-confidence than knowledge. Because of this combination of poor self-consciousness and a low cognitive ability that leads to overestimation of oneself, Bertrand *Russell* (1872-1970) said that the problem of this world is that smart people are in doubt, and stupid people know everything.

In investigating the effect named after them, Dunning and Kruger, among others (1999), asked respondents to evaluate different jokes, both, their own and others. Uncompleted people have proved to be not only bad performers, but were also less able to recognize the quality of their work than others. It is not uncommon for students who were worse on the exam to feel that they "deserved'' a better grade.

Let us now consider this phenomenon from the point of view of the theory of information in general in the collective (people, living and non-living beings, random events). A mass of equal individuals can be seen as an amorphous impersonal set, maximum entropy (mess) for which we can add that it has the smallest possible emission of information to the outside world and in that sense it is best "feminized'' (turned to itself). Reducing external communication we simply call a smaller "mind'' of a group of equal ones, which would have to be less than the average mind of its individuals. This tampering of individuals in the mass applied to living beings means that the D-K effect does not come from the less intelligence (IQ) of the respondents, but from their equality!

The mind of the mass can be stated in referendum questions in similar tests as well as the individual's minds, and the result should be different from other abilities, for example, that more them do more work. I have no doubt that such a measurement would confirm an analogy from the theory of information – the conclusion that the mass of equals is less effective than unequal ones, the hierarchy, of course, in relation to the outside world.

This efficiency can be defined as a security, economic or some third of the game theory, it does not matter. In any case, efficiency is the surplus of information[2] to the outside (of the collective), which in fact means loss of information, cost, because information like energy changes form (kinetic, potential, thermal, chemical), but not the total amount. Information is a measure of (variable) data.

The loss of information in efficiency (over time) is reflected in the reduction in the ability of communication of individuals, the limitation of their control of options, the reduction of individual freedoms in favor of maintaining the efficiency of the collective, then by time in the lagging of the

[2] Not known in the game theory, for now.

collective in the changes, or becoming it obsolete in relation to the outside world. The consequence of efficiency is a lack of development (which is rarely known). On the one hand, there are many options, freedom and development, and on the contrary there are security and other efficiencies, and societies in a harmonious development tend to optimize all these opposites.

What is not mentioned in the psychology books about the D-K effect is the understanding of its absence. These are the situations of individuals in hierarchies. If this is confirmed (by some future measurement), then it is reasonable to say that it is more effective for team work to choose the individuals of different specialties. The same comes from the thesis that nature “does not like'' equality and both comes from the “principles of information'' – that the nature is stingy with the emission of information, that is, it is more likely to realize more probable events (which are less informative).

Therefore, it is wrong to estimate people with a surplus of self-confidence as some kind of stupid. Their appearance should be viewed wider – as the success of the democracy in which they live.

1.8 Bystander Effect

Bystander effect (or bystander apathy) is a social and psychological phenomenon in which individuals in the larger group show less interest in helping the victim of a miserable event. The more observers are there, the smaller the chance that someone will intervene.

American psychologist John Darley discovered this phenomenon by publishing an application to the New York Times in 1964 for the killing of 28-year-old boy Kitty Genovese, claiming that 38 witnesses watched the attack, but none of them called the police or offered help. A lot of professional books have since been written about “Genovese syndrome'', but, I believe, not much about what I'm about to tell you now.

The principle of least action (the product of energy and time) is one of the basic tools of theoretical physics. However, as far as it was unmistakable in predicting the trajectory of the motion of the substance, both in classical physics and in relativistic or quantum, it always persisted without wider application outside science. Until today.

If we know that physical information is an expression (equivalent) of a physical action, that principle of minimalism becomes also the *stingy principle* of information, it’s non-splurge. The reluctance in communication rules everywhere around us – from the reflection of light via the shortest path, through the falling of the body in the gravitational field along the paths of the least energy consumption, to the spontaneous processes of “feminization'', that is, the tendency of the physical system to reduce the “editing'' of the outside world at the expense of its. “Genovese syndrome'' is, simply said, the consequence of such processes. Here's how.

By saving, matter can be grouped and created by surpluses of actions (unrest) and surplus information (life), and more than that. Living beings are thus further organized into more complex systems, at even more levels of life, unselfishly surrendering their parts of information (degree of freedom) or action to a common order. We also spontaneously become the cells of some tissue of our future ever more complex organization, by evolution formally similar to many other living tissues: the universality of birth (savings of communication mode), the specialization in the mature age (savings of the mode of action), the decline of freedom (saving information) the decline of intelligence (communication saving) and the ability to reproduce (saving the action).

The “Genovese syndrome'', consistently, represents a surrender of itself, the incorporation of its surpluses into a higher hierarchy. As for us today, this is above all a legal system. People adapt to their own social order become less prone to personal incentives outside and are increasingly willing to rely on the system to solve the problem. By developing in such currents, movements and individuals, we see less and less of things in personal responsibility, and more and more in the legislation (I’ll stop here to not argue with politics). When we believe in the system, then the environment like military barracks becomes an ideal and then really weakens the “bystander effect''.

In other words, individuals of a regulated society left to the situation of equality become blocked. Their apathy is a confirmation of the advanced democracy in which they live and their faith in the legal system. If this thesis is correct, then the respondents convinced that the system is “value'' and brought into equality conditions will show greater bystander apathy. This can be tested, for example, with anonymous travelers on a bus, passers-by on the street, viewers in the theater.

Valid is also vice versa. If you do not want of the anonymous to look apathetic on the incident, you should disrupt the equality, produce a hierarchy by imposing yourself temporarily as a leader. Take the initiative in the burning theater decisively, commanding the departure of the room and you'll save many. In the event of an aggression on the passerby, boldly vow, “People, he/she attacks the person! Call the police!’’ And the new authority will launch the audience. Remember, Napoleon was not physically stronger than his soldiers, but he had the ability of domination and he would become a master of turning the apathy into killing tools and weapons.

In case you are not in the crowd, decline the chances that you are reliant on the system.

1.9 Dictatorship

The biggest problem with the dictators is that they are not able to see the benefit of truth and freedom. Encouraged by the enthusiasm that comes with the order, and then because of prejudice, they overlook the outcry of obsolescence.

According to this definition of the *dictatorship* it is a lawful society that accelerate first and then slow down, such as the recent *fascism* been in which the state was the proclaimed master, and not the servant of the people. Or *communism* (dictatorship of the proletariat), and tomorrow maybe *liberalism* because of its foundation in the need to take on the rights of individuals in the name of their alleged freedom.

If we are bees or if we have shallow wisdom, less perception, modest curiosity and weaker impulses for development, we could have been born and die more than hundreds of millions of years, provided that the resources last. Evolution does not stand and we would slowly adapt to a reduced number of complications. This is likely happening in the nature, and the development of intelligence is so incredible – we are one of not too much survived among the countless millions of failed processes – that the running of our species in this direction leads to a reasonable doubt of some biology setting, its principled questions.

“Better theory gives a better meaning to facts'' – the motto is to redefine natural phenomena, so here we are going first to declare that there are *choices* and that it is possible to *make decisions*. Then, let *intelligence* declare as ability to control options, and *freedom* as their amount similar to classic information. With this we are in the field of mathematics where more truth than we can imagine is and this is already the first unsolvable problem of dictatorship, if that does not want to lag behind.

There is no the best criterion (*Arrow’s theorem*), there is no truth in all truths (*Gödel's theorem*), there is no set of all sets (*Russell paradox*). Mathematical-based theories create insurmountable obstacles with which there is no compromise, but in turn, they enable relatively easy and unlimited assimilation of exact constructions. They emphasize difficulties and clarity.

On the other hand, the assumption that we believe in physical experiments leads to the conclusion that information cannot be created from nothing and cannot disappear to null. It is plastic, like energy, changes shape and keeps the amount. Perceptions are then not only interactions, but also communication, and information, freedom, action, and truth are equivalents. It's weird, but the handy side of the magic of physics is that its phenomena, for which the law of conservation (energy, mass, moments, spin) is valid, are mutually reciprocal.

For example – in analogy with the increase in pressure by reducing the surface area, saving one's own action on one thing leaves them more for something else. A manager with simple daily routines has more creativity in a more important job, which is also a chance for less smart ones who usually better tolerate constraints.

Every action of freedom (perception) has its reaction in an obstacle (environment) and vice versa, and the total freedom is the result of conflicting (many) possibilities and limitations. This stimulates enthusiasm for those who are eager for freedom that in the limitations of the dictatorship see the liberation, but dual, and to those who are scared by open opportunities. Freedom is here the total *information of perception* which is the sum of the products among ability of the individual and the corresponding impediments to the environment.

Without entering into the algebra, it is possible to feel that the norms absurdly do the both, and define the wishes and mean the lack of freedom, and for this second we say – because the material options are consumable. The essence of freedom is those possibilities, and of them are the uncertainties and of these are originalities. The essence of all of them is unpredictability.

There are no real discoveries on the trails, so the brake of creativity is order. What the legislator can think of as the rules of the game in the economy, education, street walking, is always too narrow for a genius who could appear there. That could be one of those few who create something new, the most needed to dictatorship.

Like a ship that is driven by powerful engines in a outlined direction, and which safely and efficiently follows the route, so the dictation in its best way leads its passengers to certainty, ignoring a lot, perhaps even something better along the way. The blindness to development is one of the prices of over-stretching, and the second is dumbing down, because we as a species are also adaptable. When we evolve in one way we are dwarfed in some other way – the curse is of good orderliness, because the development directions are always too many.

So we understand that the big problem of the dictatorship is their blocking of our mission to be human beings, to remain a curious and intelligent species on this planet.

1.10 Crime and Penatly

There is no valid evidence that the extension of legal *penalties* reduces the percentage of *crime* in society. It is known that saturation of society by laws reduces the chances of development, so the question arises as to why we are striving to more and more durable laws? Why are we extinguishing out the fire with the oil in the alleged fight for justice?

What will happen now – some years ago they asked me about the proposal of the Family Violence Act (Official Gazette of RS, No. 94/2016). The *law* will come out and violence will be increased (perhaps significantly), and then it will be an opportunity for further intensification of penal policy. Today we know that all these three predictions have been confirmed, but that the same arguments have not gained popularity. A greater threat of *imprisonment* will provoke a greater affects, but it will also bring the *killings* to its alleged dismissal: I better beat it dead, but it laughs to me while I'm slaving in penal servitude. Behind this loose interpretation, of course, there are deeper reasons.

There are a number of statistical certificates, other experimental studies, but also some points of mathematical *theory of games* (Heiko Rauhut: Higher Punishment, Less Control? — Experimental Evidence On the Inspection Game; July 20, 2009) that prove that there is no accurate “rational conclusion'' the greater penalties lead to lesser crime. Because a precise analysis requires a smart and objective interlocutor, we realize that our demands for “higher order'' do not come from scientific sobriety.

The same was true with my recent criticism of the so-called Tiana's Law[3], now voted in the Serbian Parliament, and maybe soon imitated in the Republika Srpska. The state must not deal with retaliation, I state, and then from the legislation, as well as from the investigation or court decisions, it is necessary to exclude personally interested persons. However, instead of exemptions in the implementation of the Tiana Law, the personally concerned persons were given the main role. Moreover, with about 160,000 signatories, citizens are captured by fraud (who will say that it is against the “protection'' of children) in a way that many other laws can be duped, which is then considered politically correct.

The decline in credibility of legislation is always threatened by political manipulation. In this case, they are revealed in the official support of the positive sides of the new law without mentioning those other parts. In flirting with emotions that tend to *retaliate*, in the understanding that in the event of a collision

[3] Initiative for tougher penalties for killer of children.

of force and truth, the truth is easily lost. In the trepidation of politicians being able to make other “two legs'' of the state subdued under their own and discover that it is only a matter of their grace that they will. In the doubt to the politicians do they want such kind of *dictatorship* which would inevitably result us in slowing down the development.

Professional and fair *lawyers* will recognize that this law is not completely in line with our Constitution or with international law, but let's say it does not matter here. From the point of view of the wider truth, it is irrelevant whether laws are like this or that, but whether they hinder the creativity of the society. This should be equally important priority of legislation, comparable to the principles of human rights or the mentioned separation from politics.

Honored lawyers could admit that the expected maniacs or criminals returnees often do not get into prisons as much as in madhouse, and Tiana Law targets (almost) into the empty, that is, it is statistically less significant than the collateral damage it has a chance of doing. Also, it is fair to say that legislation made far more errors than acknowledging that it is willing to admit and that the austerity increases its injustice. The mistakes of the law are worsening as more *capable* people, whose agility, entrepreneurship and wittiness are most needed, are more likely to fall into its slaves as innocent victims of the judiciary.

Therefore, the danger of increasing crime in society comes from those who would allegedly suppress it, but that's not all. Our *politicians* are not only ours, and therefore they must lie and manipulate. It reveals, for example, the strengthening of the powers of the Executors who seem to be there to discipline small rogues by confiscation the large amount of their assets. But the silence of the authorities for cry of the little people that in this way goes deeper into homeless throws doubt on the IMF[4] and its reliance on big capital. Are we making for this strongman the easier prey here?

The impact of large capital has two faces. The trend is for the *rich* to be even richer, that they are (in percentage) less and they have more and more (of all), while others are becoming weaker and harmless. The rich tighten their hierarchies and by the rule of law ensure and increase the acquired values, but the state of disorder corresponds more closely to the population. So they do, and the *poor* who seek retribution get what they went for, even though the both did not want the same. This is again an interpretation behind which there are deeper reasons.

Namely, the *physical information* is true (it is impossible to communicate for which we have proved it is not possible), the action (it changes us, at least infinitesimal), matter (all substances as bulbs consist only of information). “Minimalism Information Principle'' is valid because more likely events are more likely to be realized and they are less informative. That's why we are attracted to a lie (especially if it resembles the truth), so the “principle of least action'' is everywhere in physics (the action is multiplied energy with duration). This second is generally known, first so-and-so, and the following is not: therefore, the universe is expanding[5].

[4] IMF – International Monetary Fund.
[5] This may have been said too hastily and vaguely, but it was explained in more detail later.

In short, we are striving for ever more denser and more stringent laws, primarily because of the “principles of information'', but also because information is also the both, uncertainty and aggression. The skimping of nature leads to its accumulation and creation of living beings, to our hierarchies, and of turning towards ourselves. This reversal in the physical world is called a spontaneous growth of *entropy* εντροπη – turn inwards), in the society I call it *feminization*. Both are types of escape from freedom, from which we can not escape, because this world is only of its terrible tissue made.

1.11 Uniqueness

Physical substance is just what we can in some way interfere with. Even the *dark matter* of the universe according to this definition is a physical substance, because it gravitates to galaxies, to stars and other celestial bodies, and they act upon us. Also, there are no actions without information, and in addition, both are *truths* in the sense: it is not possible the physical act for which could be proved that it is not possible.

I answer the question asked, “Why are we not equal?'' in which alludes that injustice in the world allegedly could be solved by the free proclamation of *equality* of all of us. We have overcomes the question that there is no identical faces and the same conditions, and therefore that equality is an impossible mission of legal doctrine, and then I am expected to present the deeper causes of this inequality. OK, I say, but the answer from the standpoint of today's trends is so unexpected that we have to go slowly, in steps.

Theorems we discover are like nodes of *free networks*, with a small number of so-called *concentrators* that have a large number of links opposite to a large number of others, and the idea of information, the discovery of this very theory, is one of the denser places of truth and deduction networks. Some of the *principles of information* are also thick: conservation, minimalism and uniqueness[6], and as I will explain are consequence of so-to say all three principles is the answer to the question raised.

The first is the “conservation'' principle that talks about the law of maintaining (physical) information and is mainly known to physics. If I need to say something new about it, let it be that the information is proportional to (physical) action, and we know that there is a quantum of action (Planck's constant), which is why the information is already indestructible. Different proof of “conservation'' is communication itself. That's why we can communicate because the information sent to us cannot just disappear. What started is coming. Therefore, we must communicate, I will add, because we do not have everything – because we are different.

The second principle is “minimalism'', a direct consequence of the “principle of least action'' already known in (theoretical) physics. To it, generally, we can come up with non-speculative way by using (mathematical) probability theory. More likely events are less informative, and they are more common. Therefore, because it is greater news that a man has bitten a dog, then the news that a dog has bitten by a man, we know that nature is shy with information. Then we know that in a set of equal outcomes

[6] Initially, it was the “principle of uniqueness” of this theory, but by expanding it to the “universe of information”, it became a consequence.

the singular will have the least probability, so that nature does not like equality. The throwing of a fair coin has greater uncertainty; the outcome of “heads'' or “tails'' in a fair case is more informative.

The third principle is “uniqueness''. We talked the least about it, because it is mostly a matter of physics. This principle can be understood as the announcement of the so-called *Mach's principle*, as Einstein once named, after the most famous physicist and philosopher of the 19th century, the influence of the mass of the whole universe on the water in the rotating washbowl in relation to those masses. Water is spilled due to the centrifugal force generated by the relative movement of water relative to the universe, and vice versa would not be possible. By the way, the same experiment with the washbowl also used Newton proving “absolute space''.

Analogously to the Mach's principle, us define our past. Each particle we consist of has its own history in which it is unique, and thus, each particle of the universe is *unique*. The substance is defined by information, including information on preserved information about it. Consequently, in the famous quantum-mechanical experiment *double slit* there occurs the interference of particle-waves (all matter is wavy) through two slits, even when these particles encounter one at a time separated by long periods of time. All the appropriate particles that have ever been passed, from the creation of the universe to the present, through the given space – interfere with that particle-wave now.

What we see today is like a wave on the surface of the sea which is also the *interference* of all the layers of water below. If nature allows equality, it would allow at least this phantom equality if the histories of at least two particles and the aforementioned experiment “double slit'' would not be possible. However, this equality it does not allow for any particle (fermion) of the same quantum state in relation to only four known quantum numbers. What I am talking about is well known to chemists, who, from this so-called *Pauli Exclusion Principle*, derive the known elements of the Mendeleev Periodic System.

1.12 Free Will

If there are options, then there is no *determinism* and, accordingly, it is said in another letter, we have free will and responsibility for our actions? It was a question to me from a colleague who, in accepting coincidence sees the possibility in consciousness to control our destiny. But things are not so simple.

Determinism is a philosophical idea of events and moral choices fully determined by some previous causes. It excludes free will, assuming that people can not act differently than they do. However, if sometimes we have really random events, then there is no idea of determinism. But again we are not free to manage our destiny, which is then left to uncertain outcomes.

As if they were aware of this paradox, some ancient thinkers limited any uncertainty to people, and their controls were attributed to *gods*. Today we can go a little further and calculate the more weird conclusions.

We know that there is infinity of natural numbers, we say *countably many*. Equally infinitely have integers or fractions. They make the so-called discrete (abstained) infinite sets. Unlike the finite, infinite sets can be equal to their proper part. Accordingly, all physical phenomena, for which the conservation law applies, are finally divisible.

For example, the smallest amount of action (energy and time products) is Planck's constant, and this is the smallest interaction, and, as far as I am concerned, the smallest carrier of the substance's communication. All mutual actions and physical communications, as well as all the atoms of our body, and even the universe, can be transformed into one at most the countable infinite series. Because of the wave nature (every form) of matter, we can always numerate the positions in some wavelengths, and the duration by the blinking, and the space-time of any given physical events remains a discreet set. All programs of modern (classic) computers can be so aligned, and hence, any material structure can be represented by countable, discrete codes.

In contrast, real numbers have an uncountable, the *continuum many*. There are so many points of the plane, the points of the line, the points of one segment, because the continuum is infinity, so it can be equal to its proper part. The irrational numbers, which in numeral notation have infinitely many non-periodic digits behind the comma, have as many as real. The very positions of these digits make up a series, but their variations are more than that. This impossibility of placing the continuum in discrete gives us an idea for a deeper understanding of our consciousness.

The multiplicity of our thoughts indicates their uncountability, although they always follow some (countable) sequence of moments. If the substance itself is (infinite) discrete, the world of the ideas that explains it is a continuum. Therefore, with the accurate cloning of a man by pure copying of his atoms, we will not transfer consciousness; it can not be done by classical programming, but can perhaps by quantum, since quantum states of matter are superposition of coincidences.

Superposition is generally a property of the linearity of connected phenomena, when twice more one means twice the other. Here, in particular, we collect the probability, as when we double the chance of winning a prize, by purchasing two ticket lots. Each random outcome realizes the information exactly equal to the amount of previous uncertainty, and, in analogy, the superposition by interacting *collapse* into a new *quantum state* without changing the corresponding quantities. Each interaction made the quantum system to *evolve* into its new reality, giving up of all possibilities that could happen but did not happen, which we call *pseudo-realities*. In pseudo-realms the same laws apply, but mutual (physical) communication with such is not possible because of the law of information conservation.

Thus, quantum superpositions constitute a continuum, uncountable many of possibilities, although the number of realized outcomes is always not more than countable infinite. Our “free will'' passes through the continuum of the multiverse idea, through realized options of parallel realities within the same laws of physics are in place, and which do not communicate one by other, so that our physical body and all surrounding matter remain discreet.

The *quantum mechanics* is a highly consistent representation of abstract algebra and so far probably the most exact and experimentally proved branch of physics. Perhaps it is precisely the reason that the discoveries of quantum physics are so devastating to its experts, which are more in the spheres of an abstract than physical. Beginning from its superposition, for which Einstein, otherwise one of the founders of quantum mechanics, said in unbelief that “good God does not play a dice'', and to the multiverse “whom God is not needed'', as is criticized by modern theoreticians of theology, it in spite of its scientific reliability persistently remained at the margin of acceptability and somewhat on the other side of reason.

If one really could choose his own paths, with full awareness of the exact consequences, then he would actually manage the universe with his choices, he would change the entire material universe with his own desires, decisions and will. The question from the beginning is do we really have so much power?

1.13 Repetitions

How come that the events are unrepeatable and our genes are *repeating*? Why are the celestial bodies circling, and we walk on the sidewalks using only a few templates (which mathematicians are just discovering), and we claim that matter is made up of a huge number of unique interactions? Why do political parties of one society increasingly resemble one another, although there are no equal faces or equal conditions? These are interesting questions for the theory of information, which pretends to be more general than the classical, Shannon's.

Information is the true, but also it is an action and interaction, a physical matter and comes from uncertainty. Contrary to the usual belief that we know the past and the future is hopeful, we see only the consequences but not the causes. Only by substituting the thesis we arrive at the “conclusion'' that similar events produce similar consequences, and then due to the finite partition of each property of information, and therefore the final number of their combinations, we perform (hypothetically) the thesis that everything, but really everything, in the material phenomena – is *periodic*.

In extremely simple systems like *photon* (particle-wave of electromagnetic radiation and especially lightness), the growth and fall of an electric field in one plane reduces with the rise and fall of the magnetic field in the perpendicular plane, alternately on the upper and lower left and right half-plane of the photon path, while it travels by encountering constantly to other places and other times.

The tendency of repetitiveness of matter increases the parsimony of the information. Similar to *free networks* of Barabási, which for the sake of efficiency tends to create a small number of nodes of concentrators with a large number of network connectors, large information systems favor fewer ones. Such a dominant “force'' of the Roman Empire was its attraction that stemmed from wealth, orderliness, security, and from which sprouted barrenness and weakness that could not resisted to the waves of the barbarians. The descendants of the then-settlers, the Visigoths, today's advanced Westerners, may have similar fate of Romans in the pattern of rise and fall. History, of course, knows how to “return'' even in shorter cycles.

Genomes of descendants also transmit features such as moral ones that are not physical, such as potatoes, but are material and expressions of physical information. They are also necessarily repetitive, within one species today, but also through their generations.

The theory of deterministic *chaos* is a new branch of mathematics inspired by meteorology and *recursions* (parts that repeat the whole). It deals with the phenomena of small initial differences that escalate and which is therefore a good test of the above theses. This is the *butterfly effect* whose wings movement in Mexico can cause a hurricane in Texas, or *critical mass* that is smaller than the majority but can trigger the whole system. As some chaotic and periodic things have already been discovered, for example in repetitions of the storm or structure of the tree trunks in the crown and leaves, and their forms are called *attractors*, now we just add that for all other natural currents will be found suitable “attractors''. Due to the principle of uniqueness and finality of information[7], its cycles and recursions are never identical, but are always limited and mutually no more than similar.

The examples of the period in local climbs and falls we can find also in *economy*. Say, for your new product as a monopoly, demand may grow, your income grows, but the new way of earning is appealing to the competition that is imitating you and the supply rises. The customers are finally a lot, so the revenues go through its zenith and begin to decline, which could motivate you to start a similar cycle with a new idea.

It is interesting to note that mathematical analysis, which deals with the continuum (not characteristic to the substance), knows the theorem (*Fourier series*) claiming that each function can be sufficiently approximated by periodic sinusoids. Moreover, any fragment of a trajectory wills approximate any other trajectory given in advance (similar to physical) in increments with increasing accuracy. These attitudes indicate that the form is not as important as the mere repetition, and they, in my opinion, speak of the connection of the material and immaterial (abstract) world of truths. That the first is deductible from the other, that the other is the envelope of the first.

It is not a novelty to know that there are similar periods of material occurrence, but it is the discovery of the assertion of the impossibility of their non-periodic behavior. When we think a bit more, we will encounter the principles of information in various of our everyday routines, its unpredictability and uniqueness, its stinginess and the law of conservation.

1.14 Emmy Noether

Is there a woman in mathematics? Of course there is. I will assure you of one important discovery of one of them, the brilliant Ammy *Noether*[8]} which, because of the theorem, is called a kind of icon of algebra and physics, but whose significance will only grow, I hope for the theory of information I'm just doing.

Emmy was a Jewish-born German raised to be a teacher of English and French in girls' schools, but instead she went to study mathematics at *Erlangen* University, where she worked with her father, mathematician Max Noether. Women were allowed to be on classes, but only in the presence of instructors, and its instructors are today widely known theorists *Hilbert*[9], *Klein*[10], *Minkowski*[11] and *Schwarzschild*[12]. She received her doctorate in 1907 on algebraic *invariants*.

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[7] Once principles and now consequences.
[8] Amalie Emmy Noether (1882-1935), German mathematician.
[9] David Hilbert (1842-1943), German mathematician.
[10] Felix Klein (1849-1925), German mathematician.
[11] Hermann Minkowski (1864-1909), German mathematician.
[12] Karl Schwarzschild (1873-1916), German physicist and astronomer.

The way Emmy treated these invariants became the subject of admiration for the first of Hilbert, Clay and *Einstein*[13], and then of many others capable of understanding Noether's mathematics, her own “poetry of logical ideas''. Emmy's the main work is of 1915, which we often call “the most beautiful theorem in the world,'' I will try to explain in a popular way.

At a time when physics still discovered the law of energy maintenance (conservation) – according to which the sum of the kinetic and potential energy of the body is constant (the energy of motion and rest, realized and unrealized) – *Euler*[14] and *Lagrange*[15] were miles ahead of their contemporaries. They considered the difference between kinetic and potential energy, which we call the *Lagrangian* today. They assumed that this difference in spontaneous situations did not change over time and in 1750 came to the partial *differential equations* of the second order named after them. Lagrange discovered the *principle of least action* brilliantly interpreted it and in 1788 laid the foundations of classical mechanics.

The Euler-Lagrange equations are related to any motion, in as much *generalized coordinates* as to give trajectories of the least duration consuming in reflection or refraction of light between two points, through swinging pendulum, the spring vibration, and, say, the least energy consumption in the classical, relativistic, and finally in quantum physics. Generalized trajectories are “paths'' of the evolution of physical systems of the unaltered Lagrangian, which we call *symmetries* or invariants.

When you stand in front of the mirror and observe your *reflection*, then you participate in the plane symmetry, the reflection in relation to the mirror plane. Each triangle with its reflection has equal sides, the same area, although the opposite orientation. Reflection is the axial symmetry in relation to the axis, the given real or central symmetry in relation to some point. In the same category of “immutability within the transformation'' are included the *translations*, parallel shifts of figures without distorting the distance between the inner points. In the first grades of secondary schools, in *geometry* we already have learned these so-called *isometrics* (Greek for “having equal measurement''), where we could learn that geometry does not have much of the symmetries and that each of them can be reduced to one or two *rotations*.

Emmy Noether noticed that one of the two Euler-Lagrange equation's items is a change in the Lagrangian (energy) over the generalized trajectory and that this change in the case of symmetry disappears, and that the remaining one, which represents a change in the amount of the corresponding physical system over time – also disappears. She resolutely concluded that the presence of “immutability'' means some symmetry and it the conservation of the corresponding physical value.

It is further clear why Noether's theorem will delight Einstein too, who once struggled with the understanding of invariant movements, the inertial straight-lined and the body in a free fall in the gravitational field, believing that in all such laws of physics they remain the same. The Noether's theorem also guarantees and the stability of the gravitational field.

[13] Albert Einstein (1879-1955), German-born theoretical physicist.
[14] Leonhard Euler (1707-1783), Swiss-Russian mathematician.
[15] Joseph-Louis Lagrange (1736-1813), Italian mathematician.

In quantum mechanics, we know *Heisenberg's*[16] *uncertainty relations* according to which the product of the uncertainty of energy and the duration (time) of any real physical process or particle cannot be smaller than the known constants (about Planck's). Analogously applies to momentum and position (length). It is in the way that for (almost) any pre-given little duration we can always have enough energy and have a physically realistic system, which is a condition of the differentiability of the mentioned equations. The quantum world's symmetry is, above all, the reversibility of all the quantum processes, which is reflected around the (current) present, and then it is somehow valid for macro-world.

In short, whenever we have some kind of immutability, we have adequate stability. For example, the water that goes around in the cup will look the same to us, and that is rotational symmetry – and we have a rotational law of conservation (angular momentum). The whirligig once started will continue to rotate until a force (friction) is stopped it. The body in *inertial movement* does not change and we have a well-known law of inertia of straight line motion. In quantum physics, as I have said, all processes, the *evolutions*, are described by regular operators, reversible, which is a type of symmetry, and then for the flows of information, the law of conservation is valid.

Let's step up forward shortly in front of Noeter's theorem and notice that infinite sets can be equal (in quantity) to their proper subset (part), and that the principle of conservation (my theorem) does not apply to such. In other words, if for the given physical property is Neter's theorem, then for this property conservation is valid, and then it is finally divisible, in mathematics we say is discrete. Therefore, all forms of the substance are atomized, quantized, quarked, and the physical information is also always finally split, say *discrete*.

On the other hand, from the Euler-Lagrange equations, with the zero of the item which denotes the change of the physical state by time, we see the presence of the corresponding symmetry. This is the reverse course of the conclusion of Noether, which now in a different way gives us evidence of the *periodicity* of the material phenomena we have previously discussed.

Freedom, the amount of options measured by physical information, is also discrete and consumable. Such are our originality, our discoveries, and hence the development of society. If we would measure the legal restrictions analogously, the same would apply to the judicial system, which is consistent with the theory of information I have already explained. This takes us a step away from game theory, an important part of ``informatics'', but I will talk about later.

So there are women in mathematics and their contribution is not sporadic. They did appear less often, but they can be very bright.

1.15 Balance Games

The theory of information I deal with is the mathematics of choice. Game theory is the mathematics of deciding. When we set them one by another, it will be shown that these are two related areas with much in common. The theory of games was created in 1928 when John von *Neumann (*1903-1957,

[16] Werner Heisenberg (1901-1976), German theoretical physicist.

Hungarian-American mathematician) discovered the *minimax theorem*. The proof of this theorem I'll now try to retell, but it should be known that it is very difficult in the original and that it is worth trying to understand it at least partially because its story is very abstract and therefore very universal. If you experience a single piece, you will see its reflections in many places around you!

Let's imagine that we have a player that has more options, tactics or strategies, each of which has some worst outcome. Suppose the opponent (one or more of them) can (with some probability) recognize the worst outcomes. Then it is best for a player to decide on a strategy with the most favorable outcome for him. That's some value, his “maximin''. Conversely, symmetrically, the opponent works. He decides on his strategy and his own optimal “minimax'' score.

If one of the values, maximin or minimax were better than the other, then that side would win, regardless of the impeccable game of the opponent. Such a jerk would be unfair, and the connoisseurs would be boring, and so to say the game is meaningless. On the contrary, if the values of maximin and minimax are equal, then the game is fair, it has symmetry, we say it is in equilibrium. The outcome is uncertain and the game can in the right sense last.

This great discovery of von Neumann now adds Emmy *Noether*'s theorem to the symmetric system of the corresponding law of conservation, maintenance of quantity, during other changes. Then, let us also consider (my recent) discovery that the property subject to the law of conservation must be *discreet*. The conclusion is that equilibrium games (when maximin and minimax are equal) must be discrete. Even when they at first glance look like analogous (continuous) ones, they actually have clearly separate moves in some of their micro worlds. Therefore, any physical information is discrete, freedom is discrete, prohibition of freedom is discrete, not only legal prohibition, but all that we have from direct natural laws are discrete.

This last is strange, since the minimax theorem assumes that the strategies are defined on *compact sets* of values, meaning closed domains, those containing all their limit values. However, the physical space due to Heisenberg's relations of uncertainty is “scarcely'' such, since it can be divided by an arbitrary but predetermined division to the infinitesimals. Further, the information exchanges in the physical world are always in balance.

It is impossible to transmit information from something into nothing, and it is not possible the moving of, say, photon through a *vacuum* without communication. Namely, when the vacuum communication did not take away the photon's information, the photon information would have grown unlimited for “information about its past information'' (quotation from my new book). That's why physical reality should be understood as a continuous rally of the physical, with all the “lots'' of the substances playing (multiple) always in discrete moves and in the constant Neumann equilibria. The claim that the information provided is equal to the received is expressed by the law of conservation physical information. At the same time, physical communication is also a two-sided physical action.

With the law of energy conservation, the above question arises in the suspicion that “everything will come again'' because energy is the work of the force on the road, and the force has the power to change things. The body thrown up may be coming back to us, in its “path of truth'', but forces can create disorders that have gone too far. The constants in these actions are, I paraphrase, that the biggest storms on the sea are just some of the *balance game* of nature, and that in these “game moves'' of nature only truths are always exchanged.

The players who compete for the win have: the desire for victory, initiative and cunning; and more likely the winner is who leads the opponent to *defeatism* and to this extent realizes the own *aggressiveness*, that is, those who extract from the random game more information, that is, the *action of tactics*. The theory of games is further overwritten for such a short text, even for each of the mentioned indications of this theory.

Nature seeks non-action, through the *principles of least action* of theoretical physics, that is, through the *principle of least information*, because there is nothing that has no action, information or truth (they are synonyms). There is not even the smallest part of the nature without aggression, yet again it seems as if it is complaining about it.

1.16 Parrondo's Paradox

Sometimes by combining losing processes we can get a winner. It is a paradox of the theory of games discovered by Spanish physicist Juan Parrondo in 1996, after which he was named. *Parrondo's paradox* will be used to answer the recently asked question: is there any deeper connection between “that's yours'' theory of information and the theory of games, that is, among them and us the ordinary living world?

Let us define two simple losing games and form a third winner of them, and then note that similar complex games the nature play all around us constantly. Then we connect this with the *principles of minimalism* of information and actions, noting besides that not all are the games on the victory.

Let's imagine the first game so that our player in any move unconditionally loses one euro. Just like that. If he has one hundred euros at the beginning of the game, after hundred moves he will not have them. Clearly, this is a losing game, and its simplicity makes it easier for us to continue the story. In the second game, count the amount of money the player has, so if the number is even add to him three euros, and if it is odd, he lose five euros. It's not hard to notice that this game is also a losing for itself. For two consecutive moves, the player loses two euros (because of three gains and loses five), so the starting hundred euros he also loses in a hundred moves.

Let's agree that our player alternately plays the second than the first game. In this combination, with an initial 100 euros, he is in the second game and earns three euros and rises to odd 103 euros, then loses one euro in the first game and falls to the even 102 euros. He plays the second game and increases his earnings by three euros to odd 105 to lose one in the first and stand at even 104 euros. In every two consecutive moves he is richer for two euros.

I hope that you do not bother to add three euros and subtract one during two moves and you can notice that our player is thus richer for two euros each time. After such a couple of moves, he is always on an even number of money, and he gets two euros all the time. This is a pure win game with alternate substitutions of two simple loser games. It is an abstract example of the aforementioned paradox of game theory, but which facilitates can help us in understanding the promised answer.

The first game is recognized in the conditions of regulation, in the stability, safety and efficiency of, say, companies or societies, viewed in the long run. A better organization, a pervasive hierarchy, can mean greater instant success of the company in competition, but greater stability is generally more static, and it is by the time a cause of lagging in relation to the changing environment, in relation to some “others'' that appear and whose significance grows in time.

We define the second game as hasty innovation, over-accelerated, and not for four years, which could cost the company but can be exploited. This rush because of the excess of costs and lack of revenue will lead the company to losses. Contrary to the hustle and bustle of the second game and the constant slowing down of the first game, their combination, an innovation with periods of exploitation, of two losers would make the winners third game.

Random withdrawal of arbitrary game moves, which usually does not lead to gain, is defined as the *zero state* of the given game, and we compare the difference between mastery and randomness with physical information. It becomes the measure of *action of tactics*, the level of mastery, because each the physical information is a physical action (energy in duration). The definition of such a measure is also worthwhile in equilibrium games, where everyone gets, or everyone loses, because randomness is a universal “zero state''.

The consequence of the new definition of tactics is, for example, a different view of *aggression* as a positive initiative – to the *optimum* of the inherent information. Namely, due to the objectivity of uncertainty, some kind of emission of information is inevitable, but because of the stinginess of information, they have their own optimums. In the theory of probability the uncertainty is a topic, and the *principle of parsimony* is seen in the more frequent realization of more likely events (which are less informative). In physics, where micro-effects are a permanent phenomenon and cannot be eradicated, the principle of parsimony can be seen in the need for force to cause macro-action, which is a non-spontaneous thing.

Analogously to the previous, an *initiative* of one company in competition with another means now a threat, an *action* that seeks a *reaction*, without which it makes the victory easier for the first competitor. Now the absence of opposition increases the chances of defeat, and this was not so explicit in classical theory. A similar example is an occupier that is coming to a new territory, which may be in interested in acting partially friendly and partially aggressively taking over more of the host. This example even more clearly emphasizes the importance of optimality.

Parrondo's paradox is mirrored in another way, again in *dualities* arising from the principle of minimalism (information and actions). Now we know that nature does not like excessive emissions of information analogous to spontaneous movement of the body along trajectories with minimal energy and time consumption, and further notice that its accumulation capacity results from this parsimony. The accumulation stimulates the evolution of living beings, and life itself is torn between leaking and acquiring information, that is the actions. We can say that the animate and inanimate worlds are captured by such streams, with the guards mentioned principles.

Accordingly, the life of ordinary mortals is “playing information''. Whether or not we are aware of it, the competitions and communication make us.

1.17 Thermodynamics

The word *entropy* εντροπη – turn inward) was introduced in physics by a German mathematician Rudolf *Clausius* (1822-1888). He analyzed the *Carnot cycle* (Sadi Carnot, 1796-1832), the French officers, engineers and physicists whose work has based *thermodynamics*. Carnot's cycle is a theoretical physical process that observes circular changes in temperature and fluid pressure in a closed heat engine. The idea of entropy was further developed by Ludwig *Boltzmann* (1844-1906) interpreting it in 1870 as a measure of *uncertainty* in statistical mechanics, followed by the work of the American scientist Willard *Gibbs* (1839 -1903) responsible for the transformation of physical chemistry into a rigorous inductive science.

Carnot devised an ideal heat machine, a thermodynamic cycle of maximum efficiency, with a cycle in four strokes. The first is isothermal (constant temperature) compression of the fluid (liquid or gas), then adiabatic (without heat change) compression, next isothermal expansion and the fourth stroke is adiabatic expansion. Adiabatic processes cannot be achieved in real terms, since at least small heat exchange with the external environment must exist, and with each such cycle, part of the energy of the system is lost irreversibly.

Not only in the imaginary ideal conditions, for the optimal work of the heat machine

$$W = Q_2 - Q_1$$

is the difference of the largest (Q_2) and the least (Q_1) of the heat of the fluid in states respectively the largest (T_2) and at least (T_1) temperature. The specific change ($\Delta T = T_2 - T_1$) of the temperature in these two extreme states of the imagined cycle

$$\eta_0 = \frac{\Delta T}{T_2} = 1 - \frac{T_1}{T_2}$$

is called Carnot's efficiency. Lord *Kelvin* (1824-1907) showed by his works that the maximal work of a heat machine can produce the product of this coefficient (η_0) and the greatest heat (Q_2) of the fluid

$$W = \left(1 - \frac{T_1}{T_2}\right) Q_2$$

and thus, by equating the first and third formulas, Clausius found

$$\frac{Q_2}{T_2} - \frac{Q_1}{T_1} = 0,$$

that in the ideal process, the heat and temperature are directly proportional. He called the entropy the coefficient of heat and temperature

$$S_i = \frac{Q_i}{T_i}, \quad i = 1, 2$$

which is in ideally conditions constant ($S_2 - S_1 = 0$).

In real terms, the optimal operation of the heat machine is less than imagined

$$Q_2 - Q_1 < \left(1 - \frac{T_1}{T_2}\right) Q_2,$$

and hence, orderly:

$$\frac{T_1}{T_2} Q_2 < Q_1,$$

more heat is transferred to the cold reservoir than in the Carnot cycle and

$$S_2 < S_1,$$

the entropy leaving the system is greater than the one that remains. Clausius' entropy in real terms spontaneously grows.

That's a historical look. For Clausius, the entropy was merely a quotient, a convenient substitution in his mathematical analysis of the Carnot cycle. Yet it gave the name for the entropy (turning inwards) alluding to the “something'' that remains and increases as energy leaks out, which over time get more sense.

1.18 Statistical Mechanics

In the development of entropy, Boltzmann introduced the hypothesis of elementary particles, atoms and molecules that move rapidly around their central points, vibrating by pushing each other and spreading the fluid as much as the vessels allow, occupying uniform positions. He noted that for a uniform arrangement of microstates (balls in boxes) there are more possibilities than any uneven distribution, and assuming that all combinations are equal, he found that the evenly are the most likely.

The logarithm of these schedules Boltzmann recognized as Gibbs's *uncertainty*. The changes in the thermodynamic circular process he recognized as a change in Clausius' heat and temperature ratios. Today, in science, we are largely remembered him by this logarithm of the number of thermodynamic microstates, called Boltzmann's entropy, or as one of the founders of statistical mechanics.

In an *ideal cycle* of a heat engine, how many times the *heat* (energy) is reduced so many times the *temperature* of the fluid decreases, because their quotient is constant entropy, but also vice versa, when the heat increases the temperature increases proportionally.

In the real cycle, we have energy losses of *oscillating molecules* by transferring their higher oscillations to the lower oscillations of the cooler walls of the vessel. Consistent with the increase in the Clausus entropy, the quotients of heat and temperature ($S_i = Q_i / T_i$), we now consider this as a decrease in temperature greater than the decrease in heat. In addition to the kinetic energy of the molecule, otherwise the only one in an ideal cycle, in the reality there is also a potential energy bond between the molecules, overall less dominant than the temperature drop. Again, the thermal energy (numerator) of the cycle decreases, but the Clausius entropy (quotient) increases because the temperature (denominator) decreases faster.

Consider the same from the point of view of the law of conservation information. Imagine a larger system with the cycle and an environment so that the total information is closed. The total information is constant, so as much of the internal increases by (order) so much the external decreases (disorder).

This is a novelty of the text. From the outside looking at an internal uniform arrangement we consider it impersonal, amorphous, less informative, which we perceive as the absence of order, and therefore we see an increase in entropy as an increase in disorder. It is at the expense of greater internal orderliness of the system! Molecules within the given cycle are arranged like lining up soldiers or evenly arranging balls into boxes.

The explanation of the aggregate information, internal and external, even if it is not the same before and after the process, does not impair the conformity of Boltzmann's statistical explanation of entropy with the Clausius definition. However, I believe that this view is true and that this will be reflected well in the continued application of entropy. Here I will only refer to the theory of relativity, especially the special one.

The coordinate system K' moves at a uniform velocity v with respect to the coordinates K. In each of the two systems, one as proper (own) observer's which is in that system stationary and perceives the other in relative motion. In proportion to the Lorentz coefficient

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

where $c \approx 3 \cdot 10^8$ m/s is the speed of light in a vacuum, the relative energy rises, relative time slows, and relative lengths in the direction of motion shorten.

For example, if proper energy is E_0 (observed at rest), then relative (in motion) is

$$E = \gamma E_0 \approx E_0\left(1 + \frac{1}{2}\frac{v^2}{c^2}\right) = E_0 + \frac{1}{2}m_0 v^2 = E_p + E_k$$

where $m_0 = E_0 / c^2$ is its proper mass (at rest) and $E_p = E_0$ and $E_k = \frac{1}{2}m_0 v^2$ are the potential and kinetic energies of the given body. The Lorentz coefficient (γ), taken as a function of the velocity quotient ($v/c \to 0$), was developed in series and the sums of higher degrees of this quotient are neglected, since we consider the case of velocities v negligible with respect to speed of light c.

It is shown that the “total energy'' E increases with motion due to the increase in kinetic energy, which gives us the right to (hypothetically) assume that the thermal energy in Clausius' entropy (S_i) does not change with motion, $Q = Q_0$.

Moreover, in accordance with the above explanation of the “oscillation leakage'' from the cycle vessel to the colder walls, we also add the assumption that with increasing energy of the oscillations increase the relative temperature of a given body $T = \gamma T_0$, so we conclude that the relative entropy is smaller than the proper ($S < S_0$), more precisely that $S = S_0 / \gamma$.

Such interpretations are unusual but not contradictory. They have recently appeared in similar form to other authors[17] and, of course, in my previous works[18].

The increase in temperature can be “defended'' by the Doppler Effect, which in the special theory of relativity has an additional transversal increase in relative wavelengths. They are equal to the arithmetic mean of the relative wavelengths of the incoming and outgoing sources and are proportional to the Lorentz coefficient (γ). It's easy to check, so I'm not repeating it here.

The consequence of less relative entropy than the proper is the *law of inertia*. The body will not spontaneously transit from a state of greater entropy to a state of lower entropy and therefore remains in a state of relative rest and does not go into the moving system. It sees relative entropy of moving body as smaller and in the Boltzmann's sense too, because contraction is only in the direction of motion and not perpendicular to that direction, which disturb homogeneity.

Similar is the observation of less relative entropy in the gravitational field from the point of view of the weightless state of the free-fall satellite moving along geodesic lines. In a room that is stationary with respect to the gravitational field, lower air molecules are denser due to the attractive gravitational force, which will create the impression of *disturbance of homogeneity* and decrease of entropy. That is why the body in free fall does not abandon its path, as it would spontaneously switch from higher to lower entropy. This is also consistent with the Doppler effect of general relativity.

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[17] Cristian Farías, Victor A. Pinto \& Pablo S. Moya: *What is the temperature of a moving body*?; Scientific Reports volume 7, Article number: 17657 (2017); (https://www.nature.com/articles/s41598-017-17526-4).
[18] Rastko Vuković: SPACE-TIME, principles physics of chances; Economic Institute Banja Luka, 2017. (https://archive.org/details/Principles_Vukovic)

Let's summarize. By stopping abruptly, at the moment of collision with the obstacle, the body temperature is like just before the collision, the kinetic energy goes into heat and the entropy of the body increases. A glass in flight breaks down only when it hits an obstacle according to the increase in disorder due to the increase in entropy.

2. Minimalism of Information

The aim of the second book [2] was to harness the principle of least action to the principle of the least information. The first has been known to theoretical physics, the second is unknown. In doing so, it was necessary to find, modify or re-derive proof that the movements of classical, statistical, relativistic and quantum mechanics are subject to the same principles, as demonstrated in the book, and then show that they apply to broader phenomena such as biology, sociology or law.

Compared to this, the preparation of the third book, about the effect of information, made it especially difficult for me to present it, which is why it can seem that the story about the "minimalism of information" is nothing but the story about the "action of information", which is partly true, but basically it is not. Namely, the claim that I hold in these books, that information is equivalent to action, still does not mean that nature in all these areas of physics, the living world and society behaves according to the principle of minimalism. And that principle is the subject of these stories.

2.1 Frequency

How can it be that events are unrepeatable and so limitless in this supposedly Platonic *world of ideas* in which there is no set of all sets, theories of all theories, the best criterion, and everywhere we see material, finite and periodic phenomena?

That should be the first question for a theory that seeks to explain reality and especially one that would generalize the classic *information theory*. Another question would be about its development – what could be its significance?

Presenting everything with information, which is only one particularly measured *amount of data*, is a reduction of *perceptions* with that particular abstractness that gives it the breadth inherent in mathematics. Hence, the following, both simple and fast, as well as unexpectedly deep conclusions, are possible.

Information is (locally) unique because we (as well as particles) exchange messages because we do not have everything we need. For the same reason, the cause of communication is *unpredictability*, the existence of objective uncertainty, so contrary to the common belief that we know the past and hope for the future, we see better the consequences than the causes. Not only are our perceptions blurred with indeterminacy, but this world is so structured.

The glass on the table is exactly where it is, because it is its most likely position, and because of that it will be there in the next moment, unless some force is exerted on the glass and move it. Force changes the probabilities, changes the energy (force work on the path) of an object, changes our perceptions of objects (force work on a path for a given time) and testifies that similar assumptions lead to similar immediate consequences (not exactly equal). Thus, we understand that we look at physical bodies through information, that this "world of information'' is equivalent to material, that it is equally complete and contradictory.

The *conservation law* of the quantity of matter is transferred to the conservation of information, and the principle of the least action of matter to the equivalent *principle of minimalism* of information. From the first follows its finite divisibility (an infinite set may be equivalent to its real part as opposed to a finite one). It follows from the second that any information can be attributed to some action.

Because information is always finally divisible, its limited multiplicity is always finite, so the number of all combinations of that multiplicity is finite. Sooner or later, it repeats itself, and similarly leads to immediately similar, so all material phenomena are *periodic*. Periodicity itself, however, is a type of information, at least as information about much information. That is the answer to the first question above. The second will be clearer through the applications.

For example, consider the economics of the model market *Cournot*[19]. The goods on the market that he was talking about may be fuel, cloth, milk; it is all the same, as long as it is of the same type and until its unit price generally falls with the increase in supply. He used to write completely unknown works about it, to contemporaries too overweight which were only a century later recognized and included in the then discovered game theory. Explaining Cournot without formulas is considered impossible but worth a try.

The product of price and quantity sold is total *revenue*, and all other costs are *expense*. The difference between income and expenses is *profit*. As the volume saturates the market, the (unit) *price* decreases and the growth of total revenue slows down, and the expense grows steadily, so profit has some *optimum* in relation to quantity. After the optimum, with the increase in production, the business goes into minus, the loss of the company grows.

When a company is on the market itself, we say it has *monopoly* (goods given). When two companies compete for the same goods, it is called *duopoly*, and when there are more companies it is *oligopoly*. *Competition* (duopoly or oligopoly) produces some additional price reductions in the battle of firms' placement, so it happens that a monopoly firm in the market would achieve the optimum with less goods and a higher price than the optimum of competing firms. In other words, monopoly is good for the manufacturer, competition for society.

In a given market, each manufacturer has its own optimum production depending on the supply of the others. When that supply is too small for market capacity, the manufacturer can increase production and revenue, and if that supply is too large, it will go into losses. That optimum of commodity quantity is the *equilibrium*, or (often moving) center of oscillation of competitors, with the variable smaller and larger supply over time.

Some in this "oscillation game'' fall away, others appear. The *equilibrium* state of the producer, relative to the market and the commodity, is called Cournot-Nash Equilibrium. What are further interesting are the aforementioned periodic phenomena, as the more interesting as its applications here are novelty.

Each *oscillation* is bound to some information, and any information is to some oscillation. In addition, we note that "information about crowd of information'' can also be elementary. Then, the information is

[19] Antoine Cournot (1801-1877), French mathematician.

an action (change of energy for a given time), which means that elementary information and their periods can always be redefined with “energy'', so that these products are constant, quantised.

In other words, the supposed *energy* is proportional to the *frequency* change (inversely proportional to the period), as is the energy of a wave-particle of light (photons) where the electric and magnetic fields alternate by inducing each other by motion.

This observation becomes practical when, instead of the complex relationships of competing firms, they switch to treating their circling frequencies around the equilibrium. It's an analogy with energies in physics that we know can simply be summed up, so the interference seems to go beyond *physics*. It goes just as *mathematics* helps physics with its models; the physics can now help mathematics, and both to *economics*, biology, and sociology. Finally, the question is how different are these areas?

2.2 Darwin's Evolution

Darwin's[20] evolution supports the theory of physical information because it acknowledges choices. So an anonymous colleague notes, and he asks me: Is there something in this new theory that would support Darwin's evolution? This question leads to a difficult topic and an important positive answer to the very basics of the theory of physical information, and I hope to know how to elaborate it interestingly.

I actually consider physical information theory a mathematical theory, but I model it according to the principles of conservation, minimalism, and uniqueness of information that (mutually unambiguously) maps it to the material world. Only the first two are sufficient for the definition of life, but only the first of these principles is more or less known to science, because it is still a topic of inquiry.

I will remind you that the law of conservation has until recently been largely suspected, so even the famous *Hawking*[21] once claimed that *black holes* “eat information'' because the powerful gravity created by these celestial bodies does not allow anything to come out of them, not even light.

Many of scientific papers then “confirmed'' the idea of non-conservation of information, for example, by referring to a piece of paper with text we burn and destroy the information of the text forever. Only recently did the famous physicist *Susskind*[22] explain why black holes do not consume information, and Hawking himself accepted the explanation.

In short, as the body falls towards the *event horizon* of the black hole, its relative time slows to zero and it’s radial (toward the center of gravity) length is shortened, and the process itself takes infinitely long. From the outside, the body tends to become a two-*dimensional* image on a sphere around a black hole, never leaving the outside world. Its 2-D information, the very essence of its matter, in all its initial quantity constantly stays with us. That would be cosmological evidence of the conservation.

In quantum mechanics, the *quantum states* (sets of particles) are represented by vectors of so-called *Hilbert space*, and the changes (physical evolution) of these states by *unitary operators*. The point is that

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[20] Charles Darwin (1809 - 1882), English naturalist, geologist and biologist.
[21] Stephen Hawking (1942-2018), English physicist.
[22] Leonard Susskind (1940-), American physicist.

the unitary operators are linear, unitary, and reversible, which means that changes in quantum states keep many quantities constant, including information. That should be enough, because *quantum mechanics* is the most accurate branch of physics today, and therefore the most accurate theory in the natural sciences in general.

However, I said that “mathematical theory of physical information'' is not really a theory of physics, so proving it by physical experiments does not apply. That is why I emphasize that quantum mechanics is a representation of Hilbert's algebra of abstract vector spaces, and the aforementioned unitary operators, for the sake of reversibility, provide the symmetry of the quantum states (before and after operation) and then, according to *Noether's theorem* (story 1.14), if we have symmetry then we have an appropriate law of conservation. And that is that.

Conservation of information is intuitively visible too. Namely, if information could come from nothing and disappear into nothing, then we could not believe in physical experiments. The past would not be scientifically researchable; it would change irrelevantly with the emergence and disappearance of information. Memory would be meaningless and would lose the meaning of communication in general.

So much about the conservation of information. *Minimalism of information* follows, for example, from the view that the most likely events are most often realized and such are the least informative. Namely, when we know that something is going to happen and it happens, then it is not some news. Minimalism in physics is seen in the spontaneous growth of the entropy of the thermodynamic system, when gas molecules are arranged with one another (equalizing each other distances) reducing communication to the outside, which from the outside is viewed as an increase in disorder. Faster spreading of half-truths then truths by social networks, or easier coding than decoding, are also the consequences of skimping the nature of information emissions.

The same minimalism is a kind of frugality that accumulates information. It can be proved (my theorems in [1]) that “physical information'' is (sometimes) increasingly in comparison with “technical'' (classical, Shannon's), the more complex the system is. Therefore, *living being* may have excess information due to its physical complexity.

The bodies of the excess tend to get rid of their information (the same principle of minimalism), but this does not go easy, because all the surrounding substance is filled. Living beings thus spontaneously can die on installments through interactions, conveying information to non-living substances in auspicious events, or resolving excess by organizing. With this spontaneity, people age or give up personal freedom (information) for the benefit of social organization. We can literally say that life and the legal system are killing us. Life wanted to be created as it did not want to be created, and this dualism is the specificity of information, it’s the principle of minimalism. I mention again, as yet unknown in science.

Just this spontaneous accumulation of information into less complex life forms, and then the transfer of information from less complex individuals to a complex collective, which by evolution may (but may not) become a new more complex living being, is an important link that has been lacking in Darwin's evolution. Conservation of information and the principle of minimalism are the driving forces of the evolution of life, because only a mere random selection would tend to clutter and not to highly organized life forms.

2.3 Information of Perception I

Information of perception is a special type of amount of options an individual can experience. It is a measure of its developmental ability – it is an abbreviated answer to questions about the meaning of the “strange'' title of my eponymous book[23]. Viewed in the abstract, this formula may say more about our relationship with the world or the communication of substance in general, than of each of our particular representations. I'll try to explain it.

It is enough to have at least some options and we can already define *intelligence* as the ability to choose. Unlike the results of the IQ test, the same term further encompasses both hereditary and acquired versality to manipulate opportunities. It still allows for its plasticity, elasticity, but also application to unconscious skills. Perceptions include observations from the unconscious, so the new definition of intelligence is consistent in this regard.

Individual flexibility to choose is limited and finite. Let's call its boundaries *hierarchy*. For the constraints imposed on the individual by the environment, we can use other terms, but in any case we mean that they come from legislators, social norms, instincts, natural laws. Also, within each of the above or similar prohibitions, the freedom of one person is limited by the corresponding freedom of others. Any ability to handle the outcomes of one affects the other, because the outcomes are conserved. As uncertainties, outcomes constitute (physical) information and are subject to the law of conservation.

Intelligence is directly proportional to *liberty* and inversely to hierarchy. The first says that intelligence (on average) seeks its comfort in greater freedoms (quantities of options). We recognize these in living beings as avoiding cramped states of individuals or evolving species into new possibilities in the process of adaptation to the environment for better use of resources. In the inanimate, we see the same in avoiding unnecessary emissions of information (from uncertainty and in general), in the principle of stinginess, its principled minimalism. Hence the information of perception, that is, the freedom that the individual can experience, is equal to the product of its intelligence and hierarchy.

Here is an interesting Frank *Ramsey* theorem that states that there is no zero hierarchy. To paraphrase, no matter how randomly distributed the clouds in the sky, sooner or later some preset shape will appear, or however randomly assigned letters and words to the text, there is always a chance to get a before-given sentence. Otherwise, this theorem was discovered in the early 20th century with the development of graph theory. With the supposed objectivity of possibility, it now establishes the absence of zero freedom and intelligence.

Objectivity of choice implies diversity, and independence of some phenomena. That is why the aforementioned formula, information of perception, must be more complex. At the very least, it contains individual freedoms as the product of an appropriate pair of amounts of intelligence and

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[23] Rastko Vuković: *INFORMATION of PERCEPTION* – freedom, democracy and physics; Economic Institute Banja Luka, June 2016. (https://archive.org/details/Information_of_Perception)

hierarchy. These products then participate in the total perception information as a sum, due to the laws of conservation. We do not “calibrate'' these “amounts'' for the sake of greater generality, but we can use examples.

Caesar's ability when crossing the Rubicon in 49 B.C. was opposed to the law of the Roman Senate, which forbade such a crossing. The greater the power of prohibition and the greater the ability of Caesar, the greater their product and the greater the *vitality* of Caesar (in that case), that is, the greater it’s corresponding component (item) of the perception information.

A similar example is the strength of the game of competitors and opponents in some competition. Then again we can say that the “liberty'' of the game grows in proportion to the skill of the player and the resistance of the opponent, the wealth of choices, so it is correct to consider simpler games those that seek less skill. Summing up all the individual liberties into the total information of perception, we find the form of a scalar product, here the vectors of intelligence and hierarchy. This is another difference between the new and the classic definition of intelligence – this one is a vector (string) and the old one is a scalar (number).

Because (total) information perceptions of individuals are more or less limited but intelligence is plastic, in a constant hierarchy, if we reduce our options in one domain they will try to expand in others, like fresh sausage squeezed at one extremity and explodes on the other. In support of this will be a manager who leads a rigid and boring life in less important matters and shows increased success and creativity in others. Accordingly, monogamy and its patriarchal mechanisms have been more successful in creating a civilization precisely because of the nature of its restrictiveness.

Finally, let us consider another purely computational property of the aforementioned scalar series multiplication in a non-computational manner. Let's compare the components of a string (vector) of information in ascending order, and the hierarchies in descending order, so we multiply pairs and sum all the individual products. By multiplying this, smaller with larger and larger with smaller, we get less information of perception than any other arrangement, multiplication and addition. We will have maximum value when we multiply the larger components of one string with the larger of the other and the smaller with the smaller. This also has its practical interpretation.

The minimum information of perception (liberty) is held by dead things, the subjects of the study of physics. All of them are subject to the known *principle of least action*, the smallest possible energy consumption to get from one point to another, or the minimal amount of time consumed in the circumstances. These would be “living creatures'' released as a piece of wood down the water. Such laggards are less opposed to the greater obstacles, in contrast to the defiant Caesar who did just the opposite.

That is why it makes sense to call perception information vitality. The general denial of options that comes from the fear of uncertainty, such as the need for security, stability, or efficiency, now becomes a stifle of development, and in conditions of otherwise limited perceptions, in the long run it leads to a decline in general intelligence. We see it all from that one abstract formula. If she is correct.

2.4 Information of Perception II

You call *freedom* (liberty) the sum of products of the corresponding *capabilities* and *restrictions*, and also *amount of options* alluding to *technical information*, the amount of uncertainty – is a detail from my interview with a colleague – but what is the connection between the two definitions? Here's an explanation.

The technical definition of information was discovered in 1928 by *Hartley*[24] working at Bell Telephone Company. He noted that the *logarithm* of the number of equally-probable data is a better measure of the amount of uncertainty than any other scale, and especially of the immediate number of possibilities.

There are two outcomes in a coin toss, six in a die throw, and 12 in a throw of them both, therefore not the sum but the product of the number of options, and the logarithm the product equals the sum of the logarithms. Logarithm is the only such additive function, so Hartley's definition was a jack pot. The telephone company could begin to “count” the data flow as correctly as the water mains the water consumption, or the electricity company consumed electricity.

From the additivity of logarithms it follows that the logarithm of the unit is zero, so there is so much information of certainty (null). A fair coin gives two equal outcomes, each with a probability of half to give the sum of both a unit – which means certainty. A surefire event in a fair-dice toss is one of six options, so each has a sixth chance.

In ten some equal opportunities each has a probability of a tenth, a number reciprocal of the number ten, and a product of ten and a reciprocal of ten (six and sixths, two and half) is one, so the logarithm of the tithe is equal to minus the logarithm of ten. Hence, Hartley's information is minus the logarithm of probability. Changing the log base only changes the units of information.

The inverse of the logarithmic function is exponential (of the same base). This means that they cancel each other out so that the logarithm of the *exponent* number is equal to the given number. Therefore, if the given number is the said product, of the capabilities and limitations, the summand of liberty, then its exponent is the corresponding “number of options'' for Hartley's information. The reciprocal of the number of options is some mean value of the probability of the option, and its negative logarithm is again the same information. That's the thing!

An individual product of the corresponding “ability'' and “constraint'' defines the component (item) of “freedom'', its exponent defines the “number of options'', and the logarithm of that number is again the same starting “freedom''. However, Hartley's information can be recognized. Everything becomes crystal clear when the formulas are put on paper, but something is understood here as well.

The famous *Shannon*[25] definition of information came twenty years after Hartley’s, from the same company. Simply put, Shannon observed the oddly probable outcomes, divided them into groups of equally probable, and assigned each Hartley logarithm to each group, and then took the mean of the

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[24] Ralph Hartley (1888-1970), American engineer.
[25] Claude Shannon (1916-2001), American mathematician.

logarithms by probability distribution. In technology, this mean has found great use and has supported the explosion of computer development. But Shannon's information is not physical, since it does not follow the law of conservation as Hartley's[26].

That's why I'm using a refinement of the Shannon definition that is supported by the law of conservation, which I call *physical information*. It is larger than the Shannon as the system is more complex, which is shown in accordance with the *principle of minimalism*, then with the accumulation of information, and finally with the definition of “living being''.

On the other hand, along with the development of classical information theory, quantum mechanics was also emerging. An important discovery from 1927, which we just learn to bring them together, was *Heisenberg's*[27] *uncertainty relations*. In their original form, they say that the products of the uncertainties of measuring the momentum and position of a particle, like as energy and time, are never less than a constant order of *Planck’s*[28].

This product is *action*, here “freedom” or Hartley information, to say the momentum of a particle is its “ability” and its space is its “restriction”. If we stick to the mathematical form, it is clear that it goes into equally non-contradictory views of the said “freedom”, i.e. physical information, such as physical actions.

That the law of conservation is valid for physical action follows from its quantization and constancy. Since the action is information, its exponent is probability. Unlike the information just defined, in quantum mechanics it is known that said exponents represent probabilities of quantum states, and both the vectors in Hilbert space, i.e. sets of particles in physics. Things get further complicated because the components of the quantum state vector do not go with real ones but with *complex numbers*, but that makes sense now.

Only the corresponding expressions of these complex vectors when they are a real numbers become physically measurable quantities, the so-called *observable*, now in accordance with the theorem on the discreteness (finite divisibility) of each property of information. In addition, the exponents and logarithms of complex numbers are periodic functions, which is consistent with (also mine) claim that all information is periodic.

It is not a novelty that we choose solely observable, physical quantities that can be measured, for the coordinates of quantum states. So the projections of vectors on them are the results of measurements expressed by probabilities. They are the components of *superposition*, as we called the alternatives of quantum measurement of a given state, and now we just add that the probabilities of measurement come from information or uncertainty that quantum states have. These are the “liberty'' at the beginning of this text, which we might also call “information of perception''.

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[26] It is discussed in detail in the book Physical Information [1].
[27] Werner Heisenberg (1901-1976), German theoretical physicist.
[28] Max Planck (1858-1947), German theoretical physicist.

Misunderstandings of the new with centuries-old interpretations of these terms come from their earlier daily use, from inconsistencies, often inaccurate and contradictory to their prior apprehension, not from the mathematics behind it all. This correction of meaning is one of the aspects of the progress of science, I hope.

2.5 Maxwell's Demon

The Maxwell Demon is the thought experiment of the famous *Maxwell*[29] of the Second Law of *Thermodynamics* of 1867: thermal energy (heat) spontaneously moves from the body higher to the adjacent body of a lower temperature; never the other way. This was in the century of discovering molecules and learning that a higher speed of movement means higher *heat* and *temperature* of the body they make.

Well, we imagine a demon as a man controlling the partition between two parts of a room, two regions, with some advanced unknown to us physics and technology. It passes fast and only fast molecules from the first region to the second, and slow and only slow from the second to the first.

If the heat and temperature of the regions were the same in the initial state, the first region would become colder over time and the second warmer. So the demon would send the heat from the colder part of the room to the warmer, despite the second law of thermodynamics. The thermal difference between the room parts could give a new *useful work* and the demon would be a candidate for *perpetual mobile*, for an unlimited energy producer.

Thermodynamics was founded by the French military physicist *Carnot*[30] analyzing in 1824 an imagined heat engine of maximum efficiency. He came to the conclusion that the work produced (energy) cannot be greater than the invested and that only in the “ideal'' case can the two be equal, and this is not the case in practice. It must be that energy is leaking through the walls of the pan, he noted.

These circular thermodynamic processes were further particularly carefully analyzed by the mathematician *Clausius*[31] in 1854 to publish his famous work on the theory of heat in which he established mentioned the Second law of thermodynamics, holding for the First that energy can change its forms but not the total quantity.

Interestingly is his abbreviation, the quotient of heat and temperature, which he called *entropy* (Gr. inward orientation), until then completely unknown, and which he used extensively in formulas. At that substitution of variables, entropy, Clausus never gave any physical significance, but noticed that its value remains constant in the ideal Carnot cycle and increases in the real one. Later, entropy was referred to as the amount of disorder created by the titration of molecules (*Boltzmann*[32], 1877), and also information (*Shannon*[33], 1948).

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[29] James Clerk Maxwell (1831-1879), Scottish mathematician and physicist.
[30] Sadi Carnot (1796-1832), French engineer and physicist.
[31] Rudolf Clausius (1822 - 1888), German physicist and mathematician.
[32] Ludwig Boltzmann (1844-1906), Austrian physicist and philosopher.
[33] Claude Shannon (1916-2001), American mathematician.

Let's go back to the Maxwell demon. *Landauer*[34] observed in 1960 that thermodynamically reversible processes did not increase entropy, but at the cost of not allowing molecular information to be deleted. *Bennett*[35] further showed (1982) that the demon sooner or later must run out of storage space and begin deleting it, which will make this process irreversible causing an increase in entropy. He has proven that by losing information, the circular system loses energy, becomes irreversible and entropy grows!

Additional, recent calculations (Bennett, 1987 – *Sagawa*[36], 2012) showed that the demon would produce more entropy by dealing with molecules than eliminating it by separating them in the room. In other words, more energy is required to evaluate and selectively leak molecules than would be obtained by the temperature difference of the rooms. This entire means that the demon is not possible, that the Clauses' laws are true and that there is a scientific future ahead of thermodynamics.

Note that the increase in entropy, followed by the loss of energy, can now be reduced to *principle of information* (minimalism): the nature is stingy with information. Heat spontaneously moves from the body of higher into the body at a lower temperature, because this reduces the emission of information. The uniform arrangement of the room molecules achieves the internal order at the expense of the loss of external communication that we perceive as a mess, and it is such a process of substance against which there is no cure.

The increase in entropy reduces the emission of information in the following ways. The number of combinations of uniform arrangement of molecules is much greater than the way they are piled, so in the case that all distributions are equally likely, even combinations are much more probable. That is the explanation Boltzmann explored. From the aspiration to the more likely it follows that nature tends to be less informative.

Secondly, we know that by randomly selecting words from a dictionary we get text in a mess, uninformative, while counting the words of a conversation would find statistically significantly different frequencies (number of occurrences) of individual words. If these words were arranged horizontally (along the abscissa) in decreasing height of frequency, in the first case (impersonal text) we would get an approximately horizontal line of heights, in the second case (meaningful text) we would have a descending curve.

Listening to and counting the signals (say, acoustic) emitted by animals (dolphins), according to the shape of the curve, if it is descending, we would know that they are talking, although then we could not recognize the meaning at all. It is similar to the uniform arrangement of the air molecules in the room which is externally looking impersonal to us, uninformative. It is a condition that is obtained by increasing entropy when we say that the mess is growing, ignoring the increase in internal order. Then, in fact, the internal order grows, and the external communication decreases.

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[34] Rolf Landauer (1927-1999), German-American physicist.

[35] Charles Bennett (1943-), American physicist.

[36] Sagawa, Takahiro (2012). Thermodynamics of Information Processing in Small Systems. Springer Science and Business Media. pp. 9–14. ISBN 978-4431541677.

The search for the cause of the concept (source) of energy is scarcely driven here scoring on the principle of (minimalism) information, otherwise universal to all physical phenomena. This principle is yet to be reckognised, so in modern physics we still treat information differently (mechanical, thermodynamic, or electrical). The assumption is that, along with conservation laws, it hides even deeper connections between energy and information.

2.6 Compton Effect

It's amazing how much the *information of perception* blends into everything – a fellow computer scientist, otherwise an electrical engineer, asks me doubtfully. I answer: like computers that are no longer just a matter of algebra logic and electrical switches.

We are not surprised by the physics of atoms using computers for its own research, so soon will not even informatics be when it goes into the natural sciences with this principles. It would be a miracle that the overlapping of these theories will never happen and that we do not already have some precursor to such encounters.

One of the newly discovered connections between physics and informatics is from the well-researched scattering of *photons* (waves-particles of light) in collisions with *electrons*. This is already learned in high school as the Compton Effect. The occurrence of the loss of a fraction of the energy in the collision, the photon with increase wavelength and that was predicted and described by the *Compton*[37] in 1922 considering the duality of wave and particle properties of electromagnetic radiation for which he received the 1927 Nobel Prize in Physics. I will use it to draw attention to the fine methods of information theory.

The formula, which Compton once discovered, predicts that the x-ray wavelength of 0.02 nano meters, if it hits an electron at rest and bounces at a 30-degree angle, increases its wavelength by about 16 percent, and then the electron flies off at an angle 73.5 degrees at a speed of about six percent of the speed of light.

When the same photon bounces at an angle of 45 degrees, its increase in wavelength is more than 35 percent, and the electron bounces at an angle of 65 degrees at a speed near 10 percent of the speed of light. Results similar to these are measurable and many have been carefully vetted and validated to date.

When, after colliding with an electron, the photon veers off its direction of motion, its wave is extended, its smearing increases. This is a decrease in the determination of the photon position and a decrease in the probability density of finding a photon at a given place, and thus an increase in the corresponding information – we note additionally.

Since nature more often realizes more probable events, which means less informative, consequently the photon would rather continue its previous straight line motion in accordance with the principle

[37] Arthur Compton (1892-1962), American physicist.

(minimalism) of information. From the same, forces and collisions cause changes in relative probabilities and then directions of motion.

In general, bodies move *inertial* (uniformly straight line) because they see the transition to a non-inertial or other inertial system of motion as a transition to states of higher emission of information, in states less likely. The other, relative states of increased communication for them are states of less *entropy*, because entropy grows by reducing the emission of information outward, and because of the desire for greater entropy of the body they remain in states of rest or uniform straight line motion until they are influenced by another body or force.

The disturbance of the maximum entropy of the system in uniform motion is manifested by the relativistic contraction of lengths in the direction of motion and the absence of that change perpendicular to the direction of motion, that is, by inhomogeneity. It is similar in the *gravitational* field. Unlike satellites, which fall freely in their own weightless state during inertial motion, the gas in the stationary room is drawn by gravity.

It is dense lower because of its weight, which is a relative decrease in entropy, from the satellite point of view. The satellite would spontaneously enter a state of greater entropy if it would see relative entropy in higher gravity higher (an objection to a theory that would consider relative entropy greater) and would simply abandon its inertial motion and fall into a stronger field.

We see the consistency of classical laws of physics with the (new) theory of information everywhere. The scattering rather than the merging of photons and electrons in Compton collisions is classically predicted by choosing the coordinates where the resulting electron is stationary. This process, viewed backwards in time, would give off the emission of photons (energy) from the still electrons which then leave with higher energy (for kinetic) which is impossible according to the law of energy conservation. Analogous to information theory, resting electrons do not emit information because of the principle of minimalism. On another occasion, we will see that this situation clarifies some other differences, notably complex and elementary systems, also from the point of view of information.

Compton scattering is consistent with Heisenberg's *uncertainty relations* (1927), and those with information of perception. Specifically, by shooting the still electrons with stiff rays of light (shorter wavelengths), we determine their position more precisely, but the momentum scattering is spreader, as well as vice versa. As we strive for greater determination of electron momentum, we observe them with less precise photons positions (longer wavelength). The smallest products of these uncertainties, momentum and positions (as well as energy and time), are order of magnitude of the Planck's constants and represent the smallest physical actions.

If the electron momentum is a "restriction" and the position is "capability" (or vice versa), Heisenberg's product of uncertainties is the sum of "freedom" in the total of "information of perception". She is the backbone of the (new) theory of physical information, and here I just mention it.

Archimedes' "ability" was contrasted with the "weight" of the problem of testing the gold crown when he found that a body submerged in a liquid was easier by as much as the weight of the displaced fluid.

Archimedes checked the intact crown of King *Hiero II* of Syracuse's that it was made of pure gold and that the jeweler did not deceive the king using silver, which was cheaper.

The product of two variables is again a component of "liberty" as in the case of the uncertainty relations, but defiantly formed into larger overall "information of perception" than that in the case of the principle of least effect. So we say that Archimedes has a higher "vitality" than the particles of physics themselves.

It would be a wonder if future scientists do not notice such a mix of their profession with methods of theory of information and do not intend to use it. In the end, like geometry and algebra, correct theories agree not only with their own parts but also with each other.

2.7 Feynman Diagram

The famous *Feynman*[38] on whose textbooks of quantum mechanics were raised generations of top physicists is the author of the diagrams named after him.

He was so proud of his simple and absurdly effective sketches of quantum world interactions that he put them ahead of all his other accomplishments. That Nobel Prize winner in physics was drawing them on a van to go fishing, on walls, on T-shirts, admiring their incomprehensible accuracy.

We reduce the interactions of quantum mechanics to the elementary particles that are divided into *bosons* and *fermions*. The former include carriers of forces (gravitational, electromagnetic, weak and strong), and the latter are particles that are affected by these forces.

Spin of the first is integer; the spin of the second is always half. Two or more bosons may be in the same quantum state, and this is not possible with fermions. This restriction, *Pauli's exclusion principle*, makes the behavior of the two types of particles significantly different. In the Feynman diagrams, all fermions are represented by the full line, the Higgs boson dashed, the photons and W or Z bosons by extended, the gluons usually with a wavy line with feedback curves.

Electrons (negatively charged fermions) create an electric field around them constantly emitting *virtual photons*. When a virtual photon from one electron struck into another electron it becomes real and due to the *law of conservation* the energy and momentum are transmitted. Like free boats on still water that will drift away when we throw sandbags from one to the other, electrons repel.

Thus we describe what we see in the corresponding Feynman drawing. Quantum mechanics, like classical, but in contrast to statistical, in its equations allows *inversion of time* and the interpretation of the electric attraction of electrons and *positron* (anti-electron) in the opposite direction of their times with the corresponding Feynman's thumbnail.

In the nucleus of the atoms are electrically positive *protons*, which are also attracted by negative electrons and repelled by positive positrons, so these sketches are successfully transmitted further to

[38] Richard Feynman (1918-1988), American theoretical physicist.

such cases as well as to all other known interactions, with the interpretations that gets weirder. With that comes the question of fitting the new information theory into these notions.

When the second electron receives the virtual photon from the first one, it receives information. The space toward the first electron becomes more informative and it spontaneously “runs away''. Nature does not like information even though all it of the information is created. Because of this principle of information minimalism, the second electron repels from the first, but it also emits a field of virtual photons for similar repulsion.

It does not communicate everything with everyone, but here it is possible to transfer spin +1 photons from the first spin electron +½ to the spin electron -½, when the first one stays with spin -½ and the second becomes spin +½, in addition to some combinations that are not possible.

When a particle travels empty space, it “talks'' to *vacuum*. It is an opportunity to release the excess information created by the accumulation of its past, but also a necessity, again because of the principle of information. Thus, the photon fills in and empties information, in addition to perhaps some other ways of “rippling the void'', making those surpluses and deficits interesting (visible) to different participants.

Where an electron sees a surplus of information, the positron sees a deficit and vice versa, so after interacting with the same photons, the electrons are rejected by the electrons and attracted to the positrons. This is in addition to explaining the Feynman diagrams.

A simple calculation[39] shows that it is not possible to simply repel electrons by bouncing photons between them like a ping-pong ball. It will disagree with the *Coulomb*[40] force (the law of decreasing electric repulsion with a square of distance). A correct calculus will give the spherical propagation of a virtual photon, sphere by sphere from the first electron, whereby the interaction of these spheres with the second electron is a random event (not a necessity) of the chances of a decreasing square radius. These spheres are surfaces and the information is *two-dimensional* – I will try to explain it on one occasion[41].

Like concentric circles of waves of ever-smaller ripples as they expand across the surface of the water, the *amplitudes* of virtual spheres will decrease with the area of the sphere while their wavelengths remain unchanged. The decrease in amplitude indicates a decrease in the probability of interaction, and a constant of wavelengths about the unchanged position uncertainty and the potentially transmitted momentum.

After interacting with another electron, when the virtual photon moves from a spherical state to a particle and becomes real, all the surroundings of the first electron become unsaturated. This lack of information is filled from the first electron, or, for example, encourages the transition from the fictitious to the real state and the interaction of the virtual spheres of the second electron with the first,

[39] In my book, Quantum Mechanics, Figure 1.14 and text.
[40] Charles-Augustin de Coulomb (1736-1806), French military engineer and physicist.
[41] see in [2]

accelerating the opposite direction of the same interaction. This synchronization of the transfer of energy and momentum between electrons takes us one step closer to a “phantom'' phenomenon, as the Einstein called it, who discovered it in 1935.

The *entanglement* of quantum interactions of dependent random events could also occur here. If we add it to the explanation of the Feynman diagrams, the first electron does not react to the presence of the second until the second photon of the first catches up with the second and is realized, and then, only then, a mutual interaction occurs. This would be an *retroactive* exchange of energies, momentum, and spin of two electrons, an alternative to the probabilistic explanation of the compensation by alternating exchanges of virtual photons.

Due to the great importance of this phantom quantum “coupling'' (entanglement) for the theory of information, their connection to information physics, also about the unknown jet, I may say something in another time.

2.8 Schrödinger's Cat

Schrödinger's cat is one of the most famous legends of the modern quantum world, stories that can always something be added to. It is conceived by *Schrödinger*[42] for the discussions at *Copenhagen* to emphasize the difference between the phenomena of micro and macro physics.

The cat is in a box, it is said, in which a random event can kill it, and then we open the box and find out if the cat is alive. The paradox arises if we consider that in the previous state the cat was both alive and dead or neither alive nor dead, and by knowledge she becomes only one of the two.

First of all, it is about bringing the laws of small size physics to our size. Like when an ant, which can lift a load 50 times heavier than itself, we imagine a big one like an elephant and then fantasize about an elephant carrying more than 20 tons with ease. This is not possible because the mass grows with the cube of body height, the area with the square, and little of it is linear with length. It is in our nature to admire the colors carelessly, but in the nature of the little one, even a collision with the smallest piece of light would be fatal to us. Shrinking your body changes your physical characteristics.

When, after Plank, Einstein, and a few other geniuses, in 1924, *Louis de Broglie*[43] emerged among quantum mechanics theorists with the idea that all matter has wave properties (interference, diffraction), dominant in the micro-world, Schrödinger first penciled in and defined the mathematics of such a hypothesis.

Soon, in 1926, he coined his famous wave partial differential equation and defined de Broglie's fantastic world. Surprisingly, the solutions to his equation began to be confirmed experimentally, one by one without exception. Schrödinger, with his discovery of quantum mechanics and an army of experimental physicists in the laboratories by which they had until then wandered through the dark, provided an astonishingly powerful theoretical tool.

[42] Erwin Schrödinger (1887-1961), Austrian physicist.
[43] Louis de Broglie (1892-1987), French physicist.

He was aware that his theory was ahead of practice, that concrete examinations would only confirm him, and he was in a hurry to go as far as possible in the new field. In many of the scientific papers he published at that time, he successfully interpreted the derivations of his equations, but perhaps he struggled most difficult with the paradoxical *superposition*, then a new phenomenon and an indomitable solution. It is the most common place where the interpretation of quantum mechanics is accelerated and needs clarification.

Quantum mechanics is so mathematical that it is confusingly accurate and precise in experimental predictions, and certainly because of the same, it is also non-contradictory. It is a representation of the first differential calculus (Schrödinger), then the matrix (Heisenberg) and unitary spaces (Hilbert). She is all about analysis, algebra, probability theory, always with the same concrete endings, and that are exactly the same. It's normal for mathematicians and we won't talk about it.

What is seemingly strange is the theorem of algebra that any polyvalent logic (true, perhaps, false) can be reduced to divalent (true, false), and what now with the irreducible state of superposition? Just seemingly, like six states of pre-roll dice that after throwing always, but always collapse (quantum mechanics term) into just one of them. In addition, the moment of collapse is “elusive'', so this also bothered Schrödinger.

The Copenhagen interpretation, formulated by Bohr and Heisenberg in 1927, is today the standard interpretation of quantum mechanics. It dismisses a question like “where a particle was before measuring its position'' as meaningless. The act of measuring the superposition of multiple possibilities is realized in one outcome, that is, information emerges from uncertainty – I would add.

The uncertainty is reduced exactly by how much information is generated, and the process is violent, triggered by measurement, interaction with measuring devices. These are IT interpretations (my). First comes from the law of conserving the information, which is why uncertainty is the type of information, and secondly from the principle of minimalism of nature around changing the state of information.

All matter is made up of data only, and we measure their quantity with such information for which is conservation law valid, hence quantum validation. Namely, unlike infinity whose proper subset can be a quantity equal to the whole set, every property of information, due to the law of conservation, is finally divisible.

Furthermore, each finite set has finally many combinations, and similar causes lead to similar immediate consequences (not necessarily to further), so the information phenomena of physics are always periodic, but vice versa, each periodicity of occurrence has something additional to its information. Matter consists only of information and here is an explanation of the Schrödinger wave equation phenomenon.

Finally, information is the equivalent of an action, at least the quantum of action (the product of the uncertainty of energy and time) and therefore – if a cat is of great mass, it is of very high energy, so the transformation of that energy is a very short-lived phenomenon.

She has nothing to remember when we see her in the box, because her process of collapsing from a superposition lasted a very short and there is no means in measuring something so short-lived, wither to “experiencing.” Only a very light “cat” would have a longer uncertainty of the past, so that we could speak of the phantom action of the present onto the past, that is, the *retroactive* action mentioned in the previous story.

Let us return to the classical interpretations of quantum mechanics. Copenhagen's is bemoaned that “the Moon will not disappear if we do not look at it!'' (Einstein's argument), and then there are questions of the objectivity of a multitude of uncertainties (superposition) before “looking'' into appearance. That is why *Everett*[44] in 1957 formulated the *multi-world interpretation* of quantum mechanics. According to him, both living and dead cats have become real, but in separate realities, there is no effective communication or interaction between them. In the informatics, both of these interpretations are now two parts of the same theory.

There are different hypotheses, and new ones are constantly emerging. The “informatics interpretation'' mentioned here is one of the candidates.

2.9 Twin Paradox

The God hypothesis in science is not needed unless we say “God is the truth'', after which atheist mathematicians would be in trouble. They might say: God like to hide, but he does not like to be hidden. This is supported by the principled minimalism of information and in dual the objectivity of at least some uncertainty. Also, it is in the difficulties and paradoxes of science, and on the other hand, in our successes in it.

Instead of the usual critique of the *relativity* based on its paradoxes, we do the opposite here. We will note that it has been experimentally confirmed up to almost a tenth decimal of a pound, a meter and a second. We will admit that the theory of relativity after quantum mechanics is some of the most proven that physics has today, and that in this sense it is the top science in general, and then look at what its paradoxes further tell us. And among the first is the famous *twin paradox*.

Einstein's Special Theory of Relativity was published in 1905. It is postulated that all motions are relative and that the same laws of physics apply to each of the inertial systems observers. Another postulate states that the speed of light in a vacuum is constant, independent of the speed of the source. The consequences are universal proper time (resting observer) and slow time flow in the relative system (motion observer).

Now imagine two twin brothers – one who stays in the first system (on earth) and the other who staggers equally straight and, after some traveling, equally returns. When the two brothers are together again, the paradox says that whatever one of the brothers is still, the former is older than the other and the latter is older than the former. But when they find themselves in the same place again, it will be seen that both claims are not possible!

[44] Hugh Everett III (1930-1982), American physicist.

Einstein himself once gave a solution to this situation, saying that the passenger had to rotate, slow down and accelerates to back, disrupting inertial movement. Because one of the brethren was leaving a single movement there is no equality of their conditions and no contradiction mentioned. We will not doubt this explanation, but will use it even further.

As the second system moves away from the first, relative time flows more slowly, lagging behind in the past compared to the present. After slowing down the speed, to turn and rewind, again because of the slower flow of time, the second system is then constantly in the future of the first. The difference between the two presents is diminishing until the alignment of the origin and the meeting of the brothers when that difference disappears. Part of the traveler's own (proper) time the relative observer from the ground does not see. The total elapsed proper time has been longer than that of the relative for the part which the relative observer does not see, which in relation to him, we now say, has gone to *parallel reality*.

However, the slower relative flow of time produces *virtual* energies (of *vacuum*) into real ones that are not visible to the proper observer. As time goes on, the product of energy and time uncertainty grows, some virtual particles become real, with them virtual actions as well as virtual information. The relative observer now perceives just as much new virtual information as the part of the proper has been hidden in “parallel reality''.

The theory of relativity, Heisenberg's relations of uncertainty and the law of conservation information are all in sync. But this interpretation is just beginning here.

The disappearance of part of one's own information in “parallel reality” with respect to various relative observers can take place in three *dimensions*. Specifically, in each individual Minkowski space-time plane, otherwise Einstein's geometric basis, the relative time axis tilts in the direction of motion. Since there are three dimensions of space, there are also three dimensions of motion, and tilting of time axes is also possible in three dimensions, so there are as many times dimensions as there are spatial.

This multidimensional nature of time, which is otherwise characteristic of (my) information theory[45], is a novelty in physics. Note that different dimensions of time are not considered even in *string theory*. It is still a hypothetical branch of physics that unites known forces and treats space on ten dimensions, but with a constant one and the same axis of the time.

Principled *hiding information*, now revealed in “parallel realities”, is also seen in the more frequent realization of more likely events (less informative), in easier coding than in decoding, in spreading lies faster than truths through social media and networks. On the other hand, the existence of “parallel realities” follows the existence of objective *coincidences*, and from this the theory of information, so that these three (hypo) theses are also in agreement.

In the end, this is just another of many reaffirmations that “the truth likes to hide, but does not like to be hidden''.

[45] because the objectivity of options is postulated

2.10 Bernoulli's Attraction

Any three correct theories are as non-contradictory with their parts as they are with each other. We know how to transfer geometry theorems to algebra and probability or vice versa, but it is instructive to discover this on *fluid* (liquid or gas) dynamics, relativistic motion, and the principle of information. A few years ago, one such discussion was imposed on me by a colleague, suspecting that the branches of the natural sciences can be easily connected as we do in mathematics.

The main part of that discussion is in my then-published book[46] and here I will try to convey some interesting details and perhaps at least some new untold discovery. The idea of the connection that came to me came from a little-known *train paradox*, from somewhere as a purported proof of falsity of theory of relativity. Of course, we will not pay attention to the fun “wise deductions'' (to me by an unknown author), but we will use this interesting initial construction to look a little further into the theory of relativity.

The story goes like this: two steadfast equal-speed trains pass by. The space between them is so open that the air can flow freely. We know that flowing fluid sucks the surrounding substance. This is also said in the equation of *Bernoulli*[47] in 1738: the attraction of fluid grows with the square of its velocity, besides some other irrelevant magnitudes here.

This means that the observer from the coupe of the first train should notice the movement of his air towards the second one, and contradict the observer from the second train to claim symmetry — to observe the opposite movement, the air coming out of his wagon. Consistently further, for the outside observer standing on the embankment next to the trains, two air movements, from wagon to wagon, are canceled.

Bernoulli's equation is indisputable. It is easily proved by the flow of fluid through a tube of different profiles (and therefore the speed) at which the openings with pressure gauges are laterally mounted. We also see its application in the aviation industry in the construction of *airplane wings* with a longer upper profile that airflows faster than lower ones, which makes the *thrust* of an airplane upward with the square of the airplane speed. The thrust also depends on the wing surface, aerodynamics, air density, but we can now ignore such parameters.

The special theory of relativity is also indisputable. It is derived from only two well-checked principles, relativity of motion and constant speed of light, and with its consequences we improve the operation of various technical devices. For example, GPS (general positioning system) starts from satellites that calculate the contraction of lengths and time dilation first because of inertial motion in orbit and then because of the gravitational field. This effect is exactly proportional to the increase in the kinetic energy of the body in motion, which at lower speeds (relative to the speed of light) receives the long-known value of the product of half the mass and the square of the speed of the body. Surprisingly, we add here, the same proportionality holds for the Bernoulli equation!

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[46] SPACE-TIME – principles physics of chances; Economics Institute Banja Luka, 2017.
[47] Daniel Bernoulli (1700-1782), Swiss mathematician and physicist.

The wagon is relatively shortened only in the direction of movement, and its volume decreases exactly as many times as Bernoulli's attraction increases. Therefore, these two effects are canceled out because the increase in compressed air pressure outward is in equilibrium with Bernoulli pulling inwards. In other words, we have just found another derivation of the famous Bernoulli equation, now using a special theory of relativity.

The next question is: where is the principle of information? See first my previous post about the twin paradox. In a relative (moving) system, time flows more slowly than in one's proper (own, immobile), so virtual particles (energies, actions and information) become real. They void the exact amount needed to cover the loss of information due to the departure part of the moving system into *parallel reality*. We can say that the slowing of time pushes a part of the system into parallel reality (inaccessible to the relative observer), which due to the law of conservation draws *virtual information* into the real (inaccessible to its proper observer).

Theoretically, if layer by layer we were to have faster movements of concentric spheres as we approached their common center, the effect of the central gravitational field would appear, at least with respect to time deceleration. Bernoulli's equation states that then there would be *suction* of the substance towards the origin of the spheres. So slowing down time is the equivalent of the attracting, and since all matter is made up of information, what we have here is “sucking in information.''

The same phenomenon becomes more familiar if we look at things in reverse, on a flat surface that rotates about one point. Beyond the axis of rotation, the tangential velocity (perpendicular to the radius) increases, so the pressure of the substance outwards increases, now we can say it is the Bernoulli pressure. However, these `suction' forces are already known to us as centrifugal, and we know that they exist even when there is no (visible) substance. *Centrifugal force* is the force of space and time itself! It has an equal effect on space time and matter, forms of information, which is why it is actually a phenomenon of information itself.

If the vacuum did not have virtual effects that could translate into a real by time slowdown, then the law of conservation (the amount of) information would be violated, or *gravitational force* would have to be much stronger. In principle, the lack of information is as attractive as the excess is repulsive.

In this way, fluid dynamics, relativity theory, and the principle of information seem to be parts of one and the same, for now say unknown, larger theories.

2.11 Mechanism

The German astronomer and mathematician Johannes *Kepler* (1572-1630) was among the first to deal more accurately with celestial bodies.

From 1609 to 1619 he discovered the laws that bear his name today: first, that the planets move in ellipses in which one of the (two) foci is the Sun; second, that the Sun-planet (radius vector) strokes equal surfaces at equal intervals; third, the squares of planetary patrols are proportional to the cubes of their mean distances from the Sun. Thus began the *mechanism* era.

With them, the Italian mathematician Galileo *Galilei* (1564-1642), who, when throwing objects from the Pisa tower in 1654, discovered that all bodies would fall with the same acceleration if there was no air resistance. While others argued that movement required constant body pushing, Galileo also understood the law of inertia.

All such discoveries of classical mechanics as the icing on the cake were given by the English mathematician Isaac *Newton* (1642-1727) in the book “Philosophiæ Naturalis Principia Mathematica'', printed on July 5, 1687. Displacing away from the plague epidemic of 1665, in Woolsthorpe Manor, his birthplace north of London and Cambridge where he performed most of his experiments (working on optics), he also reportedly watched an apple fall from a tree and got the idea of the force of gravity.

As a good mathematician, Newton deduced from Kepler laws that gravitational pull decreases with a square of distance. He was a mystic by nature and saw no problem in spreading force through solid bodies, or in its immediate action at a distance. Watching the water in the washbowl spill as the basin spins, he decides on the absolute space. Just doing such an experiment points to the difficulties Newton observed in Galileo's inertia, with systems in uniform rectilinear motion (inertial) in which all laws of physics should be invariant (corresponding).

The principles of Newton made a deep impression on all later explorers of nature, and their extreme ability to predict derived from formulas, precision, and in general determinism, seemed to enchant them. Philosophical Essays on Probability by *Laplace*[48], the last of the leading 18th-century mathematicians, may confirm this. They start from the realization that we need probability only because we are not well informed, and his famous sentence is a summary of mechanical materialism of the time:

– A mind that would know all at a given moment the active force of nature, as well as the relative position of all the particles that make up it, and yet be large enough to subject it to mathematical analysis, could include in one formula the movement of the largest bodies in the universe and the smallest atoms in it; there would be nothing vague for him, and he would see clearly both the future and the past. That perfection, which human reason has been able to give to astronomy, is still a poor idea of such a mind.

A deeper consideration of probability consistency would reveal the first inconsistency of Laplace's mechanical concept with his the most famous treatise (Analytical Probability Theory). Laplace discussed in detail hazard games, geometric probabilities, Bernoulli's theorem and its relation to the integral of normal distribution, as well as Legendre's least-squares theory. The striking consistency of such considerations was crowned in 1933 by *Kolmogorov*[49] discovering axioms of probability and basing by them the theory of probability as a branch of mathematics.

There was something more in this “lack of information'' that we could rely on for *probability theory* and the development of statistical physics in the 19th century, but the real shock came with the discovery of the deterministic *theory of chaos*, in transition from the 19th to the 20th century. It was discovered and

[48] Pierre-Simon Laplace (1749-1827), French mathematician.
[49] Andrey Kolmogorov (1903-1987), Russian mathematician.

based on systems whose slight initial variations gradually evolve into very different states such as metrological phenomena. Literally, the smallest grain of dust could spoil and stop the perfection of *classical mechanics*. On the other hand, it was known that the greatest stability of the system's operation could be derived from the laws of large numbers of probability theory.

It happened that none of the great researchers tried to exploit that convenience of probability, that it was a branch of mathematics. As early as the 18th century, the problem of *Buffon's*[50] needle, the formula for the probability of accidentally dropping a needle to the floor with drawn strips, and the way (law of large numbers) how with the number of needle throws the result of the experiment approaches the exact value of the formula. Because the formula contains perhaps the most famous irrational number – pi (π = 3.14159…) by increasing the number of throws, we get that number with increasing accuracy, and in similar way much more. Such harmony with mathematics has no say statistics. Conversely, the mismatch of probability and mathematics would indicate the non-coincidence of the phenomena.

So, one might devise: well, because of not being known of everything that happens with gravity, I will rely on probability theory, for it is so consistent that it will surely be in line with future findings that will be based on better knowledge and determinism. Failing that good again, I proved the determinism of Newtonian mechanics. No one came to mind it because the age of mechanics was at its peak.

It is similar to other physical phenomena of which we have no absolute knowledge. For the glass in front of us we would say: it is there on the table, because in the given circumstances it is its most probable condition and is the result of a large multitude. The most likely outcomes are, in principle, the most common occurrences, so the cup is still in the same place in the next moments until some force (hand) appears and moves it. Therefore, force changes probabilities. The diversion of satellites (bodies in freefall) from their own trajectory from the point of view of the satellite is less likely. This would follow from the mere agreement of probability with mathematics!

At the time of *Hartley's* discovery of information in 1928, the said principle of probability would become the principle of information: less informative is more common. We could then say that bodies fall freely, avoiding communication. But it had to wait for a century.

2.12 Materialism

At the time of my first recent writings on gravity I was conducting correspondence with colleagues from various professions. Those about *materialism* could then be more interesting than the main topic and, on the advice of one of them; here are the more interesting parts in the foreground. Unfortunately, I have only preserved some of these discussions, and most of them have to be reconstructed by memory.

[50] Georges-Louis Leclerc, Comte de Buffon (1707-1788), French mathematician.

Discussions were held around three issues. Is the *probability* a branch of mathematics and statistics are not, can relativistic gravity equations be derived from probability theory and why did Einstein not do it? Suppose the answer to the second question is positive[51], but I may talk about it later.

Unlike various nebulosus, including natural sciences and statistics, probability is a branch of mathematics, since its proofs are transferable to mathematical analysis, algebra, and geometry. I'll explain that with an example.

We toss a *fair-coin* until the tail falls. For a tail to occur in the first throw, the probability is ½. If it happens in the second throw, then the head is dropped first, then the letter, so the probability is ¼. If the event occurs in the third throw, a series HHT happened with the probability of 1/8. That tail in the second cast is not the same as the tail in the third and in general the events in this series are all independent. Their probabilities add up. Sooner or later the tail will fall, so in an infinite sum of the fractions we have all possible outcomes, which means that their sum into one has the probability of a certain event.

That the sum of an infinite series of such fractions, the sum of half of half's, is summed in one can be proved algebraically without mentioning probability. It is such ability to transmit the proof that no statistics have, which is why we say statistics are not, and probability is a branch of mathematics. Pythagoras' theorem is not proved by experiments, and even experimental sciences are not branches of mathematics, though experiment is also a proof by contradiction, the basic tool of mathematics.

So it makes sense to declare yourself uninformed in mechanics issues and look for probabilistic settings to derive equally accurate (with classical) equations of motion. Especially, it makes sense in the everyday macro-world where this is guaranteed by the law of large numbers (again) of probability theory.

Einstein[52] would not be happy to work on shaky foundations because he was a great researcher, and they are rarely happy with half solutions. To give anything was usually not a style of such, so he sought the maximum in deterministic geometries and tensor calculus. He noticed that the satellite in the gravitational field was actually in free fall and in the local weightless state, and concluded that the space-time geometry defines gravity and that mass and energy define the geometry. This is the essence of Einstein's derivation of the general field equations named after him.

Translated to the *tensor* metric, satellites fall moving along *geodesic lines* that represent the shortest paths between given points, also the least possible energy exchange, and the least amount of time spent. It has recently been proven that these geodesic follow the principle of least action, and now I would add the principle of (least) information.

The search for a fundamental solution in determinism and geometry only partly explains Einstein's "onslaught'' to field equations published in 1915, especially since, ten years earlier, along with a special theory of relativity, he also published an analysis of *Brownian motion*, the random behavior of particles

[51] the proofs are now in [2]
[52] Albert Einstein (1879-1955), German-born theoretical physicist.

in solution, and then much of it in quantum mechanics rather non-causal. Other reasons lie in the philosophical atmosphere of the time.

At the turn of the 20th century, mechanicism prevailed in the natural sciences. The belief that *physics* should become independent that matter is one and abstract ideas are something else that the natural sciences should stick to the sensory things, was breaking through. This was favored by the fact that mathematics grew into an increasingly incomprehensible “story'' for many. The social sciences imposed *Marxism*, dialectical materialism, and Plato's former world of ideas was losing the race.

One of the leaders of such philosophy was *Mach*[53], one of the leading physicists of the time. It is said that on one occasion he came to Boltzmann’s lecture on the propagation of heat by vibrating molecules, stood up, turned to the audience and exclaimed, “People, don't listen to this man, this man is a fool, atoms don't exist!''. Boltzmann committed suicide soon (he was prone to depression) but his theory prevailed.

Stricter to look at and geometry would be problematic in materialism. The substance world nowhere builds such straight lines, much less so thin that they could be justified in construction, and then we would have to renounce his human creations and stick only to the primal, not to say instinctive or animalistic. The philosophy of mechanistic materialism came to an end already in Einstein's general theory of relativity.

There are other times today. I advocate a philosophy of nature according to which information is everywhere. They come from “local'' unpredictability. That’s why we communicate, because we don’t have everything we need. That's why I'm talking about “perception of information'', because every local world (particle) is a world in itself; it's legal in that theory. It is irrelevant whether it is leaning on one broader uncertainty, on the general unpredictability generated by endless abstractions such as mathematical ones, because that “world of ideas'', that is, the world of truth, is always greater than imagined.

We can say the latter freely because there is no set of all sets (Russell's paradox), no theory of all theories (Gödel's incompleteness theorems), and no ideal criterion (Arrow's impossibility theorem). In this context, Einstein's general theory of relativity has met expectations, but is also ripe for new content.

2.13 Space and Time

Space, time and matter are types of information. They exist and are objects of communication. It is in the spirit of nature not to communicate everything with everyone, so the logical question is whether there is “something'' that our space-time does not directly interact with, and that such something also “exists''.

To the proponents of mechanistic materialism, such a question would be pointless, because what we cannot touch, smell, see, and feel at all, which cannot directly affect us, we would say, does not exist. But they would not be right.

[53] Ernst Mach (1838-1916), Austrian physicist.

The great German mathematician Carl Friedrich *Gauss* (1777-1855) once dealt with a similar problem whose solution he published in 1827 under the name “exceptional theorem'' (Lat. Theorema egregium). He asked himself if our everyday space was flat (Euclidean) or maybe it was curved (non-Euclidean) and whether and how we could find it out. Following in the wake of Gauss's solution, his student *Riemann* found mathematical forms of non-Euclidean geometries, and using them *Einstein* came to his general field equations.

We will not delve deeper into the entanglements of non-Euclidean geometries, as Euclidean geometries might be too difficult for us, but we can still understand some of it. An ant walking on a sphere might “notice'' the finality of its surface as opposed to the ordinary plane. It would continue along the shortest paths between the given places, but these paths on the sphere would be the largest circles, the geodesics of the ball surface.

The curvature of the surface can be considered as follows. Put a vector (oriented along the north) on the north pole of the Earth, which then moves (translate) in parallel with the zero meridian, past London, to the equator, an imaginary circle that orbits the Earth at an equal distance from the poles. We drag the vector further in parallel along the equator to the meridian of Belgrade, and then lift it in parallel with that meridian all the way to the North Pole. The starting and ending directions of that vector in the north are not equal. A direction defect is a change in information (uncertainty).

The disturbance of the direction is also equivalent to the change of the momentum vector. The change of impulses is caused by the consumption of energy (work), and it is caused by some force. However, representations of the vector change could not occur in a plane inertial space, so the aforementioned translations prove in sequence: that the space is curved, that it is a field of some force, that it has information.

Also, the method reveals additional *dimensions of space* in which the given Riemannian space is curved. As curvature means the presence of gravity (theory of relativity), and then how the direction of gravity with the time axis (time of travel the speed of light) defines a plane, at different points of the field different, whereby the time axis tends to be more inclined towards the spatial where the gravity is stronger, we find that there are three *time axes* due to three spatial ones.

It is, in fact, the (unknown) direct consequence of Einstein's theory of gravity, which tells us about six dimensions of space-time. Additional spatial (not temporal) dimensions are also addressed by contemporary physicists within string theory, but this is not the case here. Their theory is basically deterministic, and here we are pointing out information content.

I'll reinforce that story with *topology*. Topology is a part of geometry stripped of the definition of length. It may seem that it is even more deterministic and further from the concept of uncertainty, but it turns out that it is not. The inductive topological definition of dimensions is particularly convenient for this.

A point is of dimension zero and any finite and discrete set of points is of dimension zero. If a figure (set of points) has a given dimension, then a discrete set of the same figures has the same dimension. If the “border'' (set of points) is of a given dimension and it separates the “interior'' from the “exterior'' of some “figure'', if it completely separates the two areas, then that “figure'' has a dimension one larger than the “border''.

For example, the boundary of leg (line interval, length) is two points (dimensions zero), and the leg is a part of a straight line, so the straight line dimension is one. It is similar to a circle or some other curved line. The boundary of an interior of a circle is a circle line of dimension one, so a plane has dimension two. The same applies to a sphere or other curved surface with a closed (curved) line. A sphere (dimensions two) isolates the interior from the outside of space, so the space is dimension three. If the present, with all its 3-D space at a given moment, separates the past from the future, then the space-time dimension is four. Such is the nature of absolute, classical space-time.

In the special theory of relativity, inertial systems of straight linear motion, the concept of simultaneity is relative, but it can always define the “present'' which completely separates the “past'' from the “future'', and so the individual has dimension of the four. This means that inertial system has minimal communications, but more of them are no longer such. Different directions of inertial motions tilt the time axes differently and with three spatial dimensions build three temporal ones, the same as in the mentioned gravitational field. Let's look at this result once again in a way that confirms the connection of additional dimensions with unpredictability or information.

Imagine a walled prison cell and its duration. Without uncertainty and erosion, it would be a 4-D building that could insulate the interior from outer space-time indefinitely. In the case of erosion, the isolation of a part of space-time (figure of 4-D) is not infinite, so points (events) from inside the cell would sometimes be outside and, according to the topological definition of a dimension, would form a space-time of dimension larger than five.

I sketched some of the ways of discovering reality within 6-D space-time, which at a given moment of communication is always within only four dimensions. That is by the very methods of mathematics that would be criticized and successfully challenged by supporters of mechanistic materialism. This is, among other things, the greatness of the genius Gauss and his student Riemann, who lived in a time of growing influence of such a philosophy and did not quite succumb to it.

2.14 Principle of Information

There are coincidences, but nature does not like them. It is the *principle of information* in the narrow sense: information is inevitable and shy.

That’s why we work so hard around various predictions and probably make mistakes, because we work with objective unpredictability that interferes with every business. It is a matter of principle to skimp with information around us with its gentle but persistent tendency to hide knowledge and truth wherever it may be hidden. We rarely notice it.

For example, *journalists* rightly say that the news “a man has bitten a dog'' is greater than the news “a dog has bitten a man'' because it is less likely. For the same reason, the “tails dropped'' information when throwing a fair coin is greater than the outcome information of the “tails'' of non-fair coin if it is expected. There are principle shifts from this ``wasteful'' situation also in other ways.

Equalization of the initial conditions of participants in the sports competition we consider as fair, and they maximize their chances.They increase the number and success of individuals' bidding options, release the effort to raise the quality and fierceness of the fight, making the event richer. The principle of information is to suppress these shifts. This is because information is a physical action, equality increases the chances of conflict, and conflicts are unfavorable, they are arduous.

It turns out that equality is a fair, useful and unpleasant condition. Equals have more chances for advancement, but also indivisible goals and reasons for conflicts, so we have come to terms with regulating society through equality-based legal systems.

Creating equality creates prerequisites for new *conflicts*, which makes the system self-validating and growing. *Legal* regulation spontaneously becomes more complex, denser and more expensive. It gradually diminishes the freedoms of individuals by stealing them for themselves, and then suppresses fair conditions. Excessive organizing the society for freedom and equality leads to non-freedom and inequality.

Social phenomena are not exempt from the law of information and then from *duality*, its important traits. Uncertainty is the essence of information, the source of observations from impossible to certain events (right ahead to theorems), because certainties are knowledge too. Nature runs away from uncertainty to certainty wherever it can, but the latter are so little informative that we do not perceive them directly but understand them abstractly. Everything we can experience, and then space, time and matter, but also the sure things are species of information.

Examples of minimalism include *feminization*, that is, spontaneous growth of *entropy*. The gas molecules in the room are distributed uniformly because this arrangement is more likely than crowding. We call the inside order a mess because we look at it from the outside. The things that are arranged are less (outwardly) informative, like uniformed and lined up soldiers at the parade, they are impersonal and amorphous. The aggregate information of the room and its large enough environment tends to remain constant.

That the order emits less information seems controversial (to my colleagues), so I give another example. Text made up of random words in a dictionary is less a “message'' than a real messaging. In the contained text, some words are statistically significantly more frequent than others; their frequencies of occurrence in the text of the message differ. I appreciate that zero order, that is, absolute *clutter* is impossible (Ramsey's theorem: enough random words will contain every pre-given sentence), moreover, I will note that this is also in accordance with the principle of information.

The spontaneous growth of entropy is recognized in the second law of *thermodynamics* (the transition of heat from a warmer body to a cooler one), but it is also evident in the consumption of each individual *society*. Successful civilizations are filling their deficits of comfort and safety by running, developing, say civilizing, with more and more internal order and less external aggression.

It's similar to the forms of *life* in general. They arise by complicating and accumulating information with its principled thrift, and then because of the same, the body sees them as surplus that a living individual resolves by interacting with the environment or transferring his or her own action (information, freedom) to a higher form in the organization.

Together with matter, space retrieves and accumulates some of the information of the present. The increasing entropy of the substance of the universe reduces the emission of information exactly to the amount of accumulation in space. *Vacuum* is a warehouse of the past that is constantly growing.

The obscure action of diminishing information is also evident in the *law of large numbers* probability theory. As we move from the micro-world to the macro-world the complexity grows, the uncertainties become certain, so in the “world of the great'', instead of having more information we recognize it less and less. We also discover these kinds of hidden accumulated information through “restless'' forms of *distributions* (bell-shaped, exponential, or power), always because of the inevitable coincidences and the tendency of nature to negate them.

Because more informative events are less likely and because nature loves them less, social misinformations through networks travel faster. Lying is more attractive than truth, fiction than science, decoding as an act of knowing is harder than coding.

The action is information, but the strike of a stone throw to the head does not made you more informed thanks to the principle minimalism of information. On the other hand, the development of human knowledge over the millennia tells us that the nature its truths fail to hide from us.

2.15 Dimensions of Time

The concept of adding *time dimensions* is one purely mathematical abstraction and will never have anything to do with reality – is one of usual questions to me – because there where is no information it does not exist, and there is no emissions of (physical) information between *parallel realities*, at least not in the usual sense.

I will note that in such questions the “mathematical abstraction'' is dehumanized and the mechanistic philosophy is bribed, but let's start in order.

If the concept of *simultaneity* were universal to all physical systems of the universe (bodies in motion, gravitational fields), then we could represent all 3-D space with a single point on the time axis. If that point of “outer space'' is far from the origin it would indicate an older universe, and that's it. We wouldn't know what's inside. There is no information on the layout and dynamics of matter, which is why the model *information universe* we seek should look different.

It may come as a surprise, but the *theory of relativity* is also a good start, even though it is seemingly exemplary deterministic, and for the “information universe" options and objective coincidences are important. Due to the relativistic prohibition of synchronization of all present and the impossibility of defining a single 3-D space of the entire universe, the assumed point on the time axis grows and vanishes in its course. It propagates in the 3-D coordinate system of time, because each new direction of movement requires a new inclination of the time axis higher with the speed of movement.

Formal replacement of space and time variables is possible. There is an analogy of expansion and the same number of dimensions of time as space, each of the three, so that the transition of "temporal'' to the known spatial-temporal model of Minkowski's theory of relativity is formally possible. We recognize heaps of light touching the cone vertices at the origin. However, the growth and expansion of the "point of space'' further speaks of freedom of options, of the various possibilities of evolution of the universe in accordance with assumed objective coincidences. Here is an example, and then I keep going.

Biological species in *Darwinian evolution* also have a breadth of development. The great variety of ways of adaptation to the environment for the survival of individuals, as well as ways of extinction, indicates that there is often no best path here, besides some evolutionary convergences such as the formation of the same physiology of the eye from different starting points. There are various triggers for change.

For example, the development of the power of a lion, deer antlers, colorful feathers in some birds or the intelligence of humans has also involved courtship. The sexual attraction of a trait is an option, in addition to the bare ability to survive. The emergence of intelligence in humans may have been more risky than useful, because the brain knows to spend more than to contribute, but it survived.

So we could also look at the *evolution* of the inanimate world (physics) and explain one of its problems with the spontaneous growth of entropy (the second law of thermodynamics). Paradoxically, in principle, scarcity with emissions of information tends to evolve physical states into less informative ones, so then it seems that a reverse flow of time is not possible. But this would then be inconsistent with quantum mechanics, because all the evolutions of quantum states are defined by unitary operators that are reversible and allow the opposite flow of time. An explanation of this paradox, among other things, is possible from the standpoint of *cardinality* (infinity) of set theory.

The consecution of moments in which we exist, as well as the set of (all) atoms of the universe, may have at most *countable* infinite elements. There are so many natural numbers, there are so many integers, there are just as many as all fractions, we say there are *discrete* (moderately) infinitely many. Due to the law of conservation information and the characteristics of *infinite* sets that they can be equal (in quantity) to their proper part, the information is finally divisible, so let's say discrete sets. Their union as a discrete set of discrete sets, a universe of information, is also discrete.

However, there are many more real numbers, countless infinitely many, say *continuum* many. We generate them in a series of many positions by varying the values of the positions of the members of the array, allowing two or more options for an infinite subset of those members. The catch is that the continuum is so much larger than the discrete set that the probability of choosing a fraction, *rational number*, on an arbitrary part, the interval of real numbers – would be zero. Moreover, in (countably) infinitely many attempts, the probability of choosing at least one single fraction is zero.

In other words, randomly choosing a rational number among real ones is an "almost impossible'' event. Practically, in a universe driven by coincidences, the chance that same one *antiparticle* (particle with reverse time flow) from our present could have come to an instant earlier (in our past) is an impossible event. This also means that the antiparticles that we see now, and then in the next moment, are never the same.

This is why we need a continuum of 6-D space-time in a universe of information whose every property is finally divisible. That's why Minkowski's 4-D space-time is a continuum. Therefore, the assumptions of the infinitesimal calculus are valid so that the equations of motion of physics, Einstein's equations, or the Riemann geometry (due to the infinitesimal calculus) can be correct theories.

There are many similar “real'' consequences of the aforementioned “mathematical abstractions'', but the *reality* for unconscious beings such as grasses, ants, or some larger animals, does not make sense of what reality is. We also are still searching for these true determinants of reality, and we should not rush and say “it is not realistic'' for something that, for example, we cannot eat.

2.16 Doppler Effect

Christian *Doppler* (1803-1853) was an Austrian mathematician and physicist, best known for the effect that bears his name and which represents the relative change in the wavelength and frequency of the source wave in motion relative to the static observer.

This seemingly innocuous occurrence of the thickening of the waves we approach and the dilution of those we depart from has unexpected depth and interesting implications.

The Doppler Effect or shift also occurs in the *sound* of the siren of a vehicle passing by us, which has a higher tone on arrival and lower on departure than the same sirens at rest. Wave velocity is the number of oscillations multiplied by the wavelength, so in a medium (air) of constant wave velocity (sound 346 m/s at 25° C) this means that the waves of the source approaching us are shorter and longer in departure. The younger person's aural perception frequency range is from 20 to 20,000 hertz (blinks per second).

It's similar to the *light*. As the Earth in orbiting the Sun approaches or moves away from the fixed stars, their color apparently shifts to purple or red, in the first case to wavelengths of about 300, and in the second to 700 nano meters. The frequencies of these edges decrease from 1,000 to about 430 terahertz, so that their product with a wavelength is equal to the speed of light in a vacuum, otherwise independent of the speed of the source.

The special theory of relativity confirms this effect, but also adds a transversal (lateral) decrease in frequencies in proportion to the relative slowdown of the flow of time. The arithmetic mean of the longitudinal (lengthwise) frequencies of the light source at arrival and departure is exactly equal to the transverse frequency. Due to the constant speed of light in vacuum, the corresponding decrease in frequency is an increase in wavelength. The general theory of relativity by consistently slowing down time in stronger gravity predicts the slowing of light frequencies and again an increase in their wavelengths.

According to quantum mechanics, this wave elongation could be interpreted by increasing the uncertainty of the particle-wave position, and according to the (hypothetical) theory of physical information, we see that the positions of the space we approach are more likely than those of which we are moving away. Moreover, in accordance with the treatment of the (6-D) space-time of that theory, we can say that we are going to the future because it is more likely for us.

I will repeat, the relativistic effect, that the inertial system (body) approaching us has a slow flow of time whereby its and our present will equalize at the moment of encounter, meaning that it is until that moment in our ever-closer future.

On the other hand, an inertial system that is moving away, and also has a relatively slower flow of time, is lagging further in our past. Interpretation of higher probabilities due to shorter wavelengths of the first system and inversely less probabilities of departure positions is the new in the theory.

We have the final result in both, relativity theory and quantum mechanics, and it relates to 6-D space-time (I described earlier). This explanation would not be possible without the “absurd'' relativistic contraction of lengths in the velocity direction (or in the direction of the field) at the same time as the increase in wavelengths.

The seemingly harmless Doppler shift has some more interesting implications. Let's see what it has to say about *entropy*. It is known from classical and relativistic mechanics that the (kinetic) energy of a body grows with speed, but Planck's quantum formula says that the energy of a photon is proportional only to its frequency. It is paradoxical that the Doppler Effect predicts a decrease in this energy due to the movement of a light source that increases energy.

One possibility is therefore to redefine the terms *heat* and body temperature because of the famous Clausius fracture, the quotient of heat and temperature, which he called entropy in 1850. We declare that the movement increases the *temperature* of the body and its kinetic energy but not the heat.

We observe an increase in temperature as a Doppler shift towards red, and the resulting decrease in entropy is consistent with Boltzmann's statistical interpretation. Namely, the relativistic contraction of space along the direction of motion and the absence of vertical changes impair the homogeneity of the body. Relative inhomogeneity reduces Boltzmann entropy.

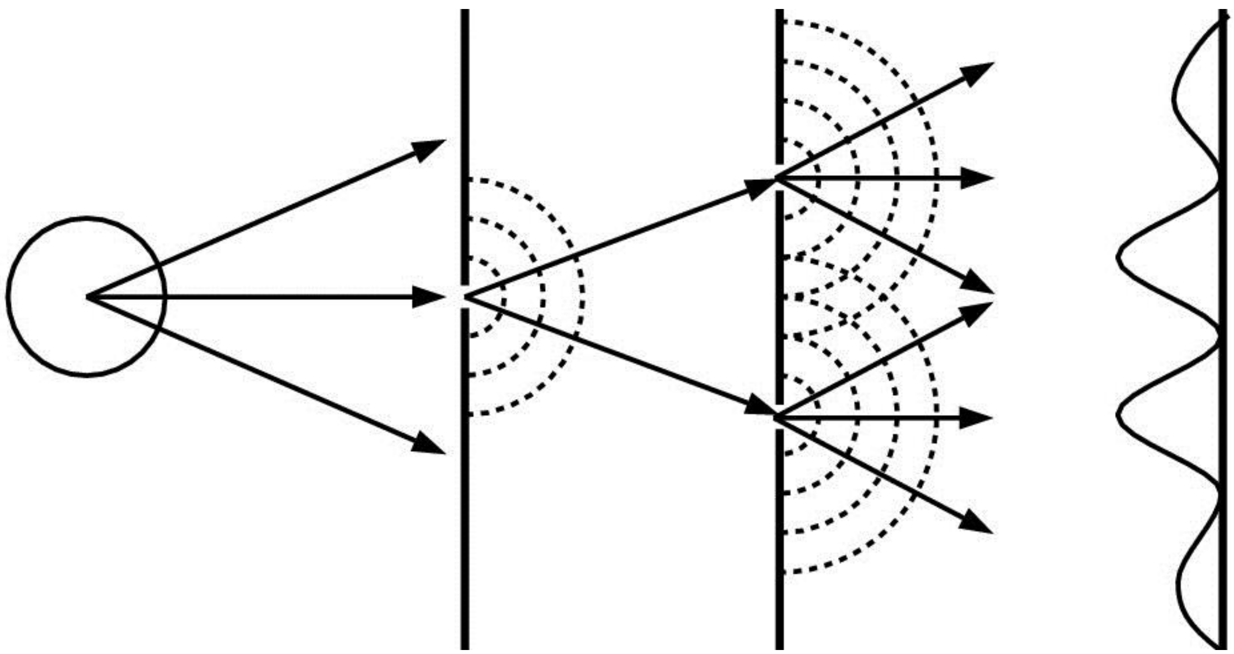
On the other hand, the separation of the concept of heat from kinetic energy will leave out the change in the numerator (heat) of the Clausius fraction and, due to the increase in the denominator (temperature), its (entropy) will decrease. Entropy thus decreases in proportion to the relative slowdown of the flow of time (redshift). Then the body remains in its inertial state of motion as it will not spontaneously transit to a state of lower entropy.

By stopping abruptly, at the moment of collision with the obstacle, the body temperature is just like before the collision, the kinetic energy goes into heat and the entropy of the body increases. The glass in flight only when it hits an obstacle breaks down in accordance with the increase in clutter due to the increase in entropy (in both situations: the glass flies and breaks the body, the glass is stationary and the body hits it).

2.17 Double Slit

Can the theory of information say something about the famous experiment *double-slit* of quantum mechanics, a questioning me friend and asks to adapt the matter a little to non-mathematicians. Of course, I answer and continue: if you view the vacuum as one big old ocean of uncertainty, and uncertainty as the kind of information, then the story flows on its own.

First of all, explain to the acquaintances that the “double slit'' was *Young*[54] an experiment of 1801 in which he proved the interference of light and that light was not corpuscular as it was described by *Newton* in his “Optics'' (1704). Only quantum mechanics, after the *Louis de Broglie* (1924) hypothesis of the wave nature of all matter, showed that they were both right. *Davisson*[55] and *Germer*[56] (1927) found the similar particle-wave duality with electrons, and then the duality was confirmed in atoms and molecules.



The device consists of a source of particle-wave beams perpendicular to two parallel straight obstacles, the first with two close and narrow vertical slits (openings) and the second is a detector, a screen for measuring the total energy flow of the beam. When the two slits are open, the beam passes through both, interfering, and dark and light streaks with more and less arriving energy, characteristic of wave diffraction, appear on the screen. When one slit is closed, there is no interference between the plates and no diffraction at the end. A picture of the hits is displayed, as in the case of a part of a jet of balls that would pass through the opening.

This dual particle-wave nature of matter is already mysterious, but with this experiment there is something even more strangely about it. When beam particles are released from the source one by one, temporally separated at longer or shorter intervals in a random or other way, the screen image is repeated: passing through only one slit the particles do not have diffraction, when they go through both they have it.

[54] Thomas Young (1773-1829), British physicist.
[55] Clinton Davisson (1881-1958), American physicist.
[56] Lester Germer (1896-1971), American physicist.

The math is clear here (to connoisseurs). We summarize the vectors of the abstract Hilbert space that now represent quantum states of passage through slits, and interpret Born rule for probabilities. One part of (beam) particles bounces off the first obstacle, the second part passes and reaches the second obstacle (detector), we calculate the probability density and find that the measurement confirms exactly what was calculated.

Quantum mechanics is, in this sense, an incredibly accurate theory, and yet it is inexplicably intuitively mysterious. Because of the latter, it may be just so tolerant that the interference of a single particle with itself as it passes through two openings is understood as its splitting before and joining after the two-slits obstacle. This "possibility" of a particle-wave probability is for now the most convincing thing quantum mechanics has in this case.

Everett, who (1957) proposed the idea of *many worlds* of quantum mechanics, in this fission saw the appearance of the same particle from different pseudo-realities and their interference. The alternative possibility is again in the most probable nature, now information. A *particle* (e.g. a photon) traveling through a *vacuum* would acquire information along the way, it would communicate with the "void" and create its past, and as the particle does not grow as a result, the vacuum grows.

Both phenomena are possible, that in the quantum world coincidences are so significant that a particle can appear in several places at once and, on the other hand, that empty space is a kind of uncertainty, i.e. information, to have the potential of communication, particle-waves and interactions. Then the size of the space speaks of its past and that past can affect the present in other ways as well. The mentioned method is the interference of past and present corresponding wave-particles.

The law of quantity conservation limits the data volume of a given system, not their internal changes. When both slits are open the path of the particle is not well-defined, there are still choices and the particle is dominated by a vacuum ripple, a communication that is a cyclical exchange of uncertainties. When one slit is closed, there is no uncertainty and the particle and its path are declared. The information is then formed and there is no room for the virtual influence of the vacuum. Computing and the screen image show the corpuscular behavior of the emission.

This description, a space that remembers and acts, is just as sufficient to explain the paradox of the double opening as the first (Everett's). As with rolling the dice (six numbers), uncertainty is always limited by options that can only be realized in information. The vacuum communicates with everything that passes through it and, therefore, has a huge potential of information. It is therefore a history of passages, a reservoir of possibilities that is constantly growing, because it always receives news from its passengers. Virtual vacuum waves are interference from those pasts, like waves on the surface of the ocean under which there is a lot of water. As geological deposits, or ourselves, after all, who we are and what we have experienced or inherited the *space remembers*.

Timeless the nature of mathematics will also support this second explanation of the "double slit" experiment. She can add it as a kind of generalization of the *Mach principle* that Einstein once advocated by reconciling the relativity of motion and the spillage of water from the basin as the vessel and liquid rotate. All the matter of the universe creates one gravitational field within which bodies can rotate, and now we only add that that field also contains the history of the universe.

Such an explanation is encouraged by the very nature of the *interference* of waves whose name is, I will note, inconsistent with the conception of the independence of random events of probability theory. At the root of the word “interfere” is an action on something, an addiction, dependence, while wave interference actually expresses their independence. Particles that attract or repel are dependent, to say not as the colors of light that we can always put together in white, and again (Newton's prism) decompose them into intact ingredients. White is dependent on its components, but its components are not interconnected.

If two random events are independent, then they are not mutually exclusive, and if they are excluded then they are dependent. This is from the probability theory[57], which, because of the form of quantum states, implies the above explanation. However, it is only the beginning of a much more interesting story about information in physics.

2.18 Piling of History

Space, time and matter are forms of information. They communicate because uncertainty is objective for them, they are compelled to do so, and because they do not have everything they need. Another important feature of information of interest to today's topic is its uniqueness.

Before we throw a coin, dice or pull a ball out of a lotto drum we have an uncertainty whose quantity increases with the number of options. What are further important to us in such random events are quantities – that before and after realization we receive exactly the same amount of uncertainty. This is the meaning of the law of conservation information and the reason for calling both of these states by the same name. Information is a particularly defined measure of data that remains constant as data (of the closed physical system) change.

There is more than one data in the uncertainty of one random event, but the outcome is only one. In addition, there will be no outcome of something that was not in the previous possibilities. When we roll a dice and each of the numbers, from one to six, has an equal chance that means that the number seven has no chance. Let's add this to the previous one as (some new) law of conservation the data itself.

Two types of uncertainty, before and after a random event, or two types of information, are called potential and current information to distinguish it. As well as generally well-chosen names in mathematics, these should be useful.

The names deliberately allude to potential and kinetic energy whose difference (kinetic minus potential) is *Lagrangian*. The energy output for a given time is called *action*, so the equivalents to the information mentioned are now potential and actual (kinetic) effects. The principle of least action (the least change of energy) thus becomes the principle of least information, which is again in line with the previous one, noting that such situations are not yet considered in physics.

[57] see the proof in my book “Quantum Mechanics”

This is how space looks from the point of view of information theory, it communicates with passing bodies, inevitably buying something from their history. It goes without saying that an elementary particle does not grow along with the growth of its past, which means that it leaves all the excess news with a vacuum (and other bodies if appropriate). The result is a constant accumulation of the history of the world in physical bodies and in space itself.

That the structure of a body, such as *geological deposits* or radioactive carbon, can sometimes give us information about itself is not some discovery, but it is that the space itself can do it too. Modern physics knows that *vacuum* has its dynamics, which it is full of virtual particles, and this is also not disputed. The originality is that the vacuum is *history store*.

Certainty has no information and repeated news is no longer informative. Repeating the same physical information is not in the interaction options. We do not communicate with literal replicas and that is why we have so many differences in the perception of the world. That is why space is growing (by the amount of uncertainty) and is never the same, and its changes offer us a hidden history.

As for the “void'', there are two major consequences of this principled uniqueness of information that it now makes sense to promote. The first is its expansion, and the second is the effect of the past of the universe on the present. Space is made up of potential information, and especially because it can be realized, and concealment and unexpectedness are its essence, as well as the action itself.

Let's take a look at how the new explanation works with the paradox of the principle of minimalism that I cited earlier as a conflict of the laws of maintaining (conservation) information and evolution towards a possibly less complex future. The same has been observed in the literature as an entropy paradox because of the reversibility of time in quantum mechanics.

Let us now add the following reasons: the overall information of the universe is constant. The eventual lack of information in a substance resulting from the principle of minimalism (it evolves into less informative) is always equal to the resulting excess of the history of the universe contained in space.

The discoveries of 20th century astronomy can confirm something more. In 1912, the American astronomer Vesto *Slipher* (1875-1969) discovered the *redshift* of distant galaxies, which was later interpreted as moving galaxies away from Earth. Consistently, we add to the (new) informatics that the temperature of these galaxies (of the same state of matter) is higher, that the heat is not the same as the kinetic energy (not increased by departure), so we get a smaller number for the Clausius *entropy* (quotient of heat and temperature). Since light from distant galaxies has traveled a long way, entropy in the past is less and this is consistent with the second law of thermodynamics – that entropy increases.

Russian mathematician and physicist Alexander *Friedmann* (1888-1925) in 1922 derived from Einstein's field equations theoretical proof of the expansion of the universe. Independently of it, a Belgian Catholic priest and professor of astronomy and physics Georges *Lemaître* (1894-1966) came to similar conclusions in 1927, and American astronomer Edwin *Hubble* (1889-1953) confirmed his theoretical results two years later with telescope observations.

According to the cosmological principle, the observation that the spatial distribution of the matter of the universe is homogeneous and isotropic, viewed on a large enough scale, concluded that the galaxies are moving away from each other. Roughly speaking, they are like stains on a balloon we inflate. This conclusion is consistent with the above findings if we accept that the accumulation of history in space is manifested by the expansion of the universe.

Moreover, from a constant increase per unit volume, we can also deduce the acceleration of this expansion of the universe, and thus be included in the latest discoveries in astronomy and theorizing about *dark energy*. Within the same hypotheses would be the consideration of *dark matter* as the gravitational action of the aforementioned past to the present, if comparisons of the movements of galaxies today and the concentration of their matter would meet some expectations.

But, from the point of view of diversity of information, it would seem strange that this is all that lies in “dark energy'' and “dark matter'', even if part of this theory is fact.

2.19 Classical Force

The concept of classical force in today's physics is in crisis. This crisis began with the theory of relativity and was still only developing, but it jet did not reach the level of the former (al) chemistry of the popular *phlogiston*, which was eventually put to rest by French chemist Antoine *Lavoisier* (1743-1794) and English chemist Joseph *Priestley* (1733-1804) through their research and discovery of oxygen.

That is why I do not base the information on the determinants of classical force, because every time I tried it something wasn't good – I say in answer to a reader’s question.

First of all, the definitions of the *force* that give acceleration to the mass and those that change the momentum give different values over time in the special theory of relativity, which were the same in classical physics. This is because the relative time, mass, and momentum of the body in motion relative to the observer at rest are so transformed that the two determinants of force do not agree.

I will explain this briefly without many formulas, except you should know that by increasing the velocity of the *inertial system* the relative units of time elongate, mass and energy grow, and also the momentum in the direction of motion, all in proportion to a coefficient called Lorentz and denoted by the Greek γ, the letter *gamma*. It is a number that grows from one to infinite when the speed rises from zero to speed of light. Inversely proportional to the coefficient the relative lengths are shortened.

Acceleration is the distance traveled in unit time by time, so acceleration in the direction of relative motion decreases in proportion to the third degree of the gamma (inversely proportional to the cube of that coefficient). Mass increases, so the force as a product of mass and acceleration (in the direction of motion) decreases with the square of the gamma. The calculations are longer, and this is just a sketch of the results.

In other words, the proper (own) observer of the moving system, which is stationary in that system and would notice uniform acceleration of its system with a constant thrust force, would be seen from the relative as he is losing of the force and even more losing on the acceleration. The acceleration drop is such that he could never reach the speed of light. Conversely, if it is externally seen his constant acceleration, the force and acceleration felt by the proper observer would have to grow to infinity.

The relative momentum of the body in the direction of motion grows in the same proportion as the elongation of units of time (slowing down of time), so the change of momentum in the unit of time remains the same for both, the relative and the proper observers. This means that the relative change of force, as the change of momentum over a given time, conflicts with the previous definition (force that accelerates mass). When you look for Lorenz's transformation of force, a special theory of relativity, in physics textbooks, you come across this term – that the relative force in the direction of motion equals the proper.

Interestingly, the lateral force by both definitions gives the same result. Namely, there is no relativistic contraction of lengths perpendicular to the direction of motion, so the calculation gives a decrease in the relative force proportional to the (reciprocal value) of the gamma coefficient. This is in line with the paradox of two trains I wrote about explaining Bernoulli's equation according to which fluid moves the surrounding matter with motion. All the same, partial agreement is a disagreement.

The exact sciences, and especially mathematics, believe only in those truths from which infinitely deductions can be made, with always exactly the same correct consequences, and none of the classical definitions of force fulfills this criterion. Unlike classical force, for now, the principle of least action and the corresponding principle of information work well in all circumstances, which is why I exploit them so much.

According to the principles, the most probable events are most often realized, whatever the circumstances, so force should be defined as something that defies spontaneity. Force, then, is something that changes the likelihood, that in new circumstances the most common realizations would change their choices, that is, something that transforms greater information into lesser. In game theory, they would say that force turns information into misinformation, and then beyond that – to make a weaker the chance of winning better.

These are sufficient reasons why the classical concept of force should be changed by the principle of least action, that is, information, and so I do – I add in the end to the correspondence mentioned.

2.20 Fourier Deriving

One of the greatest French mathematicians, Joseph *Fourier* (1768-1830), was the son of a tailor and an orphan of eight years. He began his education at the monastery, then at the military school, and reached to be a student at the French High School with the famous professors Laplace and Lagrange to obtain the chair of mathematics at the Polytechnic School in 1797.

Fourier was a participant in the French Revolution, a follower of Napoleon in Egypt (1798), a senior diplomat, secretary of the Egyptian Institute, since 1817 a member of the Académie des sciences, in 1826 a member of the French Academy (Académie française) interesting for the discovery of the after him named series.

He observed that trigonometric functions and sinusoids in particular behave analogously to waves. They are summed up accurately by simulating wave interference, and with enough corresponding sines in the sum they can mimic almost any analytical function. This universal substitution by the sum of *sine functions* may have given Louis de Broglie idea much later that in 1924 to come up with the hypothesis of *waves of matter*, but even if it is not the significance of Fourier analysis for quantum mechanics would prove enormous.

It is known that we can properly stretch the wire so that it is excited by the *standing waves*, stilling at some points, the nodes, between which it oscillates. Fourier mathematics adds and translates such waves as desired, forms pre-desired shapes and imitates every kind of trajectory of physical particles. His theorems prove that in mathematics there are no obstacles to the assumption of the wave structure of matter.

Establishing *bijections* (mutually one-to-one mappings) between matter and action, interaction and communication, we find that Fourier's development functions into sine series are equally valid to the (physical) information. Each vibration has a period, the reciprocal of it is *frequency*, and this can be associated with *energy*, momentum, and action. We note that the titration is both a data and a material phenomenon, and a deeper reason that the Schrödinger equation (1926) mimics information as well as material quantum phenomena, so let's return to the past.

Fourier's discovery was later repeatedly refined and generalized to others, today we know of any fragments of arbitrary function to make “any interference'' with almost any desired shape. In other words, mathematics allows elementary bits of particle trajectories of all shapes to be formless. This is a guarantee of the non-contradictory nature of today's microcosm-based microcosm-uncertainties of the quantum physics. And uncertainty indicates the informational origin of matter.

Moreover, both wave functions and individual “freedoms'', the summands of information of perception, which is a scalar product of the vector of intelligence and hierarchy, can be properly regarded as complex numbers. Therefore, it is possible to treat the logarithms of the exponents of these complex numbers as good surrogates of physical information and then obtain periodicity similar to particles (logarithms of complex numbers are periodic functions). Again it is mathematics that allows such views; it proves their universality and contradiction. However, with these familiar views it is not the end of the use of the Fourier method.

The hand in hand with it goes the allocation of energy to frequency, and it to information and vice versa, then the establishment of equivalences among other physical quantities with information, for example by waves. It is a detail from the general abstract connections between truth and matter, from the known to the physics as yet undiscovered. They should be distinguished from the hypothetical duality of matter and force, the idea of the *supersymmetry* theory in which is still the possibility that force and matter are not equally well-founded physical concepts.

The more familiar duality is the already elaborated, but still intuitively incomprehensible, physical resemblance of vectors and quantum mechanics operators. It leads to the duality of quantum states and processes with some of the strangest phenomena of theoretical physics that have been extensively vetted and used during the second half of the 20th century, but which are difficult to talk about.

Simply put, the basic concepts of quantum mechanics such as energy, momentum, or position, in addition to their classical physical values, which are expressed in techniques well known to systems of units based on pounds, meters, and seconds, have their dual forms in differential and other operators of mathematical analysis. These operators formally behave as physical quantities themselves, although they represent their evolutions.

To experts in mathematical analysis, this duality between the operator and the magnitude in quantum mechanics is a “normal” occurrence, but even the best routinely working missed promoting the development of research by Joseph Fourier, the French mathematician named after the University of Grenoble. It is today a major scientific center, especially in the fields of physics, information science and applied mathematics.

2.21 Law of Large Numbers

The *law of large numbers* of probability theory is another confirmation of the principle of information minimalism. When we want more and get less, it said. Here are the basic ones.

The Italian mathematician Gerolamo *Cardano* (1501–1576) stated that the accuracy of the statistical findings improved with the number of attempts. However, the Law of Large Numbers (LLN) was first proved by the Swiss mathematician *Bernoulli* (Jacob Bernoulli: Ars Conjectandi, 1713) for binary random variables who named it *golden theorem*, later named after him. His discovery *Poisson*[58] described in detail in a book of the same name (La loi des grands nombres, 1837), followed by considerable research into the subject by *Chebyshev*[59], *Markov*[60], *Borel*[61], *Cantelli*[62], *Kolmogorov*[63], and *Khinchin*[64].

When we throw a fair coin, the chances of a tail or head falling are exactly half-half, but that does not mean that every ten throws will drop exactly five times the tails and five times the heads. In addition to the mathematical *expectation*, the mean, the estimate of the average deviation from the expected outcome is also important. This scatter around the expected value is usually measured by the so-called *dispersion*. Expectation and dispersion define mainly all of the interesting properties of the probability distribution of a random event, at least as far as mathematics is concerned.

Let's imagine some random event, an experiment, a trial, like throwing (can unfair) dice. Each of the outcomes has its own probability, a real number from zero to one, so the sum of all into one means that surely something will happen. The chances of a particular outcome can also be expressed by the percentage of its occurrence in a long series of repetitions of a trial, or by a coefficient, a quotient of the

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[58] Siméon Denis Poisson 1781-1840, French mathematician, engineer and physicist.
[59] Pafnuty Chebyshev 1821-1894, Russian mathematician.
[60] Andrey Markov 1856-1922, Russian mathematician.
[61] Émile Borel 1871-1956, French mathematician.
[62] Francesco Paolo Cantelli 1875-1966, Italian mathematician.
[63] Andrey Kolmogorov 1903-1987, Russian mathematician.
[64] Aleksandr Khinchin 1894-1959, Russian mathematician.

number of a given outcomes and all repetitions of the trial. The sum of all percentages is one hundred, and the sum of all quotients is one.

The sum of all (realized) outcomes is exactly equal to the number of trials, as is the sum of their mathematical expectations. Therefore, for each outcome, the difference in the number of realizations and expectations divided by the total number of trials tends to zero as the number of trials increases. These differences, deviations from the mean, are limited by dispersions, so that with an increasing number of options, the cumulative scattering of differences increases more slowly than the total number of trials. In other words, when the number of trials increases, the sum of all differences divided by the number of trials tends to zero.

It is, in short, a sketch of the “exact in the nebulosity of coincidence ” that brings us to the law of large numbers in mathematics, which is why this law is a theorem. This implies that trials are independent: after ten tosses of a coin and after the tails falls in all ten cases, again the probability of a tail in the next throw is the same as at the beginning. On the other hand, when properly understood and used, LLN enables long-term forecasts in the insurance business, in eliminating random side factors in medicine, in reducing errors by repeating measurements.

The most famous application of LLN within the theory of probability is to reduce the Bernoulli distribution to the *Gaussian bell*. The first is the binomial distribution that we get, for example, by tossing a coin a hundred times and counting down the tails. It is more likely to be 40 tails than 30, but any number of outcomes of a tail, from one hundred to zero, has a chance. The list of probabilities of these numbers is a distribution. We can test it by throwing all one hundred coins at once or repeatedly throwing one coin one hundred times.

The law of large numbers then says that the mean values of outcomes by multiple repetitions of one hundred throws are increasingly grouped around (precisely defined) probabilities, speaking even of steps, the degree of that approximation. When, along the horizontal axis (abscissa) we place the markings of event numbers, tails in a hundred coin tosses, and their heights (ordinates) mean numbers of all realizations, we get a bell-shaped graph, the Gaussian probability distribution.

Strangely enough, but no stranger to the fact it is almost impossible for us to dictate a series of “random” numbers that would pass the randomness test. Randomness tests exist and are based on LLN, simply said, on calculated expectations and mean deviations from expectations. It's not easy to control by heart, so guessing the numbers around the Gaussian bell is probably at least a little, but statistically significant, missed from the curve shape of the graph. Intuition falls on those tests as early as guessing the relationship of, say, 40 tails per hundred throwing a coin against 30 tails per hundred, not to mention the amount of deviation of expectation in a thousand repetitions per hundred throws.

Our problem with random tests is that they are a matter of mathematics, and intuition is naive for such precision. This is why we use random tests to control gambling fraud. They respond to almost all “wise” attempts to mimic “natural coincidence” thanks to our underestimation of the law of chance or the inability to defeat it. By reducing the binomial distribution in the crowd to bell-shaped, they are the consequence of a decrease in uncertainty by increasing the volume of experiments, and this is again part of the general principle of skimping emissions of actual information from potential.

To show that there are similar topics I demonstrate by a contradiction. By collecting various uncertainties to increase the possibility of an outcome, a creature might want to have all the potential outcomes. Desiring maximum freedom of action, precisely because of the law of large numbers, it would then be maximally deterministically driven and completely illiberal.

2.22 Quantum Calculus

The classic computer is based on mathematical logic, information theory, and electrical current technologies.

From the ancient Greeks we know of absolutely correct statements, and lately we are able to “calculate'' them. Then there is the discovery that “true'' and “false'' can be replaced by binary digits — 1 and 0 — bits of information, and then with technical solutions “electricity is flowing'' and “no electricity is flowing''. Thus, microchips have become the brains of computers made of densely integrated circuits that simulate the operations of algebra logic.

Along with these developments, quantum physics also evolved during the 20th century. It is also based on mathematics, but vector algebra. Vectors are quantum states, that is, superposition of possibilities, which we can call probability distributions. The phenomena of physics to which the laws of conservation apply are symmetric (Emmy Noether theorem) and quantified (because finite sets cannot be their proper subsets unlike infinite ones), and so are physical information. That is why information can travel almost without loss and is always discreet.

From the point of view of stinginess in principle, the losses will be even smaller if we transmit them in the form of uncertainty, as unexplained outcomes that dominate the microcosm. These are the vectors, the arrays that define the probabilities of realizing certain possibilities of quantum states, which are always particles because of the finite divisibility of information.

From mathematical views, the proofs, to legal paragraphs and political statements, all forms of communication are in portions, in steps, and such are the processing of information in computers, classical and quantum. On the other hand, because they are distributions, the vectors of quantum states are unit norms (lengths), and then so are the operators that map them (unitary).

The symmetry of quantum processes means some stability, the change in state similar (inherent, in eigenvector), but also reversibility, a feature that does not lose the previous information by copying. The most famous quantum operators are the Hadamard and Pauli matrices, and the search for their concrete representations becomes the daily work of many physicists in the world.

So, instead of classic electric circuits for the flow of individual bits, the quantum processor contains quantum gates. They usually map two-component vectors, the qubits of the information, and because physical information is always the true thing (it can't happen that could be proved it can't happen) and because of preferring uncertainty over declaring, it's a more natural way. Another story is the energy consumption.

Changing uncertainty into certainty, the emission of active information from the passive is some action (the product of a change in energy by elapsed time). Hence, I derive the principle of least action known in physics, which now stems from the principle of minimalism (information), which again comes from the knowledge that more likely events are less informative and therefore more frequent.

In 1961 Landauer noticed almost the same. He emphasized that the cancellation of information is a wasteful process, because deleting a record in a molecule at some thermodynamic position will change the entropy of the schedule. If the process takes place at a given temperature, the product of temperature and entropy change is work, so Landauer concluded that to change the information someone has to pay an energy bill.

We can see from the following two examples that the energy calculus of quantum computers can be far more expensive than classic computers.

Let's imagine for us a “black box'' that transforms each of two signals, 1 or 0, into one of those two signals. A classic computer will find out what the “box'' does with two passes, separately mapping by “box'' the zero then one. However, one copy is sufficient for a quantum, because it does not copy bit by bit, but qubit (both bits at a time). Well, there is no difference, you would say if there is none the next example.

To examine a more complex “black box'' with a hundred input qubits that make up a hundred multiples of two bit variations, which is a decimal number written at about 30 digits, would take billions of years for a classic computer, even if it took only a millionth of a second for a pass. A quantum computer would do the job in a moment, in just a hundred passes.

Anything that a quantum computer can calculate cans the classic too, if it has enough time and memory. What used to be electronic lamps, transistors, and integral circuits was this formality, which is further modified by the representations of the Hadamard gate, Pauli matrices, and other recent from quantum physics theory and practice. We get the familiar but with daunting differences in capabilities, with fantastic benefits and new challenges.

The energy bill is as many times as the temperature at which the process takes place, so quantum computers need to be cooled to absolute zero. Low temperature in contrast to the environment enhances the effect of the principle of information and, therefore, reduces the noise of the environment, but cooling costs and the pan becomes more expensive when asked the cheaper pie.

There are also differences in the type of results. Quantum computing is no longer a clear deterministic process, it is a mapping of superposition of options, the probability distributions, so repetition will not produce the same results but similar even when the law of large numbers makes the quantum calculus very “exact'' in those most complicated situations for which it is made.

2.23 EPR Paradox

After confirming the theories of relativity, in the time of the transition to theories with gradual advance of distance, the *locality*, in 1935 the joint scientific work of Einstein, Podolsky and Rosen[65] on the question of completeness of quantum-mechanical description of physical reality appeared.

This work is considered to be the discovery of *non-locality* in the process of wave packet reduction, initially only as the *EPR paradox*, but by the time and physics of *quantum entanglement* too.

The first two of only four pages of the EPR text discuss the impossibility of simultaneously determining the momentum and position of a particle. In the structure of quantum mechanics is Hilbert's abstract algebra. Quantum states (particles) are vectors, quantum states evolutions, interactions, and measurements are linear unitary operators. The multiplication of states by the operator is the change of state, and the multiplication of evolution by the operator is the change of evolution. Unlike ordinary numbers, these multiplications are not always commutative (they depend on the order) and this is the first problem.

That quantum mechanics is a representation of the aforementioned abstract algebra was noticed earlier – the non-commutativity of the operator was also known – but it was not until after *Heisenberg* and 1927 that physical meaning was sought in this. His proposition is *uncertainty relations* that have a classical algebraic and informatics sense.

In order to locate the electron as accurately as possible, light is used as short wavelength as possible. But such has higher energy and in the collision increases the unpredictability of the electron momentum. Using his "thought microscope'' and his previous knowledge of physics, Heisenberg discovered that the product of the indefiniteness of the position and momentum of a particle is, at best, of the order of magnitude of the Planck constant, a quantum of action.

The meaning of the Heisenberg discovery in the algebra of linear noncommutative operators was quickly noticed. The difference between the action of the first and second operators and the second and the first on the quantum state of the order is the magnitude of the quantum of action, and this algebraic result is called the *uncertainty principle*.

Specifically, the position operator changes the position of the electron and sets values differently from those that would be created by changing the momentum (mass and velocity) by the action of the momentum operator precisely because the two operators are algebraically dependent. The action of one influence the action of the other and the importance of the order of application (multiplication) of the position and momentum operators becomes the dependence of the physical quantities interpreted.

When operators represent dependent events, the first changes the domain of the second, producing a different range of finite consequences than when the first distorts the domain of the first. The difference between the outcomes of these successive actions is, at best, a quantum of action, further

[65] Einstein, A; B Podolsky; N Rosen (1935-05-15). "Can Quantum-Mechanical Description of Physical Reality be Considered Complete?''

adding we can say the least possible transfer of information. However, when we say that operators represent independent events, it means that they do not mutually usurp each other's domains, so it doesn't matter which one acts first.

Therefore, quantum entanglement, or reduction of the quantum properties, has an equivalent in the non-commutativity of the operators representing them. The following is the IT sense.

Dependent quantities are coupled and measurement is the interaction of particles and apparatus, their communication. The uncertainty relations tell us that by subtracting the position uncertainty, the particle momentum uncertainty increases, that is, the increase in the active information of one property is accompanied by a decrease in the other, with the products being constant. We understand this directly as the conservation (amount) of relevant information of the object itself but also of its “perception'' by the measuring devices.

I will add, because of the law of conservation, we have a finite divisibility of (any) information, its appearance and perception in limited portions, so in order to increase say the resolution of the image in pixels in some restricted medium then we need to reduce the frame rate and make the motion unclear. I have written about it before, but not as here with an emphasis on the coherence, interdependence of phenomena, both as in the object itself so in its perception.

The following APR text on the next two pages discusses an analogous slightly more complex situation. Two systems (particles) that interact after which there is no communication between them are observed, but the first system (only the first one) is measured. The interaction is “wave packet reduction'' or “quantum entanglement''. Then we make measurements on the first system, and the algebra of quantum mechanics shows the changes of the second system as well!

The paradox comes from the timeless nature of formulas, because the other system can be very remote. Einstein called the effect “a phantom action at a distance'' and to keep the absurd from being abstract, he came up with an example with gloves. A *pair of gloves* was placed in two separate boxes, very separate. Opening one and knowing that it is, say, the left one, at the same time we find out that in the far other box is the right glove before the light could come to inform us about it.

To overcome the EPR paradox, at one time, the most serious suggestion was to look for *hidden parameters*. Quantum mechanics is assumed by incomplete, the very principle of uncertainty is attacked (good God does not gamble – Einstein). It also struck at the very algebraic settings of quantum mechanics, if mathematics itself could not be doubted. The public was triggered by bombastic headlines in newspapers like “Einstein destroys quantum mechanics,'' but the whole thing was quickly forgotten. It was not considered scientifically serious.

Three decades later, the Irish physicist John Stewart Bell (1928-1990) found the contradiction[66] in the proposition of “hidden parameters'': that the difficulties of this paradox can be resolved by variables added to quantum mechanics. They would restore quantum mechanics causality (randomness) and

[66] J. Bell: “On the Einstein Podolsky Rosen paradox'' Physics 1 \#3, 195 (1964)

locality (gradual action), but his theorem proved the incompatibility of such an idea with the statistical character of quantum mechanics. The work went unnoticed.

The turning point in today's great and growing interest of physicists in quantum entanglement was the French Experiments (1976), a kind of new shock. Much to the surprise of confused authors who experimented to challenge Bell's theorem, they confirmed the “phantom'' consequences of quantum reduction. They have opened a new chapter of physics, which is a special topic for us.

2.24 Entropy Generalization

Questions, suspicions and interpretations of “principled minimalism of information emission'' continue to be addressed. Moreover, they seem to grow with the reinforcement of the theory.

Few today criticize the law of information conservation, and its “shyness'' holds good too, even my explanation of thermodynamics, but some generalizations of entropy seem to be waiting for better times.

Let's say that *imperialization* and *feminization* of society are part of the broader aforementioned principle, along with speculation about the growth of the ability to absorb different nations with the former and decline with the latter. I'll explain.

The term *entropy* (Greek: turn inwards) was introduced as a term in 1865 by the German physicist and mathematician Rudolf Clausius, who considered it a measure of the energy of a closed system of a heat engine that could no longer be converted into work. For him it was just an abbreviation of calculations, a quotient of heat (energy) and temperature. He found that in the circular process, the entropy increase was proportional to the heat loss and inversely proportional to the temperature.

In the *Shannon* definition (1948) the Clausius fraction became a measure of lost information. There are more spread and uniform than thick arrangements of balls in the boxes, and so the air molecules in the room expand. Entropy is the logarithm of the number of schedules, and probability is their reciprocal value. The logarithmic definition of entropy is the *Boltzmann's* in 1897, initially not accepted because of his idea about atoms or *molecules* of gas. Entropy thus means dispersal and a measure of disorder.

My considerations begin with these definitions. Set forth, I enclose to them the law of conservation of information and its minimalism, and this somewhat changes the essence. Theories are known to make sense to the fact, which here comes with the environment of a heat engine that stores overall information.

The oscillation of the room molecules is transferred to the colder outer walls. The *heat* and *temperature* go out, the oscillation weakens and the entropy increased. As entropy is a quotient of heat and temperature, the temperature decreases faster, so we conclude that the oscillation of molecules is more important to temperature than to heat. Both are spontaneously decreasing inside, and the transfer of heat from the body higher to the adjacent body of lower temperature (note: from less to greater entropy) is called the second law of thermodynamics. The first is the law of energy conservation.

Information goes away with heat, and it's okay to say that increasing entropy is proportional to losing information. This is also consistent with the interpretation of information by *action* (the product of energy and duration, or momentum and length). As the temperature decreases, the vibrancy of the molecule decreases, which we understand here in proportion to the ability to emit information. The alleged resulting *disorder* is proportional to the lack of heat, and what remains is an amorphous state of uniform distributions, of the most numerous combinations, and therefore most likely and least informative.

The principles of information are above the parts of the physics and laws of thermodynamics. In this broader concept, entropy is also explained by the law of *inertia*: the body does not spontaneously transit from the rest to motion, because the relative entropy in motion is less than its own (proper)!

Hence *gravity* decreases entropy (many disagree with this my statement), so the body accelerates towards a stronger field to maintain entropy. In particular, falling off the glass from the table and breaking it is an irreversible process, because the entropy of the stopped glass increases (the molecules break apart). The information of the glass goes partly to the substrate and very small to the space itself. The actions are exchanged.

Conversely, if a glass at rest is hit by a moving object and broken, the object and the glass interact. There is no collision without changing the amount of movement, the momentum. The object slows down, and the pieces of the glass get speedily relaying information, the entropy of both bodies grows.

Information is not only a mere constituent of a substance, but also of life. The pursuit of inaction, inertia, is a form of principled shyness of information, self-directed, weak and persistent universal force. A *living being* with excess is information (and action) created by parsimonious, which is then diluted for the same principle. Loss of information is a loss of choice and action.

For quantum states, reducing individual options comes with entanglement (fidelity), for an individual in a society with denser regulations, but in any case, reducing information means greater causality and dependency, and decreasing both risk and aggression. Psychologically or economically, we see it as an increase in safety or efficiency.

In general, I call the processes with spontaneous growth of generalized entropy inherent in every form of living matter (as well as in inanimate) “feminizations'', and opposite and slightly less frequent aspirations as “imperializations''.

An empire is, by the classical political definition, a unit that brings together multiple peoples under one authority, and in the abstract it would be an information system with an excess of imposition in external uncertainties, risks, initiatives, aggression. Imperial and feminized societies come in two opposite directions of the “options quantity'', outward and inward, as two formal, ubiquitous and dual, but somewhat asymmetrical phenomena.

Thus, the empire is aggressive towards the outside world, in its presence, the outsiders “spontaneously'' divide. Feminized society, on the contrary, governs itself and favors internal hardship; by editing it strives for uniformity, the consideration of equalizing everything, and when that is not possible, sorting and dividing. Two processes, imperialization and feminization, such as the storm at sea and the appeasement of one another overpower but never give up.

From our side looking, the nature, in the conflict of its opposites looks as it does not know where to go, it would not be with the uncertainty, and without it it cannot. Indeterminacy is its essence, but it chooses more likely outcomes. Without unpredictability there is no need for communication, we would have everything from the beginning, but the differences are so great that there are too many of them to the nature itself.

2.25 Entanglement

Quantum entanglement becomes the new “gold mine'' of physics. It is a magnet for geniuses eager to prove themselves, for the prestige of the institute; the armies have their expectations, because it is more generous for discoveries than even tapping CERN on a “standard model'' of particles.

Two physical phenomena are said to be coupled (entangled) when a change on one causes a change on the other. They may thus be altered by the law of conservation, the principle of least action, or some third necessity. The best known are the couplings with spin (internal angular momentum), but there are also Heisenberg uncertainties of momentum and position of one particle, as well as unknown virtual actions. My (hypo) thesis is that they are generalized by “ability'' with “restriction'' in “freedom'' and the rest that follows from *perception information*.

Suppose we have a series of events where on each we can define pairs of sizes, called “abilities'' and “constraints''. The product (multiply) of the respective couple (same event) is “freedom''. The sum of all the “freedoms'' of the physical system, its total freedom, is accompanied by information of perception. That part is formally undisputed and it would be hard to break it down in physics.

Vectors are basically arrays, in one case called “intelligence'' and in the other “hierarchy''. They are with the same number of members – *dimension of vector*, which in pairs defines the same events – the first “ability'' and the second “constraint''.

However, in whatever dimensional coordinate system (observables) they are defined, two different vectors determine exactly one plane. They can always be reduced to a 2-dim coordinate system, so information of perception has the two dimensions. It is one of the more recent views.

Quantum states are representations of vectors of Hilbert space, and their scalar products tell us about quantum entanglement. This can be generalized in part to the macro world. In the case of a simple physical substance, the scalar product is the total *freedom*. It also follows the principles of conservation, minimalism and the action of information, the most acceptable of which is the first. Coupled vectors are aligned; they are dependent random events and are monitored like electrons in an electromagnetic field, manufacturer and market, or grass and soil. And the occurrences of certainty are predictable even before the announcement.

For now, the typical “bound'' situation of quantum mechanics is the emission of particles of the known *spin*. The spin is governed by the law of conservation and is easily registered by magnetic devices or polarization. If the total spin of the coupling is zero and two similar particles are emitted, they go in two opposite directions to maintain (conserve) the total momentum, with the total spin zero. When the emissions are two electrons and the first spin is +½, then the spin of the second is -½. If these are two photons, the two spins are +1 and -1.

What can be weird here? When only one particle is registered, its positive and negative spin appears as random sizes. It is a matter checked by the measurements and laws of probability theory. But after registering a (random) first spin, spin of the second particle is no longer a random event, otherwise it would violate the law of conservation! However the second particle is distant from the first, and the time between the two measurements is short-lived, the spin of the second is always opposite to the first. It would be hard for experimental physics to notice this if the algebra of quantum mechanics did not impose it.

In the now famous, but on the time unnoticed the work on the APR paradox[67], of Northern Irish physicist John *Bell* in 1964 considered the entanglements theoretically. I will not bother you with his calculations, which, incidentally, few understand today, but will just recount them. He assigned parameters to quantum states, either as a series of numbers or arrays of vectors, and found a contradiction. He proved that the assumption of missing variables in quantum mechanics algebra is inadmissible.

Knowing that the attempt to complete quantum mechanics to avoid the EPR paradox could not be reconciled with the stochastic nature of the micro world or with the previously tested the Born rule (probability of quantum measurements), Bell applied his analysis to other congregations with the same result. It was take or leave, all or nothing, and previous experiments had already confirmed the quantum theory extremely well. This unpleasant situation has long been ignored by physicists.

After more than a decade, the Americans and French were the first to experiment with Bell's findings and, as we know, the *entanglement paradox* became a physical reality. New physics has accepted experiments with instantaneous action at a distance and the absurd Bell's theorem that without coincidence there is no necessity and vice versa. To put it mildly, physics began with the belief that there was a conjunction, the interplay of the probabilistic nature of quantum mechanics and the law of conservation.

Further discoveries are additional surprises. When we act at one end of a pair of coupled quantum systems and thus achieve an “out of nowhere'' appearance at the other far end, we produce a non-local effect similar to the transmission of information, that is, *quantum teleportation*. If we have digested this, then what to say about the alleged discovery of the “action of the present on the past'', reported by the University of Vienna (2012)? This may be the *retrocausality* like the action of a virtual photon on a starting electron only after the action of the photon on another electron (that I wrote about earlier) has taken place.

[67] J. Bell: “On the Einstein Podolsky Rosen paradox'' Physics 1 \#3, 195 (1964)

If the past is an accumulation of the present information, then retro causality (process towards the past) could be related to causality (process towards the future). This is what the unitary operators (evolution) of quantum mechanics tell us, inevitable and in the program of perception information too.

2.26 Dirichlet's Principle

When a flock of pigeons arrives at the openings of the pigeon houses, and if there are more pigeons than the openings, then at least two pigeons will arrive into at least one opening. This is the original version of the *Dirichlet*[68] principle[69], who used this idea in some problems in number theory, later called the *pigeonhole principle*.

When we have 11 objects arranged in ten boxes, then at least one box will contain at least two objects, or in each set of three natural numbers at least two have the same parity. From these obvious examples of application of the principle, the less obvious ones are quickly reached: in every group of 13 people there are two people born in the same month, in a group of 3,000 people at least nine celebrate their birthday on the same day, in a class with 35 students and 15 computers there is a computer with at least three students seated. In any gathering, with any number of persons, there are at least two persons with the same number of acquaintances.

Dirichlet's principle, of course, also applies in the same algebra whose representation is quantum mechanics. That's why the bombastic headlines are that quantum physics breaks this principle, in some popular scientific journals; in others it says that it bypasses it in its own way. Ming *Cheng's* recent experiment with nine other Chinese authors[70] passes three photons through two polarizing filters, vertical and horizontal, avoiding the “pigeon principle''.

When the filters detect the photon leakage, then there is no violation of the principles, but there are if the measurements are made only subsequently by diffraction of the photon at the output. The phenomenon is irresistibly reminiscent of the famous experiment *double-slit* when detecting on a slit before, eliminates diffraction, because that communication “consumes'' information, and therefore energy. This is a reason not mentioned in the studies because for the information has not yet been officially acknowledged (not recognized) as the action.

For now, it is enough to know that in the micro-world appearances are easier transformed undefined. We write quantum states as superposition in probability distributions and say, for example, that a photon with a probability of 0.6 is vertically polarized and with a probability of 0.4 horizontally. The collapse of possibilities into one outcome is a measurement and continuation with and without collapse is not the same process, so maintaining flows spontaneously without aggressive interactions and declarations is opportunity to “defraud'' the Dirichlet principle.

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[68] Peter Gustav Lejeune Dirichlet (1805-1859), German mathematician.

[69] In mathematics, and particularly in potential theory, Dirichlet's principle is also the assumption that the minimizer of certain energy functional is a solution to Poisson's equation.

[70] Ming-Cheng Chen, Chang Liu, Yi-Han Luo, He-Liang Huang, Bi-Ying Wang, Xi-Lin Wang, Li Li, Nai-Le Liu, Chao-Yang Lu, and Jian-Wei Pan: *Experimental demonstration of quantum pigeonhole paradox*; PNAS January 29, 2019 116 (5) 1549-1552; first published January 11, 2019.

Yakir *Aharonov*, with five other authors, three years before the Chinese, published a similar study[71]. A summary of their work states: We find cases where three quantum particles are placed in two boxes without two particles being placed in the same box. Furthermore, we show that the above *quantum pigeons principle* is only one of the related quantum effects, and we point to a very interesting structure of quantum mechanics that has gone unnoticed so far. Our result sheds new light on the very concepts of separability and correlation in quantum mechanics and on the nature of interactions. It also represents a new role for *entanglement*, complementary to the usual one.

They considered three particles and two boxes. I skip the record of the quantum state vector, but we understand that any two of the three particles can have some positive probability of finding in the same box. They further show that there are times when there is no chance of the two particles being together. They define orthogonal states, so there is a Hermitian operator whose eigenvalues (observables) are particles. The result is three particles (quantum states) in two boxes, but so there is at most one in each box!

Their analysis reveals significant differences in the observation of particles separately and together, further distinguishing between measurements in general (the quantum system on which more powerful interactions are performed) and non-measurements. The described differences, before and after separation, are always there as an integral part of quantum mechanics, they are attached, and each time we make a series of measurements we can divide the original set into several different, before and after selected subsets, according to the result of the final measurement and at each such we may notice a similar effect to the subset – that each division costs.

Finally, they conclude, general measurement is the measurement of a (unitary) operator with coupled (entangled) eigenvalues (observables), and it requires either particles in interaction or the consumption of some resources. The quantum effect of pigeons is, therefore, an example of a new aspect of quantum cohesion: measurement requires connectivity to produce correlations that otherwise exist in the immediate state.

I recall that the conjunction (entanglement) state of two quantum systems (particles) is represented by their scalar product. This product expresses the likelihood of interactions, compliance and dependence, so if the higher the greater the response of one condition to another, better monitoring without communication (emissions of information) and easier “under-the-radar'' push-ups.

Said explanation is my informatics. We note that it clarifies the above descriptions even in the case of measurement differences on the sets of particles before and after separation. Better coupling results in reduced emission of information, such as connective tissue like electrons in an atom, in competitors in a *Nash equilibrium* (in which abandoning the initial strategy would endanger the player) or *living beings* (with more information than the physical substance possess) adapted to their environment. Behind all these phenomena is the universal tendency to reduce the emission of information.

[71] Yakir Aharonov, Fabrizio Colombo, Sandu Popescu, Irene Sabadini, Daniele C. Struppa, and Jeff Tollaksen: *Quantum violation of the pigeonhole principle and the nature of quantum correlations*; PNAS January 19, 2016 113 (3) 532-535; first published January 4, 2016.

Additional freedom is needed for an individual to leave the collective, or additional risk is needed for a player to exit a good position, analogous to the external energy required by an electron to leave the atom. This brings us back to the above idea that on the “double-slit'' can pass more information or energy[72] anonymously, similar to the aforementioned photon effect of the Chinese.

2.27 Cicle of Universe

I understood the uncertainty of information and its principled minimalism as well as the contribution of the information theory to Darwin's evolution, an anonymous reader tells me, and asks if I can somehow explain the *universe development* on the same way? The parts of the answers that I single out are speculative, but they are interesting and instructive.

General skimping by communication is a persistent and weak “force'' of the universe. Hence, comes the assumption that the young universe may have been (almost all) of the resultant, some highly unwanted information. Let's call it a substance. This idea is at first glance in stark contrast to the prevailing big bang theory today, but only at first glance.

At the beginning of the universe, there was minimally passive information, such as space and say tolerant bosons (some of them are force field carriers), but just as much action (product of momentum with length) as later. Due to the law of conservation action and the possibility of “melting” the effective information into potential, the space is grown. The losses of the first are gain for the second. This is consistent with the nature of the information and the assumption that *space remembers*. We would talk more physically about a fluid whose expansion is the *gravitational repulsion* of a substance, and about the *negative mass*.

There is no information without uncertainty. We communicate because we don't have everything, and because of that, repeated “news” is no longer news. Also, from moment to moment, the universe is re-emerging, mostly the most probable, which is in relation to the previous state, so the consequence of this kind of informatics is *chronological continuity* and consistency. This consistency is equal to the law of inertia, or the thesis that some (new) law of conservation also applies to probability, but we will not talk about them now.

If both the action and the momentum with the loss of the substance remain constant, then the phenomena as in the theory of relativity could occur. The relative mass and energy of the body increase, wavelengths increase (Doppler Effect), and units of length shorten and time slows down. Due to the slower flow of the present time, we see further galaxies (older ones) relatively faster, and the visible universe itself is getting bigger. On the other hand, older galaxies would have to move away relatively faster because of a higher substance that could then create more space.

We have come up with so many unusual allegations that they need to be reconsidered. That part of the general theory of relativity that arises by equating (curve) space with (tensor) energy could fit into this story. The special theory of relativity, for its side, has an additional part on the *Doppler Effect* that would also fit here.

[72] Thesis of my theory, otherwise unnoticed in physics.

Namely, the relatively slower passage of the time of the light source observed in the movement, in the approach comes to us from our future so that at the moment of passing the two presents could be equalized. I now interpret the shortening of the relative wavelength of the incoming photons as less *smear* and higher probability of position. Conversely, the light of the outgoing source is still in the past, it defines less certain places with its larger wavelengths.

In short, the *future* is more likely. If we treat space and time formally so that the development of events is the displacement of the present in space-time, evolution towards the future becomes the “direction'' to more probable events. I emphasize, because physics has no similar explanation for now.

So, the substance is less and time is getting slower. Gravity pulls where time slows down and a slow flow of time increases the relative inertia of the body and thus the *relative energy* too. The same substances have increasing energies in such a way that the total energy of the present is constant, so the law of energy conservation is valid, as the analoguos laws for the actions and information.

Consistent with information theory would be the dependence of the present on the past. We are what we were, and in part, things are so. More complex systems make it easier to remember their past in substance. They have fewer and fewer options for this if are simpler and for the simplest remain only space. The particles pile up the present and those without a trunk leave them along the way.

Photon traveling induces its electric field which induces magnetic and this again electric, from which we now see communication with space. The information is two-dimensional, with one axis always in the direction of motion, with the other alternately up (electro), then left (magnetic), down (electro) and right (magnetic), in four cycles with a total of 720 degrees of one period.

These are all (isometric) transformations of some rotation, and the double full rotation of photons in motion is described. It is *boson*[73], but all *fermions*[74] have similar rotation for two full angles, the particles on which the force fields (bosons) act. I will take an electron as an example of the trace of fermions in space.

Electrons communicate using photons. Each of them emits spheres of virtual photons in waves, which, if they interact with some other charge, become real. The probability of interaction decreases with the surface of the sphere, but the transmitted momentum remains constant. The action goes back in time, because the interaction is unpredictable and happens after the emission. At least two parts of the described process are new to physics: that the *Feynman* action with virtual photons is carried by the *sphere* and not by a line, then *retro causality*.

This story of the expansion of the universe may be a description of *dark energy*, and the story of the past a description of *dark matter*. The second would be pseudo-real (it acts more easily on us than we do on it), the disappearance of a substance would mean the formation of dark matter, the increase of saturation of space and the likelihood of popping virtual particles out of a vacuum, but these are topics for another occasion.

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[73] Rastko Vukovic: *Bosons* – Integer spin particles, January 7, 2015.
[74] Rastko Vukovic: *Fermions* – Half-integer spin particles, January 3, 2015.

Information like “reality and truth'' also offers greater miracles. Every part of the *exact theory* is not contradictory with any part of any other exact theory, so the happy-go-lucky theorizing of details, as long as it is in the field of truth, could be true, but that is also why some alternative “dark matter'' theories would not make us surprised.

2.28 Hydrogen Atom

The simplest physical system that contains potential interactions (not an isolated particle) is the *hydrogen atom*.

It is made up of one proton, one electron, and an electrostatic *Coulomb's potential*, attractive between the positive and negative charges of protons and electrons, which holds them together and decreases with the distance. As a quantum system, it is the only model of the atoms whose solution of the *Schrödinger equation* is, for now, quite known.

In short, the probabilities of finding electrons in a hydrogen atom are described by the product of three wave functions that define in turn its radius, meridian, and parallel (azimuth). Named somewhat freely, these are the three variables of the *spherical coordinate system*, respectively for distance from the nucleus of the atom (origin), the angle (phi) in the principal, horizontal plane, and the angle (theta) of deflection from that plane.

The radial function only has solutions for energies we know from *Bohr Model* of the Atom. An electron orbits around the nucleus like the planets of the solar system at quantum distances with an ordinal number that we call *principal quantum number*, n. The potential (negative) energy of an electron in orbit decreases with the square of that number, depending on the surface of the sphere and the number of possible standing waves.

From the point of view of information theory, we will say that negative energy has a negative effect (product of energy and time) and a deficit of information in relation to the neutral state. *Lack of information* is appealing. The electron then does not feel Coulomb's attractive force in stationary waves, and this is analogous to the weightless state in a satellite in a free fall in a gravitational field.

The (negative) energy must be added to the negative potential of the electron for it to escape from the nucleus to a higher orbit towards a neutral state of information. Unlike Bohr's model of atoms, the solutions of the Schrödinger equation can be positive energies, so *positive information*, then for free electrons.

Moving orbiting electrons around the nucleus produces the magnetization we find in the solution of the meridional factor (phi). It is associated only with integers that we call *magnetic quantum number*, m. The movement of electrons is an electric current that induces a magnetic field, so the presence of a magnetic quantum number testifies to the motion of electrons by *orbit*, although it is so smeared that it makes no sense to speak of more accurate positions.

The assumption of the exact positions of the electrons would lead the theory into contradiction. Therefore, we will say that due to the magnetic quantum number, the electron acts as the “outcome” of a random event, but also as a “possibility” due to smearing. These are two states of the process of shifting current and potential electron information. The electron not only oscillates in space (over time) around protons, but also dynamically. I'll explain.

The quantum system is a representation of Hilbert algebra, the *quantum states* are its vectors, and quantum processes are the evolution of quantum states represented by linear unitary operators. In the end, state vectors are always some particles simply because “every property of information is discrete” (a consequence of the law of conservation), but as the mentioned operators themselves also make some vector space (dual to the first), then quantum processes are again “particles”. Both types of vectors, each in its own way, are reduced to the same laws of quantum mechanics.

The third solution factor, which defines the azimuth (theta), depends on a nonnegative integer called the orbital, angular, or *azimuthal quantum number* of the ℓ label. Solving the Schrödinger equation, we find that it cannot be greater than the magnetic quantum number and that it is smaller than the principal quantum number.

The ordinal number of the shell, the principal quantum number is the upper (unattainable) value of the azimuthal quantum number, which is the (attainable) limit of the absolute values of the magnetic quantum number of electrons. In other words, the azimuthal quantum number, by its limitations, defines the degrees of freedom of the electrons in the atom, and thus the possibility of filling the shells of atoms.

The fourth quantum number is *spin* (s marks). The electron spin has only the positive or negative half value. It does not depend on the Coulomb force and does not come with the described solution of the Schrödinger equation. However, two electrons in an atom cannot have all four quantum numbers equal because this prohibits *Pauli Exclusion Principle*.

Starting from Pauli's principle and considering the above solutions, the electrons collapse into shells of atoms so that we obtain the *periodic table* of elements known in chemistry. This is a kind of confirmation of quantum mechanics.

3. Action of Information

I talked a lot of new things and it would be amazing if everything was true. Therefore, the continuation of the text will be a kind of repetition of the material, but not the same topics, nor the same methods, and not even the previous principle of minimalism will be treated in the previous way. The point will be on the equivalence of physical action and information, and you can find the appropriate formalism in the book [3].

3.1 Life Cycle

The rise and fall of each of about thirty known leading civilizations was accompanied, among other things, by the development of some form of the *legal* system.

At the beginning, in the phase of youth, the society has fresh norms of behavior which are supplemented over time by developing and stabilizing the system. After maturity, they become more complicated as the community slows down and becomes obsolete. The time of old age is when judicial repairs do not help with additional restrictions as they used to. A similar concept applies to many *life cycles* – from firms to living things – and easily supervenes on information theory.

I will not cite typical examples here of civilization (as before) so that deduction from history and statistics would not mislead us. With the discovery, I go the other way — the theory recognizes the facts, and if it is good, it will redefine those that “do not fit'' and predict exceptions. Nothing below that.

Great civilization was ancient China two or more centuries before the new era – according to the inventions of compasses and gunpowder, making paper and printing, observing comets and eclipses of the Sun. They measured time with shadows, developed weapons (crossbows) and became a safer and more orderly state from within.

Researchers of the pre-imperial and imperial period of China are familiar with the tradition of growing protection of personal rights, property, contracts, family relations and heritage. It is reminiscent of the Roman Republic and its later imperial period of enrichment of the Law of the Twelve Tables, in the first period unchanging.

The ancient Egyptians were especially successful in mathematics, architecture and medicine. They came far ahead of their time in terms of gender equality – men and women (except slaves) were considered equal before the law. Of the approximately 170 pharaohs, six were women, the first to Sobekneferu, and the last to Cleopatra.

Their legal system is based on the “harmony of the beginning of time'' (ma'at) – that one should be at peace with oneself, society and the gods, and violators are often cruelly punished. The judges, as today, were people considered experts in the field, the courts weighed the findings of the offense, and the police forcibly apprehended the offenders, but at the top was the king (Pharaoh). Earlier regulations were simpler to multiply later, resulting in growing bureaucracy, excessive false testimony, and a loss of faith in the concept.

The Inca civilization, in the place of today's Peru, built sophisticated and extensive roads, as well as very strict and sharp laws, starting from three basic sets: “Ama Sua, Ama Llulla, Ama Quella'' (do not steal, do not lie, do not be lazy). These and the laws for maintaining a moral and disciplined society in the Inca Empire tightened social stability. The Inca government promoted peace among its citizens, and when any crime was committed, the punishments were relentless.

The point of this story will not be disputed by worse examples than the above, nor by the cases of the cessation of civilization due to an accident. The main thing is that from the stinginess of the action, a surplus can arise, and from the surplus a life, during which risk and order interchange.

Information is *quantity of possibilities*, which makes it close to the concepts of freedom and rights. The ultimate aspects of this measure are uncertainties and outcomes, and the principles are conservation and savings. Inertia and the principle of minimalism bring information in connection with physical action. Some of their consequences are well known to physics (reflection and refraction of light, movement of trajectories in the field of force), others are less known (spontaneous growth of entropy), and here targeted (striving for security, inaction and strengthening the rule of law) are unknown as such.

The law forms restrictions. By subtracting some options, the probabilities of others increase, which directs us. The attractiveness of run-in is reminiscent of railways, trains running on rails for controlled attention and acting devoid of the need for painful surprises. The rule of law rewards us with security and efficiency and a “sweet'' feeling of living without risk, of sudden changes in energy, force and aggression. Seeking protection from the state, we actually strive for a state of less creativity, less responsibility; we hand over our freedoms to it “for safekeeping''. By conveying our vitality and intelligence through regulations, we delude ourselves that the environment can stand or that our improved organization can overcome it.

However, the legal organism becomes obsolete as it matures. The environment takes advantage of the options forbidden to us and goes further in ways unimaginable to a rigid body. In the nature of information is *unpredictability* whose power we see as the originality and audacity of intruders.

With better-established bans, communities are sinking into their *couplings* because they are more likely (fidelity). The more probable happens more often, it carries less information and has less action, so associations “spontaneously'' evolve towards such. It becomes the glue of association. That move into order, in a freer environment, makes it a victim. Once a great civilization eventually becomes a restricted, a pray of the brave or a patient in need of outside help.

The rigid old system does not recognize or see other optimums of free options. As it progresses in the dictatorship phase, with diminished confidence in truth and freedom, it is stubbornly blind to multitudes like the different biological species that are equally well adapted to the same natural environment. Many *biological species* are particularly attached to the common ground by their own perceptions. Further accumulation of bans and state coercion is followed by disintegration. However, they are artificial and unnatural, they defy the truth, that is why they are filled with mistakes and alienated from the initial ideals.

3.2 Stockholm Syndrome

Stockholm syndrome is a psychological state of connection between abductees and kidnappers. The term was first used by *Bejerot*[75]. The hostages became emotionally attached to the robbers and then justified their actions. Later, at the time of the trial, they were reluctant to talk about the incident.

Let us ignore for now all other known and unknown explanations, and consider similar states or processes from the point of view of information perception and probability. Suppose we have two subjects, a person and a situation, with a series of events that we each value in our own way.

Values are, for example, a person's ability to deal with a given event and the situation's ability to direct / limit it. The product of ability and the corresponding restriction over the same perception is freedom, and the sum of all freedoms is the information of perception.

Analogous to this is the “coupling of chances”. Both are scalar products of vectors in the same event space and therefore with the same number of components — the first information, and the second the probability of the outcome. *Product distribution* probability is a number, from zero to one, the largest when the larger component of the first is multiplied by the larger of the second, or smaller with the smaller. In contrast, in the growing series of components of the first vector, and the declining ones of the second, the product is minimal.

Information is the logarithm of probability, and the couplings of chance as well as perception have a common form and all the more interesting interpretations. The larger the *scalar product*, the larger the coupling, means the more aligned the vectors. They are then “more parallel”, the abilities are more focused (clinging) on limitations. Better adaptation of persons to the environment seemingly increases overall freedom; the exclusion of the part of possibility focuses us on what we can and frees us from excess effort.

To understand this even better, let us remember that information is an action and that the principle of minimalism applies to physical actions. We avoid the unknown not only because of fear, perhaps innate, but also because of resistance to effort, and that is why we love order and security, and we easily confuse efficiency with creativity. On the other hand, uncertainties and environments are inevitable.

Whatever conditions the subject is in, it is somewhere. Abilities are plastic and will try to adapt to some of the offered limitations, in one way or another, with this or that secondary reason behind which actually stands the principled tendency of nature to realize greater probability, i.e. less (real) information.

When we have power we will talk around about peace to gain more power knowing that everyone is a prisoner of some hierarchies. We are bound by the illusion of freedom to choose what will dominate us, and which is often reduced to choosing to avoid choosing.

The lives of micro-particles are no different. We interpret them equally using the previous “freedoms” or their exponents which are “chances”. In quantum mechanics, chances define the superposition of a

[75] Nils Bejerot (1921-1988), Swedish psychiatrist and criminologist.

given quantum state (particle), we can say the probability distribution. The two quantum states are coupled whose intensity (state alignment) measures the scalar product of their distributions. This product takes probability values, from zero to one, with the higher value being the more probable coupling.

No matter what quantum state we are talking about, it is always in some environment. The same applies to processes that are also vectors of the so-called dual space states. The tendency of states (processes) to associate grows with the scalar product, and their "selectivity" is partly deterministic and partly stochastic, first because of the necessity of the theorems, and second because of the randomness of the phenomena to which they refer.

It's unbelievable, but in the action of information there is the same deep cause that makes us subordinates, because of which lies spread faster than the truth on the Internet, which makes it easier to encode than decode, or which keeps the Earth in orbit around the Sun and an electron bound in an atom.

3.3 Uncertainty Relations

Heisenberg's[76] relations of uncertainty (1927) are one of the most important discoveries in quantum mechanics and perhaps one of the most influential recent ideas.

They were discovered by "observing" a particle through an imaginary microscope, for which we take photons (light, electromagnetic radiation) of shorter wavelengths to determine its position more precisely, but therefore with a higher momentum and the transmission of more of its uncertainty into a collision. The calculation shows that the order of magnitude of the product of the indeterminacy of the position and momentum of the observed particle is not less than the *Planck*[77] constant, the *quantum* of action.

Light (electromagnetic wave) has energy which, multiplied by the duration of one oscillation, gives Planck's constant, so it is of the same order the product of magnitudes of energy and duration. In space-time, the three momentums and energy form four coordinates, corresponding to the length, width, height, and time required for light to travel a certain distance.

The connection between quantum action and information is illustrated by a well-known example of *digital records* image and film. In a given magnetic memory, the image is sharper the times the movement is less detailed. The detail of the image (pixel) is proportional to the length, and the momentum to the speed.

It is absurd, but the deeper causes of uncertainty lay in certainty, more precisely said, the dependency hang on random events. It is not possible to change the momentum of a particle without changing its position and vice versa and there is also no instantaneous change in energy nor can time flow without its exchange. This further means that the momentum and position are dependent quantities; they

[76] Werner Heisenberg (1901-1976), German theoretical physicist.
[77] Max Planck (1858-1947), German theoretical physicist.

complement each other in such a way that the change of the first and the second is not equal to the change of the second and the first.

Dependent processes are represented by *non commutative operators*, independent by commutative ones. Quantum evolutions follow special linear functions for which we know from algebra that their compositions are usually not commutative. For example, doubling the number and adding a unit: doubling the number three and increasing it by one gives seven, but three times increasing by one and then doubling gives eight. Dependent quantum processes and only they have a similar non commutative mapping.

The equivalent of copying a vector (by a unitary) operator is a change in the quantum state. In Heisenberg's dependent quantum development, a change in momentum and then a change in position give a different result than a change in position and then a momentum. The difference between the two compositions corresponds to the quantum of action, now we say the quantum of information. Some of these secrets were revealed during the 20th century.

When we work with non commutative operators of quantum physics in general, then we are talking about the *uncertainty principle*. The difference that would result from a different order of activity of two dependent processes is some *indivisible* magnitude. This is again in accordance with the finite divisibility of each property of information, and that with the law of conservation of information, as opposed to infinite sets which can be their own (proper) real parts.

These are the deeper causes of quantization of information and action. That is why all legal regulations, rules of normal games, laws of social and natural sciences as well as mathematics are always discrete sets. Thus, we are already in my appendix to quantum theory.

If we insist that action is a product of momentum and length (or energy and time), that information transmits action, and that it is the basic and only component of space, time and matter, then we claim that any pair of non commutative physical operators can be reduced to a type of mapping position and momentum. Eventually, the notion of “information” is more complex than it seems at first glance, or that I have exaggerated somewhere in these generalizations.

In any case, states and processes are always some “particles”, because operators are also vectors dual to the states they act on. Consistent with the main above thesis, only those particles that can communicate act on each other, and we join non-commutative operators to pairs of such. The first then belongs to space, the second to substance, which roughly means that they are represented by some kind of operator of “position” and “momentum”, each in its own way.

It is strange, but it agrees with the physically known division of *elementary particles* into bosons and fermions. The former are tolerant like photons, they can occupy the same states. Others are as intolerant as the electrons to which the *Pauli exclusion principle* applies: two identical fermions cannot be in the same quantum state.

Here bosons do not communicate immediate with bosons or fermions with fermions, which should be checked along with the prediction that only some bosons communicate with some fermions. It is known that some bosons (say photons) build force fields to which the corresponding fermions (electrons, protons) are sensitive.

Such a simple division of elementary particles according to action, into bosons and fermions, given the differences and multiplicities that are in the nature of information itself, tells us that they should be packages, possibly so abstract parts that it is not possible to physically unpack them.

Another direction in the development of the uncertainty principle could go to the information of perception. For example, the abilities of freedom are interpreted by impulsivity and restrictions by spaciousness. We already consider the wavelength to be an indeterminacy of position, and the only one step from there is information.

The smaller the position uncertainty, the more likely it is to find a particle at a given location, and then the smaller the location information. Thus, Heisenberg's relations of uncertainty speak of information of perception, and then dual of multiplication of distributions.

3.4 Potential Energy

Potential energy is that which an object has in its position relative to another object. To lift an object on the closet, we invest some energy, but we get it back by letting the body fall.

By lifting an object we do the work and that is why we are talking about stored energy. However, the change in energy by duration is an action, a physical action that we now interpret as information. So, we are talking about the potential of physical information.

Two separate magnets when attracted can do the job. Similar to gravity, attraction produces supposedly stored energy, but in fact a deficient potential that is replaced by another in accordance with the law of conservation and the principle of least action. The lack of potential energy is attractive, the excess is repulsive.

According to the *Hooke's*[78] law (1676) the force of a spring is proportional to the elongation (compression) from which it follows that the potential energy of a body attached to a spring increases by the square of the distance from zero, equilibrium position. When the spring is released, the excess of that energy is “melted” and replenished with kinetic energy so that the total energy of the spring remains the same.

The kinetic energy, otherwise proportional to half the mass of the body and the square of the velocity, increases to the equilibrium position of the spring where all the initial potential energy becomes kinetic. Due to inertia, the stretching (compression) of the spring continues into compression (stretching), and the speed of the body slows down to the end point where it stops when all the kinetic energy turns into potential. An ideal spring (without friction) is an ideal *harmonic oscillator* with periodic changes of energies which, similar to the periods of rotation of the planets around the Sun, tell us something more.

[78] Robert Hooke (1635-1703), English scientist.

The gravitational potential of a point is usually defined as the work required bringing a unit of mass from infinity to a given point. I add, the body tends to a state of less information, and accelerates to maintain action. The mass in the gravitational field falls freely, it is weightless for itself, but for others its total energy, kinetic and potential, remains constant.

Kepler's[79] Second Law (1609) says that a line segment joining a planet and the Sun sweeps out equal areas during equal intervals of time. There is vector evidence that this is a property of any constant force of a given source whose carriers (bosons) could last like photons or gravitons. On the other hand, using the commutator algebra[80] it can be proved that this surface is equal to the constant action of charge on its way through the force field.

In short, imagine a straight line and a point outside it at a given distance. That point is the source of (zero) force and the segment of the given line is a part of the path of the celestial body (charge) during some time interval. The segment and the source form a triangle of the surface that does not depend on the location of the segment on a given line. The surface is then defined analytically.

The triangle is in a plane with two coordinate axes. The difference of alternating products, the first coordinates of the first vertex of a triangle with the second of the second and the first coordinates of the second with the first of the first, is called the *commutator* of the pair of points. There are three such (oriented) pairs of triangle points and three commutators, and their (semi) sum is the area of the triangle. In general, the sum of the commutators of successive pairs of points of a broken line in a plane is equal to the (semi) surface of the interior that the line encloses. It's a new thing (my) in analytic geometry, but it's easy to check.

When one vertex of a triangle is the origin of a coordinate system, then its double surface is equal to the commutator of the remaining pair of vertices. Therefore, the commutator is a surface measure!

This is easily transcribed into vectors and their operators (vectors dual to the first), when it turns out that the commutator is the value of the product of Heisenberg's famous relations, the product of the uncertainties of position and momentum, i.e. energy and time. It is the smallest of the order of Planck's constant, the quantum of action, so the commutator is then also the smallest physical information.

It’s hard to retell these formulas, but I can try. The constant “Kepler surface” is equivalent to information, and it is equivalent to action. All three are two-dimensional. They are proportional to the surfaces of concentric (virtual) spheres of bosons by which the source of force speaks to the world about itself, and the law of motion follows from the relation of the mentioned surfaces.

The body moves through the *force field* like an ant over obstacles. They are not spent themselves breaking through the surface, but in their own way follow the shortest paths, now we say trajectories of the least action, that is the least communication. So we also go over the hill when there are no tunnels through the hill.

[79] Johannes Kepler (1571-1630), German mathematician and astronomer.
[80] R.V. Potential information (https://www.academia.edu/41986473/)

The consequences of the new point of view are different. For example, *geodesic lines* of non-Euclidean geometry and general theories of relativity are feasible from the principle of least action of physics. The idea of *dark matter* due to the disagreement of theories of gravity and the distribution of masses in galaxies cannot be corrected by simply “fixing” gravity. *Newton's*[81] formula does not follow from Kepler's second law, but from the *third*: the square of the orbital period of a planet is directly proportional to the cube of the semi-major axis of its orbit. And those are already three or four examples.

There are implications of the above discovery for social phenomena as well. Striving to get rid of excess uncertainty, information that irritates us with the unknown, we surrender our free will to various authorities. By submitting to individuals, groups, the rule of law, we gravitate to order, security, or efficiency. By avoiding unpleasant options, the personal loss of decision-making is complemented by the (not always pleasant) action of the organization to which we surrender.

3.5 Quantum States and Processes

Quantum mechanics have been initiated by the *Heisenberg* discovery of uncertainty relations.

It was preceded by the successes of *Planck* energy quantization in explaining dark body radiation and *Einstein*[82] Photoelectric effect, *Louis de Broglie*[83] particle interpretation by waves, *Schrödinger*[84] equation, and at it all came the discovery of that world as a representation of abstract vector spaces. Quantum physics is a step further into other phenomena of the microcosm.

The vector is *state*, and the operation that changes it is *process*. However, processes are also vectors, so the quantum calculations become more intriguing. We tend to imagine particles spatially moving over time, separating their statics from dynamics, and sometimes notice that their arrangements and changes can follow similar patterns, but we might never have given it more importance if it weren't for algebras of quantum mechanics.

The electrical phase *photon* (particle of light, electromagnetic wave) is periodically replaced by magnetic. Electricity and magnetism alternately induce each other in standing waves *electrons* in the shells of atoms. Also the half-integer positive *spin* (internal magnetic moment) of a free electron is transformed into a half-integer negative by the emission and interaction of a (virtual) photon of a unit spin with another electron $+½ - 1 \rightarrow -½$ to then negative half transformed into positive by the following interaction $-½ + 1 \rightarrow +½$, now a virtual photon of opposite unit spin. This periodic time schedule of events corresponds to the wave structure of the electron.

The conditions remain periodic due to periodic processes and vice versa. We also see the effect of the process on the state in conservation the momentum, *inertia* of the body in motion. Just as action is transmitted through space over time, so it is transmitted through time through space. The body is where

[81] Isaac Newton (1643-1727), English mathematician.
[82] Albert Einstein (1879-1955), German-born theoretical physicist.
[83] Louis de Broglie (1892-1987), French physicist.
[84] Erwin Schrödinger (1887-1964), Austrian-Irish physicist.

it is, because that was its most probable position, and then it will be directly there due to the inertia of probability[85]. More probable events are less informative, less effective and hence inertia.

The elementary particles of physics are in some of their changing states, but those many turn-turns remain what they were. The changes they undergo are limited in their goals, the need for the electron to remain an electron, for the laws of conservation to apply, and the like, as if they only fall into such troubles that do not essentially harm them. For particles that choose reusable processes, we say that processes according to states behave like states according to processes. A similar thing happens in particle fusions or decays when different states choose different processes.

The *dualism* of the linear operators and vectors on which these operators act guarantees us that the replacements of the ideas of space by time for physics will be non-contradictory. Besides, that is why we will find that this universe is composed of an equal number of temporal and spatial *dimensions*. Places and duration are equal concepts to isomorphism, mutually unambiguous mapping of corresponding concepts.

Quantum physics further tells us that achievement and development are not just two equivalents of phenomena, but each is also a reciprocal (regular, invertible) function. Globally, it allows the reversal of the flow of time, together with a change in the direction of the road and the charge. This does not seem to be in accordance with statistical mechanics and its irreversible breaking of the glass due to the one-way spontaneous growth of *entropy*, i.e. with the transfer of heat to a colder body. The paradox resolves the broader view, from the point of view of information minimalism. Let's look at how broader this new position is now on an example of economics.

Some company has production of items from three factories and delivery to three sales centers. Factories in a unit of time give 300, 300 and 100 items in a row, which they sell in centers at a rate of 200, 200 and 300 pieces. The cost of delivery per unit of an item from the first factory to the centers is 4, 3, 8, the second factory 7, 5, 9, and the third 4, 5, 5. The company has the issue of distribution with a minimum total cost. This is a typical task of the so-called *linear programming*.

There are several ways of delivery, even with the condition of the goods without the rest, but this is an example with only one minimal cost. I skip the solution (simplex method) that the first factory should send 200 and 100 pieces of goods to the first and second store, the second to the second and third 100 and 200, the third only to the third 100. If you are not interested in these numbers it is good again because the point is not there.

We imagine that the relationship between producers and consumers is a quantum process that translates the state of goods in production into the state of goods in sales. The condition of minimizing the cost corresponds to the principle of information and the principle of least action. The former earn as storekeepers or traders, and the latter as organizers of distribution, the first as representatives of the state, the second of processes.

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[85] The corresponding conservation law also applies to probability.

Reversibility of (all) quantum operators would mean that for goods at the point of sale we can always know exactly in which factory they were produced. By the process which is “always” in the “correct” state. The vectors are original (300,300,100) and copy (200,200,300). When such vector pairs are not equal, the quantum states and processes before and after can be significantly different. Anyway, they are still phases of a broader quantum process, here market economics.

When the original and the copy are equal vectors, there is no significant change in the quantum state (the atom remains an atom of the same type) as opposed to cases of fusion or decay of particles. Unless a different vector is formed, the constant of the proportionality of the image and the original expresses the *observable* that lasts, the probability of its observation which is therefore a real number.

The components of the vector and the coefficients in quantum calculus are also complex numbers. If they are not real numbers then micro phenomena cannot be observed. They are otherwise reluctant to declare themselves, as I said, because of the principled minimalism of communication.

3.6 Selectivity

The informatics view of the world is broader than the philosophy of *materialism*. That is one part of this story. The rest are observations that matter itself is more subtle than the concepts we experience and that our perceptions only partially inform us about the environment.

Information is manifested by physical *action*, and it is the product of momentum and distance or energy and duration. Due to the law of conservation, both are discrete (finally divisible) and our observations are always final. However, physical reality is part of the infinite abstract world of truth and that is why information is selective and diverse.

When one of the two factors of action is greater, the other is less, and, in the limit case, all-spatial information becomes impulse-free, and all-time information is energy-free, like universal *theorems* that do not seem to belong to the material world. Each part of the theory constructed in this way is correct and agrees with every other part of that or any third correct theory (geometry, algebra, probability), although they can be divided into countless mutually independent *axioms* (Gödel's incompleteness theorems), selective and multiple.

More substantial truths are less absolute, in various ways. We know that the *universe* is expanding and that the limits of its visible part are further and further away. This phenomenon in “information theory” (mine) supposedly can arise from the accumulation of world history. By that assumption the space remembers, for the particle that travels the depths of the cosmos does not accumulate information about own travel. So space grows and matter is less and less. The same results come from the spontaneous growth of the entropy of the substance, I emphasize only the substance.

When we go down to even slightly lower levels of action, we find again a slightly different variety and ``selectivity of information''. For example, we communicate (interact), because we do not have everything we need, nor can we have everything, and then not everyone communicates with everyone.

Greater information comes from greater uncertainty, so uncertainty is proportional to the energy it transmits and duration. Hence, disinformation as well as anything that increases confusion can be energetic and offensive. Such a lie becomes part of a tactic, means or weapon in *games to win*. But not all games are games to win. The good-good game tactics in trade or the search for compromises in politics are examples of good, peaceful games.

The opposite of peacekeeping would be the loss-loss tactic (lose-lose game), in chess gambit (sacrifice figure for position) or in business investing. Almost every game to win (winning game) wins the good-good game and it is crucial to protect "goodies" from "evil", say for the stability of the economy.

Well, if "something" is being lied about, there's probably some kind of war of domination going on. The guests have "bad intentions" against the hosts and that is why they are lying. The home team, on the other hand, in front of their audience, accomplices or independents, also lie, and when the "match" starts, then some others lie, cheering for "theirs". And all this testifies about many faces of truth and its game of hiding.

Through the narrow windows of the senses we see just as much as we need. This minimum of communication for their own survival is required by all biological species, and these then converge around similar conditions, needs and conflicts. The principles of information and least action speak of such exclusion.

Stinginess can acquired too, and from the surplus of physical actions, and then from the power of choice, living beings are created. Excess of the action, information or freedom, the nature resolve when it can, spontaneously and selectively. There is always an environment around and if we choose, it is rather safety, indefatigably and purposefulness, primarily because of the thrift of the action, and secondarily perhaps because of psychology. Similar processes of reducing options, individuals and societies, are subject to the convergence of the senses of species.

There is no information without possibilities, and the more there are, the more choices there are or the less likely they are. With fewer chances, the information is higher, but the resistance to its broadcasts is also higher. Thus, the narrowing of perceptions and the growth of vitality are opposite aspirations, which tells us of our ignorance and the importance of the optimum. We believe that the world is simpler than it is due to the principle of information that we advocate for the need for security, efficiency or fatigue, and on the other hand we often mistakenly believe that we get more from more of everything. It is also selectivity.

At an even lower level, the peculiarity of snowflakes, tree leaves and all living beings in general, testify to how much nature resists abandoning its mixtures. *Law of Conservation* the amount of information intensifies this interference; it makes it even more difficult to reduce the number of options, to merge all forms of life into one species, one society, under one flag.

In a world of even smaller sizes, the Swedish physicist Johannes *Rydberg* (1888) discovered a formula for predicting the wavelength of a photon emitted by changing the energy level of an electron in *atom* using the principal *quantum number* (n). It is a natural number (positive integer) and one of the four quantum numbers that every electron in an atom has. As it grows in order, it denotes upper numbers of shells that are like concentric spheres farther and farther from the nucleus which bind the electron to the nucleus less and less, which, among other things, now reveals new types of information selectivity within atoms.

Information feeds on choices, but it is reluctant to consume that food. Materialist *philosophy* does not need this original diversity and it overlooks it, for it the universe is too large, the needs and scope of interactions are confusing to it. Communications, as well as living beings, come to materialist philosophy as surplus, and space, time and matter are inconsistent concepts. However, they are all tissue of the information and follow it's the same principles.

The foundation of the new philosophy is the smallest particles. As authentic representatives of physical information, its unpredictability, and they are so vague that it is not possible to know them exactly.

3.7 Dualism Lies

Science tacitly divides reality into a world of truth and a world of *lies*. The first of these worlds is divine, the second is devilish, some would say, and the question is whether we will ever be able to grab the "dishonorable" by the horns. That is the subject of this story. First, let's look at an example of my colleagues from Valjevo.

The citizens of city A always tell the truth, the citizens of city B always lie, and every citizen from city C alternately tells truth and lies. The firefighter on duty received a message on the phone from one of these cities: "We have a fire!" said one citizen. "Where?" The fireman on duty asked. "In city C" — the same citizen answered. Which city should the fire department go to?

The mentioned citizen could not be from city A, because they are constantly telling the truth, and the two statements received by the firefighter cannot be both true. He could have been from city B, citizens who just lie, because he could have lied "There was a fire with us!" And then again lied that he was "In city C", because the fire could have been in A! Citizen C, who would alternately tell the truth and the lie, could not say the first and then the second statement in that order. Also, it is not possible that the first statement was a lie (then the fire is not in C) and the second truth (the fire is in C). Therefore, the fire brigade should go to city A.

The lesson of this "task" is that the world of lies could in some way be consistent, similar to the world of truth. I will explain the anti-logic of that world through the algebra of the Irish mathematician George *Boole*[86] (1854) in which the only values of the variables are *true* and *false*. In applications, we represent them with the numbers 1 and 0 or the state "there is electricity" and "no electricity" in computer processors.

In Boolean algebra, each formula can be written using three operations: *negation*, *disjunction*, and *conjunction*. The first translates the value "true" into "false" and vice versa. The second and third include two statements each; disjunction gives them the value "false" only if both are false, and

[86] George Boole (1815-1864), Anglo-Irish mathematician.

conjunction results in “true” only for both true. By translating these into circuit gates it is possible to simulate various logic processes.

On the other hand, there is symmetry of this logic. Every truth as a “reflection in the mirror” has some untruth and vice versa, so that the world of lies is exactly as consistent as the world of truth, in its twisted anti-way. For example, the conjunction “A and non-A” is always incorrect, it is a *contradiction* and in the world of lies it is the supreme value. If we copy it in the alleged mirror, the disjunction “non-A or A” turns out, which is *tautology*, the statement is always correct, the supreme value of the world of truth.

So, it is possible to look for total untruths in the very world of lies and then turn them into total truths by twisting (true to false and vice versa). But alas, just as it is difficult to understand a substance without space, it is difficult to find truths without lies or lies without truths. And that is the third part of this story, and it mostly concerns “information theory”.

Math is a miracle. It is not the first time that she has been told that she is taking steps that no one will doubt in order to reach a claim that no one will believe. That's how we discovered that lies also inform us. What we could prove that cannot happen – it does not happen. That is why we consider “events” to be true (information is equivalent to action, and action is equivalent to happening). The opposite would be “non-events” (if any) from which it is not possible to obtain any information and which the true equivalents of untruths are. However, such cannot exist, at least not in a world in which every part of space, time and matter has some information.

In other words, the *universe* in which we live contains only the illusion of untruth. She is playing with us, because the truth likes to hide even though it cannot be hidden. The uncertainties that make up the tissue of information are inevitable, and nature does not seem to like them. It springs from the principle of information (which I advocate), its minimalism and the principle of least action (the latter is known to physics).

Nature does not have the possibility of classical lying, but it has incredibly great abilities to ignore and hide. Among us, the most famous of these are not declaring and reducing the chances of realization. On a scale of probabilities from zero (impossible event) to one (certain event), those more compact events of greater information are less likely and occur less frequently, those disjointed are more frequent.

Boundary, the densest would be impossible events, theoretical untruths, and the rarest would be theoretical truths. What we see is very likely somewhere in between. Due to the principle of information, nature almost never puts all its simple truths on the table, so that anyone who is too informed will become misinformed. Nature does not allow even the lies themselves, it over saturates and exposes the other extreme — the state of “completely uninformed”.

If there are fewer chances for the event to happen, it is more informative and “hits” us more. At the other end of the probability are events with great causality, abstract, certain, poorly informative news and less material. They barely affect us, and we have no effect on them. What has mathematical accuracy is so intellectual and subtle as if it does not belong to this world; it is the opposite of what would have the ultimate inaccuracy, which would be excessively forcefully informative, brutal and destructive.

The principle of information thus initiates the principle of disinformation that just as the material world cannot do without at least some random events and therefore at least some information, it cannot do without at least some misinformation. By resisting the excess of "truth", nature has symmetrical reasons to resist the excess of "untruth". If you lie a lot, few will believe you, and if you only tell truths, they will find it difficult to understand you.

3.8 Gibbs Paradox

Just as politicians and historians regularly somewhat neglect the importance of inventors in the development of civilizations, and local masters and engineers neglect scientific discoveries, we all together underestimate the impact of mathematics.

So, too, Western social changes two centuries ago, due to the rise of liberalism and the industrial revolution, had their deeper root in the discoveries of probability, information, and quantum mechanics. Known as the French revolutionary, Lazare *Carnot* (1753-1823) was a mathematician and one of the first to (abstractly) explore the useful work of gases.

His son Sadi described (1824) the circular process of an ideal heat machine operating at the difference of temperatures of water vapor, heated air, or some third substance. The German mathematician Rudolf *Clausius* (1822–1888) gave it an even more precise form (1850) and used a later famous abbreviation, the quotient of heat and temperature, which he called entropy.

After two decades, the American scientist and mathematician Josiah Willard *Gibbs* (1839-1903) discovered statistical mechanics. He also discovered "information'' which was then (1948) elaborated by Claude *Shannon* (1916-2001), an American mathematician. Gibbs, like many scholars from Clausius to this day, struggled to give the entropy some physical meaning, and in doing so, he was one of the more successful ones.

He noticed (or was close to) that entropy was growing by breaking glass and dissipating the pieces, which is why we call it "the clutter amount" today, and that the weakening of the bonds in the glass on that occasion speaks of energy and information loss.

This occurred in the shadow of *Napoleon*[87] wars, the struggle of many peoples for independence, the decline of the Ottoman Empire (from 1299 to 1923), *Meiji*[88] Restoration in Japan, Colonization of Africa.

At the end of the 19th century, the Austrian physicist Ludwig *Boltzmann* (1844-1906) worked out the statistical mechanics of particle vibrations, atoms whose shaking gave heat and temperature, but he did not experience the victory of his ideas that came to life only after Einstein's explanations of Brownian motion (1905).

[87] Napoleon Buonaparte (1769-1821), French military leader, born of the Revolution.
[88] Meiji Revolution, Reforms in Japan from 1868 to 1889.

The falling gas temperature with the expansion of the vessel also bothered Gibbs when he (1875) made sense of the situation of his famous paradox of entropy. His thought experiment reveals the problem of mixing gas particles that we consider different in a situation where they are no longer. The resolution of the paradox is the (then absurd) treatment of particles of the same gas indistinguishably, such that when the permutation (swapping places) of two particles the state of the system does not change.

Why is it “paradoxical'' to consider equal parts of a substance, what does “particle equality'' mean and how far can we go with equalization? It is difficult to understand these dilemmas today, but I will try to explain their weight at the time by flipping a pair of the same coins. Each of the two coins has two sides, head or tail, so the outcome of the throw has four options: HH, HT, TH, TT. Over time, after many repetitions, the outcome of HH is about a quarter of all throws, so counting them we also know that we really had four equal options mentioned.

Let's apply this to particles of two types of ideal gases separated by a barrier inside an insulated vessel. Let them be two parts of equal volume, pressure and temperature. When the bulkhead is removed, the gases are mixed and spread throughout the vessel, each to twice the volume. The total entropy is higher, which will show both the calculus (omitted here) and the fact that restoring the bulkhead does not separate the gases back, that it is an irreversible process.

Then imagine that the same gas is contained in the both parts of the pan. By removing the barrier, there is no mixing of the “two gases'' and spreading to twice the volume and the barrier is restored to its initial state. The process is reversible and the application of the same argumentation contradicts the account.

The point is that entropy does not notice the replacement of the place of the “same'' particles, that such do exist, and that the number of combinations rather than variations is then important for changing the energy and information of the vessel.

Therefore, entropy then is not an extensive quantity (proportional to the amount of substance), so if it depends on the possible distributions of the particles but not on the order of them, then dividing by the factor of the number of partitions (multiplying by a factor $1/N!$) In the calculation of the entropy will improve the calculations, and that really happened.

The solution of the Gibbs paradox indicates the subtlety of the two situations: the first particles in state A and the second particles in state B, and the first particles in state B and the second in A. Quantum states are vectors, compositions are tensor products, so the sum (AB + BA) is a symmetric state and the difference (AB - BA) is antisymmetric. Symmetric elementary particles are called bosons, antisymmetric fermions.

Experiments show that there are only two types of elementary particles mentioned, with no numbers other than plus and minus one between pairs of states. The same thing comes theoretically.

For example, by replacing two particles, the boson state does not change, and the fermion state changes sign. Twice this substitution restores the initial state, becoming the unit (neutral) operator, i.e. unitary, as are all operators of quantum mechanics. They are such that they would not change the (unit) norm of superposition of quantum states. The eigenvalues (of each) of these operators are only plus or minus one, so in no more complex system is there any mixing of bosons with fermions, since the superposition would give a third value.

The energy operator (Hamiltonian) is symmetric, so the potential and kinetic energies of the body are in boson-type fields, and therefore what the field acts on is fermionic. Photons and gravitons are bosons, electrons and protons are fermions. If the fermion state contained two of the same particles it would be zero (due to subtraction), and this cannot be normalized (into the unit intensity) and cannot represent superposition, so it makes no physical sense.

Therefore, two fermions cannot be in the same quantum state as the *Pauli Exclusion Principle* say, otherwise successful in explaining *Mendeleev*[89] tables of chemical elements.

It is difficult to understand how many discoveries in the chemical industry, energy, telecommunications are in the aftermath of this short story, until we look back at the way people lived in the 18th century. Even kings are not what they used to be, and all this is reversed by exact thought.

3.9 Hamiltonian

Information is manifested by physical action, action is the product of energy and duration, and energies take two main forms, kinetic and potential.

The sum of the two is the energy of the body in motion, that is, the function we call the "Hamiltonian'' after the Irish mathematician *Hamilton* (1833) who began building the physics on the law of conservation energy.

A gravity-free satellite is faster in a stronger field due to changes in potential energy, which is supplemented by motion energy. The sum of these two energies is constant until another force such as a rocket engine, cargo deflection, collision or friction with air acts on the satellite. Similar things happen to charged particles in the electromagnetic field, but also to other forces.

The states and processes of quantum mechanics are the representation of normed (unit) vectors and operators of abstract *Hilbert*[90] spaces, among which the *Hamiltonian* is one of the most important. It is the sum of the kinetic and potential energy operators and they are functions of the momentum and position operators. The actions of these over time are "realities'' for further testing.

We know from classical mechanics that any change in total energy when a momentum changes will be reflected by some change in position over time. It says the first of the two famous equations of the Hamiltonians. The second says that any action that changes the (total) energy of a body by changing its position results in a reaction that changes the momentum over time. These two equations define the Hamiltonian and vice versa, the law of energy conservation gives these equations.

[89] Dmitri Mendeleev (1834-1907), Russian chemist and inventor.
[90] David Hilbert (1862-1943), German mathematician.

The elaboration of the above equations takes us into the amazing world of theoretical physics. The first step is the *Schrödinger equation* which, simply put, is the oneness of changing the wave function over time and the action of the Hamiltonians. We believe that all matter is in waves because the known physical phenomena of quantum physics are solutions of this equation, and we cannot prove by experiments those which are not its solutions.

The *commutator* of two operators A and B is the difference between their successive operations AB - BA. It is zero when processes A and B are independent, which according to the said Hamiltonian equations does not apply to momentum and position, or to energy and time. Then these commutators are not zero but of the order of magnitude of the quantum of action, and their equations become *Heisenberg's uncertainty relations*. Physics is mathematically very connected, even when it speaks of indeterminacy over definiteness. This is why quantum entanglement is so confusing and *Bell's*[91] Theorem (1964) is incomprehensible to many.

This theorem proves a contradiction of the idea of hidden parameters that could supposedly avoid “spooky action at a distance'' (Einstein) in quantum mechanics. The problem with it is the contradiction of randomness as well as consistency itself, where it is said that without uncertainty there is no certainty, without causality there is no coincidence! And that is hard to digest.

The wonders of the Hamiltonians are a story without end.

If in said commutator A is an arbitrary function and B is Hamiltonian, then commutator equals the change of function A over time. So there is no change of function if it and the Hamiltonian are independent phenomena. In other words, every change is about energy and time. The product of energy and time is action, and it is the equivalent of physical information, so information is the very essence of the nature of things.

From the above, it is easy to prove (algebraically) that the commutator of two momentums or two positions (different particles, places, and moments) disappears. By the way, the momentum and position commutator (the same particle) is not zero. These commutator relations are called canonical and are referred to in the most general form by Stone–von Neumann theorem (1931). We interpret it by reducing the mutually dependent phenomena (formally) to “position'' and “momentum''.

The question remains the understanding of the term “position'' by “particle'', because space, time and matter are only information (the hypothesis I hold), and each form of information is ultimately divisible, corpuscular. The solution to this problem has long existed in physics (Fock space, 1932), and it is not understood until the “theory of information''. And that, I hope, is some of the next topic.

3.10 Bell Inequality

If we misunderstood a phenomenon, in experiments it might seem to us that the nature is deceiving us, and the deceiver would break up rendering the correct algebraic expression as incorrect.

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[91] John Stewart Bell (1928-1990), Northern Ireland physicist.

This is the point of John Bell's method of contradiction (1964), which challenged the idea of *hidden parameters* after the discovery of quantum entanglement. These hypothetical parameters and the “incompleteness of quantum mechanics'' was an attempt to explain the *Einstein–Podolsky–Rosen paradox* (1935) in order to avoid “spooky action at a distance''.

Bell's theorem and his further research proved such attempts to ``rescue'' quantum mechanics are logically impossible. It is perhaps even more relevant to information theory because it supports the basic premise that – coincidence exists.

I tried hard and couldn't understand it – is the usual statements made by students of theoretical physics. Bell's theorem is simply too difficult to understand, but if it can be explained to laymen at all, then the American professor David Harrison's example (1982) also helps.

We have three different properties A, B and C. The number of objects with property A but not with property B plus the number of objects with property B but not property C is greater than or equal to the number of objects having property A but not C. This is algebraic correct statement, check! Sum of numbers, number (A, not B) + number (B, not C) is greater than or equal to number (A, not C).

We call this relation *Bell's Inequality*. Let's test it in some (imaginary) room with different people. Let property A mean 'man', property B 'height 175 or more' in centimeters, property C 'blue eyes'. The inequality mentioned then says that the number of men below 175 plus the number of persons (male or female) is higher than 175 but who do not have blue eyes is equal to or greater than the number of men who do not have blue eyes.

As much as a room is, with as much as we want and with any kind of person, upper algebraic inequality is always true, it is indisputable. That is why, if we find the numbers in the room to be inaccurate, we will conclude that there was cheating, for example, some were entering or leaving the room while we were counting them.

The aforementioned relation is not thoughtless; it is a typical ending of calculating quantum entanglement and is similar to other Bell's inequalities. Each of them breaks the idea of the assumed hidden parameters of the APR paradox – introduced to avoid “spooky action at a distance''. Measurement that would challenge Bell's inequality would tell us that nature is cheating on us or that we are being misled in understanding nature.

For example, this inequality applies to stream of particles (photons, electrons). Spin is a measurable vector (by polarization or magnets). Let A be the orientation of the spin “up'' (north), B the orientation “up-right'' (north-east), C the orientation “right'' (east). Then Bell's inequality says: the number of electrons with spin “up'' but not “up-right'' plus the number with spin “up-right'' but not “right'' is greater than or equal to the number of electrons of spin “up'' but not “right''.

However, measuring the spin “up'' and then “up-right'' creates a paradox. Of all the electrons that pass the first filter, 85 percent of them pass the second, not 50 percent – which we would expect from a simple distribution (orientation of the direction of random vectors, spin, in the classical way).

The experiment shows that only 15 percent of electrons are spin-up with spin up-right, which corrupts Bell's inequality. In the example of counting people in a room, the analogy is that by determining the gender, we change the height of the person.

In fact, if this disorder of (expected) probability did not occur, it would mean that we had defeated *Heisenberg's uncertainty relations*. It would be apparent that the uncertainty in the quantum world is ostensible, that it comes from our not knowing of all causes, or that it has parameters that only need to be accounted for to achieve the universal causal reality. In contrast, in nature, some coincidences are objective and cannot be replaced by tricks.

From the point of view of the theory of *information perception*, I add, when we get some information from a coupled quantum system, we subtract some of its indeterminacy and so much determines it. It is synchronized, because other laws (information) that speak of certainty, non-coincidence also apply, and the way of this “strange'' harmonization is confirmation of the informational nature of the physical world.

The fact that synchronization (of space, time and matter) can happen instantaneously and regardless of the distance of the parts of the entangled system, and possibly the action of the present on the past, more precisely because it confuses us, tells us that nature is not exactly what we think it is. On the other hand, we can think of dependent incident events as interesting “actions'' created by a deficit of action.

3.11 Pauli Principle

The Austrian-Swiss-American physicist Wolfgang *Pauli* (1900-1958) formulated in 1925 the principle of the exclusion of quantum mechanics, which, at the suggestion of Einstein in 1945, won the Nobel Prize in Physics.

This principle as a chemistry tool for building *Periodic Table* of elements is well known in its trivial form: there cannot be two identical electrons in the same atom. The real challenge is to explain it more accurately, popularly, without being banal.

Quantum mechanics is a representation of *Hilbert algebra*. Measurable quantities (observable) are coordinate axes, particles (quantum states) are vectors (probability distributions), and projections of vectors on coordinate axes give chances of measurement. In abstract algebra, a point is a vector, as is a “set of particles''. Wave functions are also vectors, and the vector space is the solution of the wave equation. Such findings of math “spin in your head'' and its point escapes momentarily.

We know that in reality, two different bodies cannot be in the same place at the same time. Similarly, when we throw two coins, each with a half chance of a head or a tail, we get four equal outcomes: hh, ht, th, tt. This means that there are always 'first' and 'second' coins, because otherwise ht and th would be the same outcome, with both hh and tt in about a third of outcomes in multiple throws.

Abstracting this concept, we look at two “particles'' and two “states''. Thus AB means “the first particle is in state A and the second is in state B'', and BA means “the first particle is in state B and the second is in A''. Then comes the hard part. When we say “two apples plus three apples are five apples'' without considering the term “apples'', only then are we in the field of mathematics.

Now try to abstract this, or at least move slightly towards the domain of “some'' sizes, not caring about any. The states (particles) are “vectors''. Their products are “tensors'', vector compositions, and don't think too much about what those “sizes'' might be. Bodies that cannot occupy the same space are not tolerant on each other, and their negation is the tolerant entities.

The sum of AB+BA would be one tolerant situation, because at the same time we have the first particle in state A (second in B) with the first particle in B (second in A). Such is *energy*, for example. It can be added to each other, kinetic to potential, no problem. So is space, so are opportunities before the outcome of a random event. This sum is of *symmetrical form*, because by replacing particles in states, it remains the same.

Then what would be the negation of this negation? This, we said, is an intolerable situation, but coming from its negation, we see that we must form it so that it cannot make physical sense if the first particle were the same as the second. In short, the negation of tolerance can only be the difference between AB-BA and nothing else, and here's why.

Physically realistic can be only such vectors that can be normalized (have unit intensities), which can always be achieved by dividing a vector by its intensity – except with zero vector. Only a normalized vector can represent the probability distribution, that is, the superposition of quantum states, and only one that cannot be normalized can express what we need now. Such is AB-BA, because considering the two given as the same particle, would give you zero.

Therefore, as tolerance is obtained through negation of intolerance, so the opposite of the situation AB+BA becomes AB-BA. The first states (sum) are symmetric, the second (difference) is said to be *antisymmetric*, and the first is called *bosons*, the second *fermions*. The former are named after Bose–Einstein statistics, according to the first of these authors, who was unhappily died at the time of the discovery, and the second according to Fermi–Dirac statistics. The bosonic probability distributions do not distinguish the individual particles, and the fermion particles differ, whether or not these differences are easily observed.

Mainly, I hope you understand. It would be too much for me to further explain why bosons have the integer *spin* (internal magnetic moment), and fermions are always halved, but from this one you also can feel part of Pauli's subtlety and ingenuity and Einstein's delight when he nominated Pauli for the Nobel Prize.

The essence of Pauli's discovery was in the antisymmetric wave functions of pairs of points (particles, quantum states) and their projections to coordinate axes when measuring direction. The antisymmetric function by substituting the place of arguments (fermion) changes sign, so when two arguments are the same fermion, the negative and positive value of the function would be equal, which means that the mentioned function is null, there is none. It is Pauli's original principle that two fermions of the same species have a common wave function that is antisymmetric.

In other words, two fermions of the same species cannot be in the same quantum state simultaneously. This applies primarily to the four quantum numbers electrons in atom: the principal quantum number (n), the azimuth quantum number (ℓ), the magnetic quantum number (m), and the spin (s). In the same atom, two electrons, two protons, or neutrons cannot have all four quantum numbers equal, but a proton and a neutron can.

This idea was further developed by Russian physicist Vladimir *Fock* (1898-1974), and German Pascual *Jordan* (1902-1980) in a direction that in (my) theory of information will become particularly interesting. With Paul *Dirac* (1902-1984), an English theoretical physicist (1927) they laid the foundations for the so-called second quantization, formalism for describing many-body quantum systems, with multiple tensor product vectors, symmetric or antisymmetric, analogous to Pauli's. But that's another story.

3.12 Globalization

One of the important points that information theory has so far mastered is the *principle of least action*.

It is not wrong to use this term, for information equal to that famous in theoretical physics from which we derive today all known equations of motion – from classical physics, thermodynamics, theory of relativity, to quantum mechanics. Physical substance possesses that laziness of physical action, and information in that sense is equivalent to action.

Substance tends to be inactive and less surprising, so the basic laws of physics are simpler and apply to simpler structures. Their information (action) will not just be delayed, but must be exchanged or the whole particle will be handed over. On the other hand, in trying to get rid of excess, matter becomes more complicated because of one mechanism that I have only recently known.

A quantum state is primarily one or more particles. We formally run it as a vector whose components give *probabilities* of outcome or – more physically speaking – it is a *superposition* of possibilities. More probable options are more often realized, but are less informative.

The conjunction of quantum states is the sum of the products of the corresponding components of two vectors (fidelity), so it also takes probability values (Schwarz inequality) and has the property that couplings of higher values are more often realized. Because they strive for less action, less information, which means more likelihood – quantum states associated!

Paradoxical situations arise. Going towards a smaller action, a physical substance spontaneously sinks into larger structures. It thus finds calm and new value. Like a disassembled machine that will not work, complex molecules have the properties at first glance absent in the atoms they consist of and may have a new quality that would be completely inexplicable without information theory.

Similar *synergies* (the interaction or cooperation of two or more organizations, substances, or other agents to produce a combined effect greater than the sum of their separate effects) exist in the higher levels of association all the way to living beings and beyond. Simpler life forms evolve into tissue cells of more complex forms, lower into higher hierarchies. The constant impulse to coupling mentioned the principle of minimalism, the tendency of the physical structure to get rid of its excess information (action) under conditions when all the surrounding substance is filled. That's how civilizations evolve too.

Driven by instincts produced by surplus of information the individual, among other things, strive for security and efficiency. By relinquishing personal liberties, we surrender them to the Pharaohs, emperors, kings, leaders, political parties, to increasingly “better'' organizations, unaware of the deepest cause of universal subjugation.

Excess information means having more action, greater uncertainty and greater ability to choose. At a greater level of complexity, these structures cease to be subject to the study of physics; they no longer move through simple trajectories of the smallest action, such as the light bouncing off a mirror by crossing the shortest path between the two points, or as it would refract through the midpoints of different optical densities (speed) arriving in the shortest time, rather than becoming “disobedient''. Then instincts, customs and legislation come into play.

What we consider to be the introduction of rules and order is actually the desire to get rid of surplus effects. It is useful to note that for a more intensive understanding of the function and evolution of society, the need for social discipline comes from the excess of information from individuals and the desire to reduce these surpluses. The individual is then freed from the unpleasant uncertainty, the need for urgent critical decision making, the risks, but so supposedly life lasts. We then favor the more capable king than the selfish pharaoh, governed by Rome over barbaric survival, the tranquility offered by churches and feuds of the Middle Ages.

Equality generates conflict, so it is also attractive as a good position to express our own excesses of vitality, but also to facilitate the creation of new hierarchies. The idea of equality through the rule of law was a full blow at the time of the French Revolution that its monarchy could not cope with.

But the vision of a (legal) system as an automatic machine that excels each individual in the ability to bring us safety and efficiency has the flaw (deficiency) as deep as invisible at the beginning. She stifles “aggression'' by favoring her. By fostering equality, legal systems create an increasing need for legal regulation, and by not opening the door to new hierarchies they are digging its own grave, and digging it again by opening it.

Communism thus came to the point where it became merely a clamp and could not go on, and capitalism brought about corporations. It has brought us to a state of maturing new obsession with order and work, of companies and corporations, which for now is shyly recognized as globalism. The new motto is “Politicians are not the solution, but the cause of the problem!'', and when these trends empower and ideas reach, things will turn compared to today and people will want globalism.

The history, of the clash of the rule of law and unworthy monarchs, threatens to be replicated in the clash of the idea of perfection of firm hierarchies against less effective and outdated politics methods. The initial surrender to the principles of law in monarchies resembles the corruption and manipulation of the political elite today. However, globalism will also have to offer security, meaning peace, prosperity and equality, much that it cannot achieve because of a deficiency, now of a different kind from the previous the legal one.

Corporations are essentially hierarchies designed to conflict with one another. They cannot cultivate sincere mercy on their subjects, because otherwise they will perish. They will feed on the need for money and their orderly society will be forced to evolve towards an ideal slave system. Thus, eternal opposites between desires and reality will grow, the same one hatreds that are actually the main feature of life.

3.13 Diversity

The essence of information is unpredictability. Repeated news is no longer original news and in this sense the very notion of multiplicity takes on new meanings. Until then neglected, the concept of diversity in (my) *information theory* is fundamental, and with the law of conservation it is particularly interesting.

The seemingly contradictory claims that this world is made up of news and news alone, that the news as soon as appear no longer are what they were, that their quantity (information of an arbitrary closed system) is constant, represent interesting discoveries. First of all, hence the *past* which is constantly accumulating and growing in a way that is never the same. Like everything else in this world, the past is a type of information, so it is also a type of action.

It is not possible to turn off the news so that nothing is left behind. As an elementary particle, news consists of options in shifting in a way that stores the amount of uncertainty given. Similar to a tour of a building, an object, an “something'' when we see fewer and fewer of one facade to see more of other, the quantum of action is integrity, the smallest packet of information, and an elementary particle that, by more accurately observing the position, momentum becomes inaccurate.

In this way, information subtly connects us to the infinities that are the “normal thing'' in mathematics. In this theory, infinity is the material of physical action, and its philosophy in this sense resembles *Plato's*[92] world of ideas (but there are and differences).

Aside from philosophy, we have the same in physics, for example in the movement of the water wave. What is in it moving about? The water particles go up and down and barely move left and right, and the wave goes perpendicular, forward. What is the substance, molecular, in the motion of a wave? If everything in the universe is made up of (parts of) a chemical substance, then the water wave is a paradoxical phenomenon. Here is one of the boundaries of the worlds bound by such a theory of information.

It is difficult to understand such a theory, even if it is impossible to hold that reality is only a concrete substance and nothing more. There is nothing better or more extreme about creating math. We discover it if its truths are pseudo-information (acting one-way), alias we are in this world both cause and consequence.

[92] Plato (429?–347 B.C.E.), Athenian citizen of high status.

The assumption that information is ubiquitous implies the idea that space has memory needs to be checked. It would resolve the known paradox of the growing entropy of a substance on the one hand and, say, the reversible operators (evolution) of quantum mechanics.

Breaking the glass and scattering the pieces of the heart increases the *entropy* (clutter) of the glass irreversibly, and part of the (active) information of the substance becomes (passive) information of the space, its past from which the information (in principle) becomes more difficult to activate. Quantum mechanics operators, on the other hand, are all unitary. They are such that the normalized (unit) vectors of probability distribution (substitution) are transformed into the normalized ones, and the unitary processes are reversible, will preserve information.

Space thus remembers so the entropy of a substance spontaneously increases, which means that substances total energy and information are decreasing, in such way that the total energy and information of the universe remains constant. This very slow and persistent flow of substance melting and increasing space affects the expansion of the universe. As I have already written about it based on the principle of information, it is mostly one-way, because the nature is stingy with emissions of information, here from the uncertainty of space into the certainty of substance.

Additionally, that past may (must not) also act as the *dark matter* of the cosmos.

Due to the law of conservation, every aspect of information is finally divisible (because only the infinites could be mapped to their proper parts). More specifically, this refers to outcomes rather than opportunities, rather to current than potential information. Possibilities are boson forms (them may be more, they are tolerate), and outcomes are fermion (one by one, they are not tolerate), so the fermions are the ones, above all, which is the most *infinitely countable*.

When to almost every discrete outcome of a random event (fermion, vacuum site, moment of existence) is joined multiple options from which something might have arisen, we get an uncountable infinite set of possibilities. There are so many sets of states and then worlds that could (or would) happen, but didn't (or wouldn't) because the outcomes are unique (intolerant).

The mathematics of infinity that came up with Cantor's set theory is not easy to retell. There are “equal numbers'' of positive and all integers, because there is a bijection between them. Threading them from zero and alternatively one positive and negative integer, we can count all the integers, so its set is a “countable set'' such as the set of positive integers.

The countable set is also a set of decimals of the number Pi (π = 3.141592...), but not the set of values that such decimals would give. All their values, the *continuum* of real numbers, are obtained when, in an infinite series of positions of digits, we vary infinitely them with decadal digits.

The uncountability of the continuum is proved by the contradiction of the assumption that there is an infinite series of all real numbers from zero to one. Namely, from the assumed sequence of numbers (decimal notation) we observe the first number and the first digit behind the comma (let say it's digit *a*). We assign a different digit (*x*) to it. In the second number, notice the second digit (*b*) and join a different digit (say *y*). Regarding the third digit (*c*) of the third number, attach to the new sequence the new digit ($z \neq c$), etc.

We bead new digits to a new decimal number (0.*xyz*...) that is real one, it is also from 0 to 1, but not equal to any of the numbers in the given string! It differs from the first on the first decimal place, by the second on the second decimal, and differ from any in at least one decimal place; the new number is not in the given series which supposedly has “all'' the real numbers. This is a contradiction with the assumption that real numbers from 0 to 1 can be sorted into one series. Therefore, a continuum cannot be equal to a countably infinite set.

From the infinite, therefore, there is the more infinite, and at the core of this story is that such abstractions are some information also. It doesn't communicate everything with everyone, so it might not be its end either.

3.14 Distributions

I work with *statistics* in social phenomena and I use probability distributions – a colleague asks me for advice – but in new situations I find it difficult to recognize the right one.

My best suggestion would be for him – looking at it more broadly, it doesn't matter, all *distributions* are the same, and in each of the situations it is possible to apply almost any of the statistics. But that proposal is not easy to understand. Without mathematizing, to analyze the nuances of seemingly very different distributions, to see similar broader patterns and their peculiarities at random under a microscope – is that possible?

The basic in probability theory is the *binomial distribution* (Bernoulli). The dice are rolled multiple times (eg 100) and the realizations of the same “desired'' event are counted. When that one of the six numbers is, say, “five'', the expected value is one sixth of all attempts (100/6). It is the average value and the most probable number of “fives'' in the set of all (100) attempts. The chances of others decrease with moving away from that “expected'' value. The mean deviation from the average is called the variance. In the binomial distribution, it is the product of the number of attempts and two probabilities, favorable and unfavorable outcome. The binomial distribution model has many applications.

For example, in the hospital, it was recorded that 75% of all patients (some diseases) die from it. What is the probability that out of five randomly selected patients, three will recover? Due to only two outcomes, it is a binomial distribution – the patient survives or not with probabilities of 0.25 and 0.75, respectively. In a series of five such three are favorable and two unfavorable outcomes, the cube and the square of the given probabilities, and their combination is ten. The product of the probability and combination for retail is 0.1. The chance of three patients out of five random recovering is 1:10.

When you recognize a binomial distribution in a given example, it will be easier in the next one. We count cars on a road and especially those that move at the “desired'' speed. The number of favorable divided by the number of all, in a certain period of time, is the probability of the favorable. To it added probability of unfavorable outcomes is one, so we have a binomial distribution. The distribution of oscillations of gas molecules is in the same scheme. The number of molecules is huge and the binomial distribution is approximated by the so-called *normal distribution*, exponential function of the square of the velocity. Its graph has the famous shape of a Gaussian bell with a vertex above the mean.

If we replace the velocity squares of the exponential function with kinetic energy (multiplied with additional constants), they become exponential functions of the probability distribution of the energy of the molecules. In the exponent, there are no (Gaussian) squares of variables, but first degrees, and the distribution is known as Maxwell-Boltzmann. Exponents are also probabilities, and their logarithms are then information. Visually completely different graphs are connected by internal logic!

Please note that in (my) IT interpretation, MB energy distributions would be *information perception* additions. They are individual “freedoms'' that are each product of the “ability'' of the subject and the corresponding objective “restriction'' on a given (accidental) event. As the “information of perception'' is close to the physical action, the product of the change of energy and the elapsed time, we formally come to the same, to the MB distribution.

From the examples of cars and molecules, we can see that the MB distribution requires air between its entities. This, in turn, indicates its “secret connection'' with Barabási distributions of free networks, the arbitrariness of distance interpreted by that freedom.

Deeper in the microworld, there is no such commotion, the interactions of particles cannot be ignored and the need for a new formula arises. Then the division of elementary particles into fermions and bosons becomes important, the former with the Fermi-Dirac distribution and the latter with the Bose-Einstein distribution. As soon as we move away from the quantum world, the two distributions do not differ, the difference is so subtle. Both are equally well approximated by the thermodynamic (MB) distribution.

The reciprocal value of probability is a mean value of the “number of present'' (equals) from which we randomly extract one. When we add one to that number of gas distributions (MB) we get the distribution of fermions (FD), and if we subtract one we get the distribution of bosons (BA).

These slight, quantum differences are easier to remember if we remember that fermions do not suffer in their environment like themselves, so let's say they present themselves as if there were more of them. Bosons are more tolerant and, conversely, pretend they are not cramped. The fermion distribution also works well in social phenomena in situations where there are several candidates and only one can be chosen. The bosons distribution, among other things, works better in the case of the mentioned free networks. How to understand it?

We transfer the law of conservation of energy or information approximately to the law of conservation of the amount of money in commodity-money transactions. When there are not too many individuals, the analogy with physics then goes further into its distribution. For example, if we freely add new ones with new links to existing nodes of a network, the chances of adding nodes with more links are higher. The degree law of *free networks* comes out of the account, with a very small number of nodes with a very large number of connections versus a very large number of nodes with a small number of connections.

Such are money flow networks (with very few very rich ones), internet networks (with rare concentrators), and even power lines of larger richer countries or social acquaintances and popularity, not only of people but also of movies, songs, politics. Such is the spread of infections in clusters, and recently the idea emerged that the same model applies to the spread of “accidental'' murders in American centers and ghettos.

Because the *power law* applies to free networking it is an approximation of the boson distribution. Namely, the exponential function developed in series and the unit subtracted from it, becomes approximately a function of the power law distribution. With the fermion distribution, that unit would be added and the “magic'' of transition to the power law would disappear.

You should now recognize the smallness of the fundamental difference of the leading distributions, but if you are looking for greater accuracy, this still popular story becomes something else. If it weren't for that, mathematical discoveries would be too easy and we would have been masters of the universe a long time ago.

3.15 Fixed point

As I will not hear about *Banach*[93] fixed-point theorem, so everyone knows that, these are the first words that children say when they speak — a colleague told me jokingly in a conversation about infinity in physics and continuing — I can hardly remember that from a study, remind me. I know that in mathematics, “there is more infinity than the infinite” — quoting me he asked further — but from your explanations, the transfer of the alleged infinity to physics is not quite clear concept?

I agree that infinity is a tough nut to crack for physics and that is why I am reticent in these texts, I say. Infinities are inevitable in mathematics because of the strength of the very principle of contradiction, and then they are part of (my) “information theory” because of the very existence of the idea of them. And, yet I am in no hurry, not for me but for others.

It is confirmed, for example, by the fantastic harmony of mathematical analysis. Although it was a stumbling block to Cantor's theory of sets and a reason for contemporaries to consider him frivolous, the idea of “more infinite than the infinite” prevailed by the power of its logic. *Gödel's*[94] Incompleteness Theorem (that there is no end to truths) is a turning point behind which the existence of infinity in mathematics can be taken for granted.

I believe that (my) information theory will join that development, and here is why. Pseudo-information (pseudo-reality) is the one that affects us, and we do not affect it. Such are, for example, mathematical theorems. How then to explain the *leakage of action* (information) from that pseudo-world towards us, from something that does not change or supplement? I think out loud and the interlocutor joins in with a question. The law of conservation doesn't apply to them? – He asked.

[93] Stefan Banach (1892-1945), Polish mathematician.
[94] Kurt Gödel (1906-1978), Austro-Hungarian-born Austrian mathematician.

Yes, well done, that's one of the good options – I answered – Formally, it does not seem to be the only one, but for now we can consider it sufficient. There is no contradiction, because from the infinite set it is possible to separate out countable infinitely many of its elements and still leave infinitely many of them.

It opens up possibilities that are seemingly in line with many, even with the Gödel's theorem of impossibility. But it is understandable, I guess, that I still can't brag about it, otherwise many would say "I knew he wasn't normal" and the continuation of the theory would be even more anonymous. But let's get back to the topic.

For now, it is silent how, let's say, we have a continuum of points, some definition of distance and a mapping of space into itself. When it is so-called contraction, which means that the copies are closer to each other than the originals, then there is a single "fixed point", the point that is not moved by copying. This theorem was first precisely expressed and proved by the Polish mathematician Stefan Banach in 1922, and since then we have seen it everywhere.

It is the application of infinity. A simple example of the Banach's theorem is a terrain map placed on the ground of the environment it represents. Then there is a single point on the map that exactly matches the place on the ground.

We get the second example starting from an arbitrary triangle ABC. The midpoints of its sides, the points A' on BC, B' on CA and C' on AB form a new triangle A'B'C', and the midpoints of these sides new and so on. In the nth step, the middle of the page forms the nth triangle. It can be shown that the sequence of these triangles converges to one point which is the center of gravity of each triangle in the sequence.

A similar example is "picture in picture" (mise en abyme), placed copies of the picture inside the picture itself. A seemingly infinite series of recursions (procedures or functions that are defined by them) are obtained, which, according to Banach's theorem, contain one fixed point.

A little more "mathematical example" would be proof of the uniqueness of the solution of a "sufficiently regular" differential equation. In the space of functions supplied with metrics (defined distances), which is complete (includes limit values of arrays), with mapping of functions into functions that we then call the operator, the solution of the differential equation, if it exists, is a fixed point of that operator.

Schrödinger's equation is "sufficiently regular", as are almost all other imaginable wave differential equations, which means that each potential can be joined by a wave, but also vice versa that each wave can be joined by a potential. The first is well known in quantum mechanics, and the second is not: each wave can be accompanied by some information, its action, and then energy. The energy-frequency model of physics can then be applied to periodic phenomena in general.

The process of free fall in the gravitational field is an example of contraction mapping, which is especially interesting to us due to the principle of minimalism of information. The physical system spontaneously tends to a state of lesser information; in that sense, the satellite's orbit is its private minimum and "its fixed point." In the usual language of physics, the trajectory consists of the states of the smallest potentials of a given satellite, its potential energy which, multiplied by the constant units of its proper (own) time, gives its proper actions, that is, information again.

It is similar with all other fields of forces, because we also calculate the charge paths in them from the corresponding potentials without violating the rule that the lack of (relative) potential energy is attractive, and the excess is repulsive. All of this would make no sense if the use of infinity in physics were banned.

3.16 Democracy

The lie of the naive seduces, and the cautious teaches. In that saying, there is a lot of sadness and joy of modern *democracies* and societies in general, similar in their desire to achieve some equality among people – whether they are obviously special or are in subtle nuances.

Just as equal starting positions of competitors promise better competitions, so do *equal opportunities* on the market through greater competition or various increasingly interesting conflicts that arise from modern principles of equality of persons before the law. We stand for equality in order to increase the possibilities, for the sake of progress, and for those who feel underestimated to follow us.

But, “no one has drunk a glass of honey yet, which has not convulsed it with a glass of bile,” Njegos wrote. If something is good, it is not universally good. Better treatment today probably causes an unhealthy population tomorrow, state aid to a worse economy hinders the emergence of some better, employment of the politically eligible as much as it contributes to the rise of power through loyalty paves the way for its staggering due to incompetence. Promising competitions for the masses produce champions against whom the ordinary world no longer has a chance.

By squeezing the balloon, its contents overflow somewhere, the tension seeks its unfolding, and the effort for the equality of society flows into some inequality. These are just analogies, of course, but I hope they are useful, if not for understanding the proof of the impossibility of democracy that I will try to sketch, then at least for remembering the results.

On the path to communism, the tending to equality of the working class for each of the society gave birth to a lifelong president. Let us notice the same pattern in dictatorships in general because of their appeal to some equality without which the rule of the masses is not actually possible. Trivializing in the correction of “injustices” produced by the “good” modern legal system, in the race to regulate conflicts that it itself generates by insisting on equality, what we have recently recognized as “political correctness” in a negative sense is emerging. Giving priority to the “free market” resulted in the rule of wealthy individuals, bank owners or corporations.

It is unbelievable, but the principle of equality is the key generator of the mentioned inequalities. I have written about this absurd automatism from various positions – from listing historical events to its causes in the principles of information, and partly in the following way.

The mathematical model of *free networks* consists of nodes with equally probable connections. When we connect a new node with the old ones, the new link has the same chances as any other: that is why it is more likely to belong to a node with more links. It is a general form of equality. The speed of distribution of the *power law* then distinguishes a very small number of nodes with a very large number of links versus a very large number of nodes with very few links, so precisely because of the insistence on equality of connection!

The consequences of "free networking" are further treated formally, such as a multiplication table and often with a known intellectual effort to solve problems from practice using mathematics. Let's try to understand some general points first.

This well-known network legality also has its IT part. The number of links (denoted by *x*) of a node is proportional to the probability of connection (*p*), and since the logarithm of the probability (equally probable outcomes) is information, so the probability proportional to some degree of number of links usually denoted by "minus alpha" ($-\alpha$). Hence the "minus" that the probability *p* decreases when the number *x* increases, so the exponent α is always greater than one. In the most common situations, alpha is a real number between two and three.

The function of cumulative distribution is the probability that the number of links is greater than a given one (again *x*) and is calculated by adding (integrating) the previous probabilities. The result is the so-called *Pareto's law*, a type of power law with alpha by one less (α-1), between one and two, with a graph more similar to the line and simpler to estimate the number of events in a given period.

Pareto's law arranges acquaintances, quotes, books sold, receiving phone calls, likes, spreading the Internet, protein interactions, earthquake magnitudes, crater diameters. It is used in guessing the time until the next earthquake, flood, and asteroid fall.

If there were an infinite number of inhabitants on Earth, and the virus of an infection did not mutate, nor would the other conditions of its spread change, then the growth of the infected would stabilize over time along some (straight) line of Pareto's law. The stochastic phenomenon would then become causal. But in practice, there are limitations that can be included in the account, and hence the optimums, the extreme values of free network expansion.

The current achieved value divided by the optimal is the computable coefficient of the network, which is popularly called the *rule 80-20*. The "80-20" rule says that about 80 percent of free networks will be nodes with few connections, and the other 20 percent will be nodes with many connections. The interesting thing about this calculation is roughly this same relationship, its great independence from the type of free network.

Another interesting thing about free networks is that "my friend has more friends than me". There is more, and there is more charm in finding interesting things ourselves. I will add, free networks are also situations when one can lie freely, spread untruths relieved of the danger that someone will catch and punish us for that. For example, if this is the case with the placement of *fake news* on the Internet, then the "80-20" rule says that a lie spreads four times faster on the Internet than the truth. Approximately, this relationship could, I suppose, be the scope of written fiction versus learned works, the proportion of worse and best students in school or what an individual did not and did not understand in a lecture.

Finally, democratic rights include some rights to lie. One should be naive and not notice that people do not telling the truth and do not know how to read the truth about them, about the world and oneself from those lies, because then it is no longer matter of democracy, but it is up to the reader.

3.17 Present

Where does the *present* come from? This is important, and perhaps the central question of my “information theory”, to which the answer might seem so unusual that it is better to remain silent. This is part of that story.

In all physical interactions, something communicates with something, actions are exchanged and reality is defined. When one subject communicates with another, the two of them are mutually real, and if the other can communicate with the third, with whom the first does not have to directly, then we say that the third is also mutually real (some kind) with the first. The story of “reality” is thus reflected in networks and formalism, and the inconsistency of mathematics becomes the correctness of this unusual definition of reality based on chains of interactions.

Wherever there is energy and change, there are actions, and then information, but also vice versa, because information is omnipresent in this interpretation. In such conditions there is no place for an “abstract world”, say logical truths that would be “out there somewhere” outside the physical and independent of it. Here, everything we observe changes us, even the discovery of Pythagoras' theorem, despite the fact that we do not change it.

An abstract idea that is timeless is energy-free (the quantum of action is the product of a change in energy and duration), but since we are not able to comprehend infinitely long duration, then we do not get even infinitesimal action. I am not claiming that infinities do not exist, by the way, but that what we can take from them is at most finite.

The known proof of *Noether's*[95] theorem[96] derived from Euler-Lagrange equations of motion does not apply to asymmetric interactions and therefore there is no law of conservation. This means that “closed'' pseudo-systems can (do not have to) lose (gain) information and, in particular, it is possible to constantly subtract parts from the world of mathematical truths, while it remains equally infinite.

That there are more mathematical truths than elements of any conceivable set is guaranteed by Russell's paradox (there is no set of all sets), then proof of (Zermelo) set theory that there is a greater than every infinity, even Gödel's theorem of impossibility, and the world of truth is bigger.

In other words, there is the possibility of creating the present by filtering information from an infinite pseudo-world of truth. Through the sieve of the law of information maintenance and other principles of physics, abstract ideas are separated into forms of concrete reality. Along with taking over from infinity, and because real information “disappears” at the time when it “occurs”, it also accumulates in the past.

[95] Emmy Noether (1882-1935), German mathematician.
[96] see: https://www.academia.edu/39562358/Emmy_Noether_--_Poetry_of_logical_ideas

At the same time, unlike the unchanged amount of the present, for the future and the past, the law of conservation becomes debatable.

The world of the past is “pseudo” (false, one-way) because the past accumulates; new quantities of the present are constantly deposited in it and form a “false” reality different from abstract truths. Both are informative for (our) present and are able to act directly on it, but abstract truths do it subtly and almost always equally, and the past is less often the older it is. Like the effect of gravity decreasing with spatial distance, the influence of the past decreases with time.

The new theory of information occasionally turns out to be so shocking that it should be retold as a fairy tale, even if we believe that there is no fairy tale. But it is not enough to assume that the present awaits a certain, static schedule of events in the future, even if their choice is considered uncertain, in a theory that cannot do without objective coincidences. We would then make a mistake as in the interpretation of Heisenberg's relations of uncertainty as a kind of only our ignorance, making then a theory contradictory to Bell's theorem on quantum entanglement.

Due to the extremely low intensity of the actions we are talking about, the consequences of this aspect of the information theory are easier to see in cosmology. We know that the visible part of the universe is limited because its farther points move away from us faster and faster, so that those beyond the *event horizon* – which move away from us at the speed of light – escape us. That is why there is more and more space in relation to the substance within the universe visible to us.

I explained this expansion of the universe from the principle of minimalism of information and I would not repeat it now. In short, one of the explanations is, *space remembers* and matter melts into space at the rate of spontaneous entropy growth. What is more interesting now is the following hypothetical question: is the total amount (of information) of space and substance always exactly constant and how could we check this by observation?

For example, because substances are slowing down less and less, the expanding of the space slows down (never stops), unless the space receives additional information from the pseudo-world of truth. However, if the total arrival of the future into the present of the substance slows down, the time of the universe could also slow down.

Is it otherwise an unexpected consequence? It is not, because, for example, the relatively slower *flow of time* in the universe results from the increase in the “mass” (energy) of its space. Namely, the properties of the gravitational field may be initiated by the mass it contains at one point, but they are further maintained by the space that surrounds that mass. This turns out to be in line with Einstein's theory of relativity, although it seems like a surprise.

In information theory, now all of a sudden, the meaning of a space that becomes increasingly, say, “thicker” to leave for later the term “pregnant”, and then its special contribution to relativistic effects (relative increase in energy or slowing down the time of the bodies in the field) becomes more visible.

3.18 Quantity of Options

The screen image consists of a grid of *pixels* (dots). Older TVs and many 32-inch ones have a million (720p), smaller 49-inch models have just over two million, and newer 50-inch and more have eight million up to the latest with over 33 million pixels (8K). In order to see one pixel of such a TV, you need a magnifier.

The *screen resolution* refers to the number of pixels of the grid that makes up the image. Not to exaggerate, because that doesn't matter for the point of this story, I'll stick to the 720p resolution which means a matrix of 1280 × 720 pixels arranged in columns that make up the width of the screen and the rows that make up the height.

Each pixel can be controlled by the mains' voltage that defines its brightness and color. Light is digitized, said and quantized, usually in eight bits with which 256 (eighth degree of two) levels of intensity are achieved. Each brightness goes in three basic colors (3 × 8 = 24 bits) which make a spectrum with more than 16 million brightness' and colors per pixel (256^3).

If we multiply the number of spectrum possibilities of an individual pixel by the number of them in the matrix, we get the amount of screen options, which is a simple number of screen possibilities. A more complex type of quantity of options is information. It is not the immediate number of possibilities, but the logarithm of that number. Information is also a matter of control.

We can arrange all rows of matrices into one line and consider pixels (spectra) as components of a vector. Dividing that string into two parts, and then the part that interests us more into two again, and so on, we get to one pixel. The number of divisions is the logarithm (base two) of the number of all and it is the screen resolution information. When the pixels have the same capabilities this is the *Hartley Information* named after the engineer of the Bell Company who first defined it in 1928.

One bit is one position with two possibilities, has or has not current, or 1 and 0, it is the basic unit of information. Three bits have eight possibilities (two to the third power, $2^3 = 8$), five bits 32 possibilities (two to the fifth), and the product of the number of possibilities (8 × 32 = 256) is the sum of the information of these possibilities (3 + 5 = 8). This is a feature of the logarithms that Hartley observed, enabling the Bell telephone company to start measuring the consumption of information analogous to the consumption of water or electricity.

The same applies to the collection of the *amount of uncertainty* of random events, which is then also called information. For example, there are 2 outcomes of tossing coins and 6 of throwing dice. Throwing both a coin and a dice has 12 = 2 × 6 outcomes, and their information is equal to the sum of the individual information of the coin and the dice. The logarithm of the number 12 is equal to the sum of the logarithms of 2 and 6.

The information of the pixel spectrum (8) multiplied by the current pixel intensity (number from 0 to 256) is the current activity of the pixels, and the sum of all these is the total intensity of the screen image at a given moment. When pixels are occasionally not active but are included by some distribution (independent event probabilities of unit sum), then the sum of probability products and corresponding information will give the average information of each pixel.

That average is *Shannon's definition* of information. It is named after the mathematician who founded it in 1948, also working in the Bell Company. A huge number of theoretical papers on the capacity of the channel that transmits information, on Markov chains, ergodic source, crypto codes and their applications, confirm the correctness of the ideas of Shannon and Hartley.

Note further that the variation of nuances in these definitions gives “surprisingly large” differences in the meaning of the terms. This is typical of mathematics and is a frequent cause of its alleged misunderstanding by laymen, and when it comes to new discoveries it is also the reason for misunderstandings among connoisseurs.

Information perception is the next step in information theory. It generalizes the previous two definitions, and it concerns physical action. For example, the emission of a screen image is also a matter of consumption or emission of energy over a given time. Multiplying unit information by energy and adding by spectrum and resolution we get the sum of the products of pairs of two sets of values, the sum of the products of the components of two vectors, which we call perception information.

The components of a vector represent individual dimensions of a vector space and their number can be huge. However, when the two such starts from the same origin point, they lie in a single plane, we say they span a parallelogram. The area that the *vectors span* is equal to the product of the intensity of the vectors and the sine of the angle between them. In addition, there are their mutual projections that are created by multiplying the intensity and cosine of the same angle. Both of these values are important in information perception theory, but they are not today's topic.

Common to the three definitions of information is their increment with the growth of the number of options and uncertainties. Outcome information decreases with probability, so the principle of more frequent realization of more probable events becomes the principle of less frequent realization of more informative ones.

Unlike the previous two definitions, there is no information of perception without energy or action (there is no change of energy without time). The mentioned, and otherwise new, principle of information minimalism is equivalent to the long-known principle of least action in physics. Then it is confirmed that the law of conservation applies to information (perception), such as the conservation of energy, and suddenly it turns out that such a law must also apply to probability itself.

I develop the theory of “information perception” quite lonely, but from years of work it is evident that it opens Pandora's Box not only of miracles within mathematics and physics, but from social phenomena, through biology, to artificial intelligence technologies. Hence, so many sequels to these more carefully viewed very different information stories.

3.19 Flows of Events

Quantum physics divides *elementary particles* into bosons and fermions. The spin (internal magnetic moment) of the boson is represented by an integer, the spin of the fermion by half. The force fields are made up of bosons that exert their effects on the corresponding fermions. Bosons tolerate equals in the same place (space-time events), fermions do not. I'm just mentioning familiar traits.

Parts of electromagnetic radiation, photons to which *visible light* also belongs, are types of *bosons* — tolerant particles. They do not collide with each other, but are ignored, bypassed or interfered with, and the components of white light as elementary colors are obtained by refraction through Newton's prism. It then shows us that there is a quantum structure (in the photon of white light) locked in some process of coherence with its own law of conservation.

Unitary operators (processes) of quantum physics confirm this conclusion everywhere. By being *reversible* (invertible, regular) these linear operators that represent the quantum evolution, store and remember the information. Cases of ignoring bosons by bosons can be added to them as a kind of mutual *independence*. It is a disinterest similar to everyday life in tolerating something, someone's behavior, insults or praise that would provoke reactions milder than normal, that we would pay less attention to than usual, or would not touch us and be irrelevant to us.

The Pauli principle of exclusion applies to *fermions*: two identical ones cannot be in the same quantum state. For example, two identical electrons cannot be in the same atom. Electrons communicate using *virtual photons* that are always somewhere around, while the photons themselves do not have such an incident. It is a well-known process of *Feynman*[97] diagrams, and the overtone of his schemes that we now listen to is that a randomly taken type of particle communicates with a fermion rather than a boson.

Virtual photons constantly leave a given electron and, if one of them interacts with another electron, the photon becomes real and the two electrons are electrically repelled by the Coulomb force. As with boats on water, when we throw a bag of sand from one to the other, the subtracted photon momentum from the first electron is added to the second.

So it makes more sense to talk about photons without electrons than vice versa, about electrons without photons; as if there is a tendency to have more photons than electrons. With the square of the distance between the electrons, the probability of that interaction decreases, but its quantity is constant, so (recently) I assume that virtual photons propagate as concentric wave spheres, with the probability of action in smaller amplitudes stretching over the surface of the sphere. However, even that is not enough to explain where all these (virtual) photons come from and what if not all of them are realized.

In addition, it is known that in the mentioned exchange, for example, the spin of the first electron +½ decreases by the spin of the photon, then +1, and the second increases by that much, which means that the spin of the second electron had to be -½. The next exchange can only be reversed, to subtract the

[97] Richard Feynman (1918-1988), American theoretical physicist.

second electron spin from the unit and add it to the first. Hence, the following remark that the process of exchange of (virtual) photons between electrons is very selective. In this I see the confirmation of the "strange" new idea of "taking the present from the infinite" which befits the theory of universal information.

Even if you didn't think it was speculative before, you probably want to in continue. Holding that every event must go with a change of some action (read information) and vice versa, the knowledge of Pythagoras' theorem (or any other) should work on us.

However, the power of action of abstract truth depends on the objective amount of perception, and it is always some final value. Regardless of the fact that (if) the duration of the theorem is infinite and the energy that such a transfer could therefore be null and void, any physical perception is always finite. I emphasize once again, the product of energy and time is a physical action (information) with a positive minimum (quantum) whose one multiplier (time) if the other grows indefinitely (energy) decreases indefinitely.

The laws of conservation apply to physical actions as well as to energies, and these are therefore finite quantities. The finiteness of physical quantities can take over parts of the infinite in accordance with the laws of physics and its power of perception, while infinity remains unchanged, because its basic property is that it can be its real (proper) part. By subtracting (adding) to infinity a certain amount, it can remain the same, which is not possible with finite ones.

These well-known attitudes of mathematics still do not have their application in physics, and we are now connecting them to the world of elementary particles. To the above (hypo) thesis, that the "inflow of the present" (from the infinite) to bosons is less probable than to fermions, we further add the previously mentioned "melting of substance into space", i.e. fermions into bosons. The idea of such a course of events comes from the principle of minimalism of information, but it can also be derived from the (generalized) spontaneous growth of the entropy of matter. Anyway, the space of the universe is more and more, and the substances are less and less.

Because space becomes "thicker" with age and because it is the ultimate carrier of the gravitational field — relative time slows down. Due to the increase in the energy of space-time itself, the values of the energy tensor on the right side of Einstein's general field equations increase, so we can consider this phenomenon as a new-old effect of gravity. This is because gravitational attraction always leads to a slower flow of time, whereby the mentioned increase in space takes on the character of gravitational.

On the other hand, it is justified to say that time flows more slowly and because there are more and more bosons and less and fewer fermions. Interactions of the present with the infinite are less and less probable and transmissions into physical reality are becoming rarer, and I define the relative speed of time in information theory by the perceived "amount of events".

3.20 Dichotomy

In religion, ethics, philosophy and psychology, *good and evil* are common *dichotomies* (division of the whole into two equal non-overlapping parts). Whether the development of information theory happens in the way I imagine it and it interferes with these, for now non-mathematical concepts or not — it is interesting to consider them. In addition, they are informatics more than solid phenomena.

The starting principle of information is its *comprehensiveness*. Honestly, several years ago, I imagined a "self-sufficient" universe of information only as an attempt to find contradictions, and it has remained so to this day. Reduction to contradiction is a powerful method of mathematics, typical of it, tested and reliable, but it often proves too difficult, and we cannot always count on it.

Deduction is also a method of mathematics, otherwise worthless when at the beginning of each chain "if is, then is" there is no proven truth. In that sense, it is a secondary way of final research (experiment is a kind of proof by contradiction) and that is why it is primary in manipulating the truth (for fun, marketing, in politics). This presumed exact beginning of the chain of implications in the topic of "good and evil" could be a universal possibility of mapping "correct" into "incorrect" and vice versa. This is evident in the operations of Boolean *algebra of logic*.

These operations agree well with the aforementioned principle of comprehensiveness, this one with the finding that information is action and it further with the understanding that action must be something that is true. Thus, we come to the conclusion that the world of truth joins the world of lies by *bijection*, a mapping that is both one-to-one (an injection) and onto (a surjection), to a completely new thesis with enormous implications. I emphasize, everything that can happen is true, but it does not have to be provable to us and, again, everything that is true does not have to be available to us.

The information theory I am talking about implies some coincidences, hence unpredictability, inability to communicate everything with everyone, and then the limitations of perceptions of any subject (living or inanimate being, body or particle of physics), so it is in itself in line with the stated attitude, that a lie is not what we thought it was.

It turns out that the seemingly foreign "world of lies'' contains exactly as many truths, moreover, also the same ones that are in the "world of truths'' known to us, packaged in ways that are harder for us to access. It is the first step, to see the universe of information with that inner symmetry, with the easiest way of knowing by reading immediate truths, and the others more tedious. The next step is to join the individual notion of "good'' (one by one) of the logical value "true''.

The idea of less and less good in order to eventually reach "evil" does not work now, because it would be reduced to polyvalent logic (true, perhaps, false) and the theorem there that any ambiguous logic can be derived from bivalent (true, false). Also, there is no longer a dichotomy of good and evil, and the question is what could this world be like?

When a huge meteor fell to Earth nearly 66 million years ago and killed the *dinosaurs* that dominated the planet for hundred of millions of years, the possibility was opened for mammals and eventually humans to develop and rule. Deforestation seems good to some, but it also deprives the environment of others and who knows what damage it does to this planet and then to us on it. By supporting the unsuccessful company with donations, the unknown self-sustainable is not allowed to exist.

In short, good and evil could be relative terms dependent on the observer. This view is in line with the information of perception, I note once again, because it values the perception of things always relatively, in relation to a given subject. We communicate because we do not have everything we want, nor can we ever have it, and because of the limitations of perceptions, the world is then always at least a little different for different subjects.

Because the essence of information is uncertainty, and *information is universal* (everything that exists has it and without it exists nothing), no subject can know everything; there is no standpoint, nor standpoints, from which the total universal and across-the-board truth could be derived. This would be a possible proof of *Gödel's incompleteness theorem* derived using the above information theory, or let's say a proof of the impossibility of the existence of a set of all sets (Russell's paradox), but, for now, it is only an evidence and another confirmation of this theory.

In that ancient saying that in every good there is something bad and in every evil there is good, for now we emphasize: to one good is to another bad. Something that is "bad" for all our previous civilizations may be "good" for some future, or for some other living species around us, but it doesn't have to be. Mappings between "good" and "bad" can be separated by cosmic distances or eons, but they are always parts of the information universe.

That such a model is logically possible; I will sketch the proof using graph theory. Let some points be given, nodes of the graph, with or without connections between pairs. An arrow (plus) can appears at the end of the link if the link for the given node is "good", otherwise it is "bad". If there is a link between two nodes, it can have two, one and no arrows. However, a graph is possible in which each node with a "good" link also has a "bad" link.

For example, nodes A, B, and C are assigned meanings in order: dinosaur survival, meteor destructive power, and mammalian development. Then it is $A \to B$, $B \to C$ and $C \to A$. First, we interpret that the greater destructive power of meteors has a worse effect on the survival of dinosaurs, then that the greater destructive power of meteors facilitates the development of mammals, and third, that the development of mammals begins at the end of dinosaur survival. Each of the three nodes is "good" for one and "bad" for the other.

3.21 Fiction

Fictions in everyday speech mean the creation of a separate world through literature, film, painting or art in general, but also incorrect ideas that run through our heads. We believe that only living beings can have fiction, and that they generally experience it differently.

Although it is outside the materialistic models of the world, it is made up of some data that can move us and therefore it is part of the universe of information. Behind any information there is an action and vice versa — with any action comes some information, so fiction is the topic of "information physics". An important part of it understanding is reality through communication.

If two phenomena can communicate directly, we will say that they are mutually directly real, and if there is no direct communication, but there is a third phenomenon that could communicate with both, then the first two are (only) mutually real. Thus, photons are mutually real because they can communicate via electrons and are not directly mutually real because they do not communicate directly. In the world of information, all phenomena are real, not just primary or secondary ones.

The secondary includes the pseudo-reality with which we “communicate” one-way. It can affect us, but we not on it, like (I guess) a mathematical theorem or the past. There are also fictitious phenomena that can affect us, and we can affect them, but whose information is received differently by different subjects. God is partly pseudo-reality and fiction, and we have examples of the overlap of fiction and reality in the quantum world. I'll explain the latter.

If process A will not significantly change the state of x, then we have the characteristic equation $Ax = x$, otherwise we have some $Bx = y$. It is the alphabet of quantum mechanics, where A and B are unitary operators, and x and y are vectors. $ABx = Ay = z$ and $BAx = Bx = y$ apply to the compositions of these processes, so when z-y = x we have Heisenberg uncertainty relations and, in general, if z is not y, we have non commutativity of processes A and B and reality overlaps with fiction.

Note that a similar formalism of quantum operators and vectors is applicable to the macro world of physics, with a clear phase separation, operations A and B. When there are no restrictions on the relations of uncertainty then there is no mixing of reality and fiction. And since each (unitary) operator can be decomposed into factors, then we have the complexity (composition) of the process up to their fragmentation to the bottom of the micro world.

In the quantum world, we do not consider living beings, but due to more dominant uncertainty, i.e. coincidence, the choice of micro world particles is proportionally larger. Where does this difference come from? First of all, it is a consequence of the law of large numbers, which increases the certainty of the “big world”, and then there is the mentioned mixing of reality and fiction inherent in the “small world”. The result is the absence of natural fiction in the world of the big and the absence of life in the world of the small.

The excess information created by synergy is a particularly interesting phenomenon. It occurs similarly to the excess action of storms that are born, scattered and end in a couple of hours, or can last and last like the “Big Red Spot” on Jupiter, defying principled minimalism. By skimping on information emissions, there is both an excess and a lack of vitality, just as the striving for as few effects as possible gives birth to a storm as well as calms it down.

The attraction of the information deficit keeps the electron in the atom from which it can erupt only by externally added excess (photon), but also such very selectively. Because information is equivalent to the product of energy and time (action), and units of time in the case of atoms can be unified, then we interpret the lack of information as negative potential.

Negative potential energy is more attractive than positive when it represents a lack of information, so then positive potential energy is repulsive. The deeper cause of this is, I repeat, the principle of minimalism of information, a very mild, ubiquitous and persistent force. On the other hand, diversity and pickiness are immanent to the world of information that defies the former and encourages storms and life.

Through the creation of surplus in the general aspiration to deficiency or the planting of untruths in escaping from lighter forms of truth, apparent dichotomies, fictions and various other expressions of the principles of information, nature's aspirations not to act while everything consists only of actions are incredible.

3.22 Light

Light is a flickering vacuum. The number of vibrations per second, frequency f from 400 to 790 terahertz, makes information about the color of light: from red, through yellow, green, blue to purple. The light energy $E = hf$, and therefore the color, depends only on the number of oscillations. Planck's universal constant h is also the smallest physical *action*.

Frequencies outside the given (light) range belong to other photons, the smallest particles-waves of electromagnetic radiation. In fact, the product of energy E and duration t is equivalent to information, and the options that a photon could have can be reduced to some mean number N of equally probable outcomes, so that the logarithm of that number ($\ln N = kEt$, constant k) is just *photon information*.

The number N, the numerus of the logarithm, is an exponential function of the action, $N = \exp(kEt)$, and the reciprocal value is the probability of one of the equal outcomes, $P = \exp(-kEt)$. If the constant k belongs to a set of complex numbers, these probabilities take the known form of a wave function and, moreover, the solution is Schrödinger's equations for a free particle in general.

In this popular explanation, I intentionally do not avoid the mentioned “easy” formulas because of the demonstration of the simplicity of (my) information theory. By the way, this is one of the most difficult topics in the exact sciences, and Schrödinger's equation itself is one of the two epicenters of accuracy and the difficulty of intuitively understanding quantum physics. The continuation of the story is the wave nature of particles, interference and the problem of shape.

When the mentioned constant k is a complex number, the upper exponential and logarithmic functions become periodic and the energy transfer of the photon is a wave. Like a water wave that moves the energy of water horizontally, perpendicular to its molecules moving vertically, a photon is a vacuum wave without other very numerous vacuum options.

In official physics, the *interference* is the appearance of the mutual influence of waves, the result of which can be their amplification, weakening or cancellation. This is considered a very complex physical process that occurs when waves interact in correlation or coherence, either because they come from the same source or because of (almost) the same frequency. Interference is known to all types of waves, light, radio, sound or, for example, water surface waves.

For us here, interference is the packing of multi-wave information. A simple wave travels horizontally, deviating correctly and periodically up and down from the main direction like a sinusoidal graph. A complex wave obtained by the interference of several of them would represent a curve whose parts also wave in practically innumerable ways. Sinusoidal disorders are again periodic and represent the "fingerprint" of the waves present.

Visible light interference will give *white color*. It can be decomposed into the elements by passing through Newton's prism, which is, among other things, proof that interference does not destroy the structure of its components, and that there is no significant interaction of photons. Photons tolerate each other because they are a type of boson.

There are other interpretations of photon shapes. For example, photons as false balls were recently described by an Indian physicist (Narendra Swarup Agarwal, 2015). He showed that they too can leave a sinusoid-like trace and mimic the packing of information by interference. Here, this difference in the interpretation of shapes, on the other hand, we understand that shape is not important for photons.

We can also draw the last understanding from mathematics. Namely, almost any part of an arbitrary function can be used to construct with a given accuracy the periodic interval of almost every other function (Fourier transform, 1822). This makes it possible to represent "shapes" and photons in countless ways. In other words, I don't consider it best to insist on a (unique) photon shape.

The principle of information minimalism is a special spice to the science of photons. It dictates that information arises when disappears, as if the information does not want to exist but cannot escape the law of conservation. Light and all other elementary information therefore simply said vibrate because they have a certain amount of data that they would be happy to resolve off if they could. Consistently further, information is pooled, synchronized and interfered and their freedoms are drowned in the group. For example, an electron, striving for minimalism, will join an atom and get rid of a photon.

With the new understanding, photons are like waves in a "sea" of vacuum. They are a surplus and a disorder that moves on the "surface" of a huge "mass" of space whose "interior" is a past that is constantly being deposited. Space is also information, so the universe is not equal to itself in any two moments, it is always news that it could exist in the "universe of information".

According to such a (hypo) thesis, the particle-wave today could interfere with the corresponding wave that passed the same path yesterday. Confirmation of this strange conclusion can be sought in the timeless nature of some equations of quantum mechanics, for example, in calculating the interference of a photon with itself as it passes through two narrow slits.

Quantum mechanics uses this otherwise *Young*[98] experiment (1802) to prove the wave nature of light and to prove the wave nature of other particles, and the confusing interference of an isolated quantum (the smallest packet wave of probability) with itself for now has interpreted only by its splitting for the simultaneous passage through two openings and interference of parts after.

[98] Thomas Young (1773-1829), English scientist.

3.23 Gravity

The basic "force" of information theory (which I represent) comes from the principled minimalism of communication, from the (hypo) thesis that nature prefers less emission of information as it prefers to realize more probable outcomes of random events. We see that concept everywhere.

For example, it is in the capacity of news that the repeated fades or that too much information misinforms us, that in the multitude the data is hidden like a needle in a haystack. The tendency of knowledge to disguise itself, in its own way, is also found in the law of large numbers (LLN) of probability theory. The diminishing uncertainty of a larger mass is also a decrease in the freedom of movement of particles that are in the mass — due to the higher priority of the center of the *gravitational* force generated by them.

Let's abstract LLN from the gravitational field of large mass (particles of matter or energy) and again we will get more certainty. We will get a smaller inflow of the present and, according to the "information theory", a slower flow of time. Relative time flows at a speed defined by the amount of realized random events. From the general theory of relativity we have the same conclusion about the relative perception of time with the remark (I wrote in more detail earlier) that the deficit of relative time in relation to one's own (proper) is exactly equal to the excess of one's own presence in parallel-reality.

At the other end of the scale, in a quantum world of small magnitudes, uncertainties are just as dominant as a particle violating the laws of (large) physics; it is (temporarily) absent or is duplicated (simultaneously). Her multiple appearances were frequent enough that she could interfere with herself by going through a "double slot." Now I am talking about the famous Young's experiment (Young's double-slit experiment, 1802), which once proved the wave nature of light, and which confuses physicists today more than ever.

Photons (but also other particles) when directed individually towards a curtain with two close slits will pass as if they were interfering with themselves and on the screen behind they will form characteristic bands *diffraction*. This phenomenon, I believe (as I wrote earlier), was observed by *Everett*[99] (1957) and described as interference of copies of the same particle in *many worlds*. Because of similar "copies" that he considered to be made wherever they had at least a chance, he was so despised by the academic community that he left his work in science.

The commitment of an individual to the environment can be calculated by scalar multiplication of vectors that in quantum mechanics represent superposition, the probabilities of possible outcomes in the observable. The components of vectors give observational distributions of observations (Born's law, 1926) in relation to given circumstances (quantum system), so a scalar product that is never greater than the product of the intensity of the vectors themselves (Schwarz inequality, 1888) is not greater than one. Hence, comes the meaning of probability for these products.

Namely, the vectors of quantum states (particles) represent probability distributions, and they are therefore of unit norms (intensities). Their scalar products (the sum of the products of the

[99] Hugh Everett III (1930-1982), American physicist.

corresponding pairs of components) are not greater than the products of their norms, of one, and have probability values. States unite if they have the opportunity to make the probability of their coupling higher, and they then gravitate into less informative.

The assumption is that a similar mechanism drives the evolution of life in general and makes the herd prone to subjugation or people to association.

There are various consequences of this, and one of them is the existence of borders. The accumulation of uncertainty increases the number of individuals, but reduces their significance and impact. The rise of some and the fall of others are found in an extreme we call the *optimum*.

Optimal is, for example, the state of a satellite in free fall in a gravitational field when its subjects do not feel external attraction. No matter what the gravitational field is around, there is no gravity inside the satellite at a given moment. It can be proved that this is the state of least action, because the satellites move along geodesic lines which are solutions of Euler-Lagrange equations. These are trajectories derived from the principle of the least action of physics, from which it is possible to derive Einstein's general field equations.

Information is equivalent to action, and in that sense, satellites move in orbit, adhering to the above-mentioned principle of minimalism of communication. The state of minimum communication is the state of minimum emission of information and both go with the most probable random events and the state of maximum entropy. All these phenomena are equivalent to each other and to the *principle of inertia* discovered by Galileo (1590), Newton (1728) and Einstein (1916).

Since I advocate the connection between spontaneous growth (generalized) *entropy* and the attractive force of gravity, some (well-meaning and others) correct me that the entropy of a stronger gravitational field must be higher, because for God's sake, they say, it is therefore attractive, and you ‘’made a mistake’’ into the opposite statement. I mention this as one persistent misunderstanding.

The body has the highest relative (own, proper) entropy in the state of free fall when the gas molecules in the room are evenly distributed. The lower is the entropy of the body standing below or above the orbit, because the molecules are then unevenly distributed, the lower ones are denser. So it would be according to *Boltzmann* statistical interpretation of entropy (1872), but also according to *Shannon* (1948) where an increase in entropy means a loss of information.

Thus, the entropy of a fixed point is lower in a stronger field and higher in a weaker one, and it is always lower than the entropy of a satellite in orbit (on a geodesic). That is why the satellite moves, or the field moves in relation to the satellite. In general, the greatest entropy of a body is in relative rest, when it has the least information, so it will not spontaneously pass into a state of motion, and hence the *law of inertia*.

3.24 Many Worlds

According to the “theory of uncertainty”, information and action are equivalent concepts, so are communication and interaction as well. All reality consists only of information, and this of uncertainty, which means that the realization of something is always possible, and everything is impossible. What follows are consequences that may seem so speculative to some that it is better to keep them quiet.

We say that primarily two subjects (particles, bodies, or people) that can communicate directly are real, and if there is a third with which both can communicate, then they are secondarily real. We set the relation *reality* so as to discuss its transitivity (if *A* is in relation to *B* and *B* is in relation to *C* then *A* is in relation to *C*). The goal is Everett's proposal *many worlds* of quantum mechanics and "information theory", and here's how.

Let's say we accept the explanation of the experiment *double slit* using the mentioned multiverse (existences of secondary realities that are not primary) and accept the "fantasy" that in the case of two places where a particle-wave can be found it remains in reality at one and goes to parallel (secondary) reality to another. If in the "other" reality it has the same choices, there is a chance that the same particle will reappear in the primary reality, now as a double. In *Everett's* time (1957) such ideas were insane.

Today, we know from experiments about the double appearances of the same particle-wave, and this explanation of its interference with itself is worth considering. Uncertainty is so dominant in the "small world" that the description mentioned there is more significant, that the notion of the real is relative, and the question now is can we somehow introduce and test such a description in the "big world" of physics?

Every body is a multitude of particles and its part always communicates with the parallel reality. To simplify things, we will talk about some mean value of the number of body particles in a given situation, by which we consider both the particles themselves and their positions and moment. Like, say, the average weight of a group of people whose value none of those present have, we can use (this imaginary average value) in an appropriate calculation.

Let the first body we observe be close, at a distance r, to some other much larger body of mass M, and we are distant relative observers. We say we are out of a two-body system. According to the above definition of reality, all particles of the first body are real with itself (to their proper), but they are not necessarily real with the relative. That part of the first body which is not part of the reality of the third, the deficit of the relative reality of the first body, is proportional to the total mass of the two bodies (approximately M). The deficit of the relative number of events that happen to the (first) body is proportional to that. Let me remind you, space, time and matter are information itself.

In *information theory*, the number of random events defines time. Let the proper (own) elapsed time be t and let us denote the corresponding relatively observed one with t'. The relative time deficit is proportional to the total mass of the two bodies, $t'-t = t'kM$, where the coefficient k is a very small number that decreases with distance r. Hence, we calculate the dilation (deceleration) of relative time, $t' = t/(1-kM)$. Such a written result can be compared with the one known from the general theory of relativity.

In *Einstein's* general field equations, $G_{ij} = T_{ij}$, on the left is the space-time geometry tensor, on the right the energy, and the indices i and j each take the values of three spatial and one time coordinates. *Schwarzschild*[100] solution of these equations applies to weak centrally symmetric gravitational fields such as the Moon, Earth or the Sun. It roughly (very accurately) coincides with Newton's gravity, but we usually represent it by means of the space-time interval expressed by the coefficients g_{ij}, the so-called *metric tensor*.

When we work with orthogonal (vertical) coordinates in a spherical system, of the $4 \times 4 = 16$ possible coefficients of the metric tensor, all 12 with different indices are zeros, and the remaining four define Einstein's *Pythagorean Theorem*, i.e. the square of the length of the "diagonal" expressed by the sum of the squares of the "leg" 4-D space-time of gravity. In particular, the "time coefficient", g_{44}, which stands next to the square of the time coordinates of the mentioned interval, and which is greater than one, expresses the (slowed down) velocity of the body's time flow in the gravitational field.

It is interesting that this coefficient corresponds to the above result for the dilation of relative time predicted on the basis of Everett's idea of "many worlds", and that the slowing of time resulting from assumed parallel realities and (hypo) thesis that the flow of time is proportional to the number of random events agree also with the theory of relativity.

In this order of presentation, confirmation of the idea of parallel realities in Einstein's general equations, otherwise based on (Galileo's, Newton's, and then Einstein's) principle of inertia, was sought. But, once we accept the settings of "information theory", we will derive Einstein's equations from them in the described way, then not necessarily mentioning inertia. The principle of inertia will remain a special case of the principle (minimalism) of information.

The space-time metric coefficient, g_{44}, otherwise indicates the relative flow of time. Einstein himself used to say that gravity pulls bodies towards a slower time, and now we add, because the lack of information is attractive.

3.25 Space Memory

Space remembers. It is a warehouse of the past that we see with light and other particles from distant stars, in the distance of galaxies from which we read the age of the universe, in the deposits of "memory" in relation to which the water in the basin accelerates as it turns and spills, then perhaps in traces of memories we call *dark matter*.

Light year is the path that light travels in a year at a speed of about three hundred thousand kilometers per second. The nearest stars to Earth are three in the Alpha Centauri system, a little more than four light years away from us. They are closest to us, except for the Sun, which is almost 150 million kilometers away from the Earth, one hundred thousandth of a light year.

The diameter of the *galaxy* "Milky Way" is 100-180 thousand light years. There is our solar system with maybe up to 400 billion other stars. The Milky Way is part of a local group of 54 true and dwarf galaxies,

[100] Karl Schwarzschild (1873-1916), German physicist.

a formation called the “Virgo Supercluster” with a diameter of more than 110 million light-years. It is estimated that there are at least 200 billion galaxies in the visible universe, and the most distant galaxy discovered to date is MACS0647-JD, about 13.3 billion light-years from Earth.

The distances between the galaxies, mega galaxies and quasars themselves are much larger than the interstellar ones; they range from several hundred thousand to several million light years. These distances are not constant and on average grow steadily over time, so we assume that the universe is constantly expanding, and then we calculate that its expansion began about 13.8 billion years ago with the “big bang”.

Electromagnetic waves, which travel to us from the depths of space for thousands of years at the speed of light, are read by astronomers using the Doppler Effect and other laws of physics. They testify to the ancient places from which they started, with which science always has some new dilemmas. For example, the observed faster distance of distant galaxies could mean their faster movement in the past and the acceleration of the expansion of the universe, along with the slowing down of the present time.

From (my) “information theory'' is the hypothesis that the observed expansion of space could be a consequence of *memory of space*. During the movement of particles, it communicates with space. Captured by the principle of conservation and minimalism, it lasts and tries to disappear, and because everything that happens is information, so is its duration and its history. As the elementary particle does not “grow'', does not accumulate information in itself, the resulting surpluses remain along the way.

It is an alleged IT approach. Another way to approach this question is the mathematics of quantum mechanics. Hilbert vectors are quantum states, hence particles. But vectors (dual to the first) are also operators over them. This means that processes are “particles'' (dual to the first) and as such are written in space-time. Processes are also subject to conservation laws that lead to what we now call space-time memory.

To make the matter more intriguing, there is also the theory of relativity, whose general Einstein's equations we can formally obtain equally by taking four of the six space-time coordinates of the universe. The three dimensions are then “spatial'', and the fourth “temporal'' – who’s coordinate we multiply by an imaginary unit. We already have such a model with variables derived from three Pauli matrices of the second order (roots of a unit) and three quaternions (roots minus a unit). And that is the third way to conclude about the space that remembers.

The question of how “information theory'' explains the appearance of excess information by the emergence of the history of particles seemingly out of nothing, given the law of conservation, is a possible answer in slowing down time. The units of time of today's present in relation to yesterday are longer, because there are fewer and fewer events, and there are fewer of them because there is less and less substance in relation to space. There is less and less information of the substance, because the entropy of the substance increases spontaneously, and with the increase of the entropy, the information decreases. I would not repeat the details of this now.

On average, galaxies farther and farther away from us are moving faster and faster, to those from the edge of the visible universe that should be fleeing at the speed of light. But gradually overcoming that speed is impossible, so we will constantly see through increasingly distant galaxies and a seemingly declining density of the universe. Compared to the past, our time is slowing down, units of length are decreasing and relative masses are growing. The present acts as if it is entering an increasingly gravitational field. This again connects the above three interpretations.

The same Einstein equations of the field speak about the effects of lowering the body into (real) stronger gravity, relative to the distant observer. They are written in 4-D space-time coordinates and refer to distant places as well as to the distant past. However, during t, the distance in the fourth coordinate is ct, where c is the speed of light in vacuum, and the square of that “distance'' is a huge number, so the gravitational influences through “history'' are negligible compared to those within the present.

Information theory suggests to us that information is two-dimensional. As when it comes from the distant present, it transmits force from the past to spheres *virtual bosons* whose surfaces increase with the square of the radius of the sphere, and with that surface the amplitudes and probabilities of transmission decrease, i.e. the chances of interaction with a given present event. Hence the decrease of force with the square of “distance'', but, as we see, it is significantly faster in time than in space. At the same time, it is necessary to distinguish the action of gravitational virtual spheres that expand in more dimensions than, say, electromagnetic ones, due to which the field of the former is weaker.

A more significant decline in information transmission through history than through the present can also be explained by channel noise losses. Let that be the next topic, with the only remark here that different interpretations of the same reality are not foreign to mathematics. We know that there are more than 620 essentially different proofs of Pythagoras' theorem and that this does not mean that the methods, or the areas from which these proofs come, are in contradiction.

3.26 Channel Noise

An important practical question of informatics that arises when designing or using a system for data transmission or processing is what is the capacity of a given system, i.e. how much information can it transmit at a given time?

Shannon's theorem (1948) says that *channel capacity* is $C = B\log_2(1 + S/N)$, in bits when the logarithm of the base is two. This B (band) is the frequency range for signal transmission in hertz; S (signal) and N (noise) are average signal strength and additive white normal (Gaussian) *noise* in watts. The signal-to-noise ratio is usually given in decibels. The capacity is the highest upper limit of transmission.

For example, a typical telephone line with a signal-to-noise ratio of $S/N = 30$ dB and a band of $B = 3$ kHz has a (maximum) capacity slightly less than $C = 30$ kbps (kilobits per second). A satellite TV channel with a signal-to-noise ratio of 20 dB and a band of 10 MHz has a capacity of 66 Mbps (megabits per second).

The quotient of capacity and band (range) that reminds us of the quotient of weight and volume, which is why we can call it the specific weight of transmission information, is actually more similar to the quotient of heat and temperature and thus to *entropy*. A larger increase in the entropy of the thermodynamic system corresponds to a greater loss of information, so that C/B can be considered as a "loss" of transmitter information, or a "gain" of receiver information.

The entropy in the exponent, $\exp(C/B)$, is the number of some equally probable options. When we subtract the unit from that number, we get the number of possibilities of the Bose-Einstein distribution, $\exp(C/B) - 1 = S/N$. The reciprocal value of the number of possibilities, N/S, is the probability that describes the statistical behavior, here the boson, of one of two types of elementary particles characterized by the fact that at low temperatures they can be found in unlimited numbers in the same state of energy, in a phenomenon called *condensation*. From the mentioned Shannon's equation, therefore, we find that the ratio of noise and signal corresponds to the Bose-Einstein distribution.

I have described a simple calculation that could appear in physics textbooks (not yet), but what follows are deeper. We get that the noise is proportional to the probability of the boson. Hence, the first conclusion that less uncertainty of the place has a higher probability (finding) of bosons. Due to less information, they are therefore more attractive. The second conclusion will be that time passes more slowly in those places.

Both of these excerpts belong to "information theory". The first comes from its principled minimalism, and the second from the understanding that the present, that is, time, is created by the realization of random events. The first appeared because natural phenomena run away from information and the second because natural phenomena consist only of information. We now find how bosons trace the probability of space.

We have the opportunity to check new attitudes with the general equations of relativity. These are Einstein's equations on the tensors of the 4-D geometry of space-time and energy. Initially, these energies are provided by mass, finally optional, which we consider to be the cause of the gravitational field. What turn out to be important now are the amounts of bosons that make space more likely and time slower. A higher concentration of bosons gives a denser field, we say a stronger gravitational force (a slower flow of time is gravitationally attractive).

In this sense, the agreement of Shannon's theorem on channel noise with Einstein's equations becomes unexpectedly simple and good when we notice that information can be potential (like six possibilities before rolling the dice) and actual (a single outcome after). Bosons are generally analogous to potential information, but they themselves can be divided into virtual and real, again into (new types) of potential and current. Examples of these are photons (electromagnetic radiation) with which electrons communicate (see Feynman diagrams).

We will find different examples of the above attitudes in modern *cosmology*. The universe is expanding so that more and more galaxies are leaving us (on average) faster and faster. They accelerate towards the edge of the visible universe, to the *event horizon* of the universe, the farthest sphere from us within which everything we can see is located, and which escapes from us at the speed of light. This process is conducted by melting the substance into space, while the present is stretched and diluted, constantly disappearing in the thickening sediments of the past.

Although galaxies are accelerating from us, they remain visible, because they do not reach the speed of light. This whole process is like observing from a safe distance a body falling into a black hole. It does not violate the laws of physics (say, conservation of energy, momentum, information), but its relative mass increases, units of length shorten in the direction of the center of gravity, time slows down to a stop.

No matter how much you look at that body, it does not reach the event horizon of the black hole, the sphere that surrounds it and, as far as we are concerned, the time on which it stands. The body gradually wraps itself around the sphere like a mantle, leaving only two-dimensional information.

From the point of view of the one who is failing, before he reaches the event horizon of the black hole, our time from the outside world seems faster and radial distances greater. For a body falling into a black hole, we are becoming more and more accelerated phenomena, as galaxies look to us.

3.27 Graviton

Classical physics knows four basic forces in nature — strong and weak nuclear, electromagnetic and gravity.

For each of them, there are special particles that are carriers of the force field. They are *bosons*, one of two types of elementary particles characterized by integer spin (internal momentum), unlike the other type with half-spin on which these forces act and which are called fermions. The Higgs field and the boson named after him have been recognized recently (CERN, 2012).

Carriers of gravitational force are *gravitons*, electromagnetic photons (electromagnetic waves including light), weak forces — two types of W (Weak) bosons with opposite electric charges and neutral Z boson (Zero electric charge), and eight types gluon mediator of strong quark interaction. Unlike photons and gluons, weak force bosons have mass.

The existence of gluon has been experimentally confirmed since 1979 in Hamburg, Germany, and bosons W and Z a year before that, when weak and electromagnetic interactions were combined. We have known about photons for a long time, and gravitons have not been isolated in the laboratory until today.

The electromagnetic force between electrons and protons in a hydrogen atom is 10^{39} times greater than the gravitational force between them. That unimaginably large decimal number written with 39 zeros behind the unit is considered to be the reason for the weight of the graviton experimental proof. Despite that, we learn about gravitons from the known equations of gravity with great certainty. They travel at the speed of light and have no mass, or are close to it.

Quantum physics distinguishes virtual from real bosons. An addition to my theory would be that virtual photons propagate in the form of concentric spheres around an electric charge (electron), and not linearly, primarily because they are carriers of two-dimensional information, and then because of the area of the sphere growing with the square of the radius its amplitude and probability of interaction decrease, as does Coulomb's force. The wavelength of the virtual sphere does not change as well as any delivered momentum. Real photons travel in planes of polarization.

The basic assumption is that it is analogous to gravitons. The photon must have zero rest mass precisely because of the square decrease in force, which has been very exactly checked (Williams, Faller, Hill: Experimental Test of Coulomb's Law, 1971), which is why it must move at the speed of light. It is then a property and graviton of weak gravity (of the Sun), and let the question remain as to how long they are virtual. The spin of a photon is (plus-minus) one, the graviton is two.

It is complicated to explain why the graviton spin must be exactly two. In short, it comes from the metric, a symmetric 2-tensor of the gravitational field that is covariant, local, and tangent to the point of Minkowski space represents Poincaré group. Hence, mass 0 and helicity 2. Details on this can be found, for example, in the paper: Phys.Rev. 138 (1965), B988-B1002.

Given the law of conservation of total spin, especially graviton 2 and electrons ½ and that they are elementary particles, it is unusual to observe that such two do not interact directly. If it exchanges spin at all, graviton acts on a multitude of particles as on a water wave, on the additional entity of the orthogonal motion of water to the vertical motion of its molecules.

As the additional information of the child on the swing in the park, on the synergy of the simple sum of the information of the child, the swing and the park, gravity acts on the abstracted excesses from the particles of matter. In that sense, gravitons are more subtle communicators than photons, and their number (within the visible universe) could be proportional to the total information of those parts of it. This result is essentially no different from the one recently obtained (Ioannis Haranas and Gkigkitzis, 2014) by calculating information according to the holographic principle.

Unlike electromagnetic fields, for which the law of conservation of energy applies, the energy leaks somewhere from gravity. The Soviet physicist Lev Landau was the first to say this publicly, and Einstein seemed to know that, because by parallel movement (translation) of a vector along a closed line of curved space, the initial and final position of the vector will have different directions, which indicates the presence of (gravitational) force and change of momentum, energy and now information.

In the "information theory", we place the gravitational field 3 + 1 in 3 + 3 dimensional space-time, so the mentioned "departure" of energy acquires a physical meaning. Gravity is therefore much weaker than electromagnetism, because it dissipates into additional space-time dimensions. String theory also predicts additional dimensions, but as microscopic volumes of cylindrical threads of visible space, while here we are talking about larger widths of time.

Unlike space threads, according to string theory, whose thicknesses we do not see because they are small, in "information theory" additional dimensions of time are large, but again we do not see them because the photons (with which we look) do not come from there. If we looked by gravitons instead by photons, we would also see those dimensions?

Graviton information is also two-dimensional and spreads on the surfaces of spheres, but in more dimensions than virtual photons. As one-dimensional large circles on the surface of a sphere that need to cover the whole sphere a lot, these two-dimensional spheres cover only pieces of 6-D space-time, and this coverage deficit speaks of the weaker force of gravity relative to Coulomb's force.

3.28 Authority

Authority is the right to give orders, make decisions and extort obedience; it is also a person or organization that has political or administrative power and control. Formally, in the perceptions of an individual, the authority appears as a series (values) of restrictions on appropriate possibilities, considering its ability to manipulate.

To every event that creates a situation, a problem for the subject, we attach some values of personal ability and objective limitations. An ordered set of abilities is called the *intelligence* of the subject, and the corresponding set of constraints is called the *hierarchy* of the environment. The product of a particular ability with a corresponding limitation is *freedom*. The sum of freedoms is “information of perception.” With more general treatment, these terms are gaining wider applications.

When the sum of freedoms is an interpretation of the scalar product of vectors (arrays) of intelligence and hierarchy, we gain consistency. Compared to the *Ramsey*[101] theorem, which says that there is no absolute disorder (in a series of random words a meaningful sentence will sometimes appear, a preconceived notion will appear in the sky of clouds character), this product says that there is no zero hierarchy. With the previously assumed objectivity of some coincidences of “information theory”, it further follows that each subject has some non-zero amount of options.

In conditions of (approximately) constant information of perception, a temporary limitation of external perceptions will result in an increase in internal (monk effect), and a limitation of internal perceptions by larger external ones (listening), while a permanent deficit of “hierarchy” will encourage an increase in “intelligence”. Examples are (perhaps slightly) the greater intelligence of the older brother or the cognitive retardation of children as they grow up with intelligent aids.

Greater information of perception means greater *vitality*, stronger opposition to more difficult obstacles, such as Caesar's daring crossing of the Rubicon River despite a Senate ban, and fewer propensities to surrender to fate like a log dropped through the water. With more information (action) comes greater aggression, and with less passivity; the smallest have simple physical bodies to which the principle of least action applies.

The subject is all the more able to solve the situation if he makes the obstacle smaller, but that has little effect on the change of his overall freedom. Ultimately, *unlimited ability* would go with the absence of prohibitions and would not belong to the “universe of information”, nothing would be unknown to such a subject.

[101] Frank Ramsey (1903-1930), British mathematician.

Perception information is an inert quantity, as if it is an enemy to itself. With a deficit we are insufficiently informed, and with a surplus we become misinformed. Its optimums change slowly, so in a state of hopelessness we are more prone to inventing phantom observations and bowing to authority, and in conditions of self-confidence, others will find it harder to deceive us. Participants who have unsuccessfully solved tasks will find it easier to see characters that are not there, they will look for comfort somewhere, unlike those with restored self-confidence. That is why religion is stronger among the poor and disenfranchised, and its influence weakens with the growth of the authority of the rule of law.

An important property of the alleged product of arrays is Schwarz's Inequality: this intensity is less than or equal to the product of the “intensity” of individual arrays. These intensities are defined by vector theory consistently and very universally for different applications (to connoisseurs of algebra). They are crucial in quantum physics. Let's just say that a scalar product has probability values (a number from zero to one), if the vectors we multiply are probability distributions (outcome values of the complete set of separate outcomes).

For example, let's have two counterfeit coins with tails and heads falling probabilities of 0.4 and 0.6, and 0.3 and 0.7, respectively, with a scalar product of 0.4 x 0.3 + 0.6 x 0.7 = 0.54. This product is larger when both sequences are increasing, which means better “alignment” of the two vectors, more geometrically speaking — their greater parallelism. This leads us to the assumption that in quantum mechanics, harmonized states (particles, vector representations) are easier to combine, because they make events more probable.

From there, the electron would descend to the lower shell of the atom releasing energy (photon) because the atom and the electron form a more probable coupling. They have a higher value of the scalar product of their superposition. To the well-known observation of physics that an electron will come out of an atom with the addition of energy, we now add that its smaller action (products of energy and time) within the atom comes from a lack of information.

The principle of minimalism of information is activating every time we work with physical potentials, because information corresponds to action. However, information is a concept broader than the four basic forces of physics, and we find the same mechanism, for example, in associating people into groups, or in the subject's attachment to authority. Authority is then a vector (environment) with which a given vector (subject) would be better aligned. For the sake of comparison, in the case of uncertainty of the momentum and the position of the particle, the authority is the position.

It is not wrong to say that authority is something like food, water or air to people, bad in both shortage and surplus. It is obvious that children love well-intentioned authority and so, in addition to that, for example, peer violence decreases, as well as crime within a disciplined army, despite the possession of weapons. In that interpretation, spoiled as well as abandoned children show signs of growing up with a lack of authority.

Equality generates conflicts in a way that competitions of athletes in fair conditions become fiercer, and the proclamation of certain types of equality (believers, castes, workers, and market conditions) encourages the dictatorships of the Inquisition, Napoleon, communist leaders, or the oligarchy of liberalism. It is known that distributions of equal probabilities have the maximum Shannon information, and now we only add that this leads to the aspiration of nature towards “authorities”.

3.29 Turning Point

We tilt the box to turn it for an angle, after which it rolls itself. *Turning point* is the crossing of the center of gravity of the box (intersection of large diagonals) over the verticals above the axis of rotation – the lower edge of the side on which the box falls.

We know that a full glass will fall before an empty one, because its center of gravity needs a smaller way to the turning point. Non-return point has and the raft on the river approaching the waterfall, the trigger on the rifle before firing the bullet, the differently adjusted chronometers attached to the board that can move freely on a horizontal surface will also spontaneously adjust and eventually synchronize.

The irreversible condition is sometimes the “movement of butterfly wings in Mexico that will cause a storm in Texas''. I quote the “butterfly effect'' of deterministic chaos theory founded by the American mathematician Edward Norton *Lorenz* (1917-2008) who said that a state of chaos is when the present determines the future, but the approximate present does not determine the approximate future.

Journalist Malcolm *Gladwell* wrote an interesting book, The Tipping Point (2000), in which he sought a critical moment, a trigger, or a boiling point, as he puts it, which triggers a “social epidemic.” He described a famous event in American history on May 18, 1775, when Paul Revere and William Dawes decided to spread rumors about a possible attack by the English to the locals around Boston, moving in opposite directions.

The first was very successful in spreading the news, and the British attack on Lexington on May 19 met with organized and fierce resistance and suffered a heavy defeat. The other whistleblower failed. Analyzing this event, the author highlights three important characteristics of the person who initiates the “epidemic” of oral tradition.

He calls the linker, connector an exceptional individual who is somewhere around us, and we may not be aware of him, but who has a large number of acquaintances. Thanks to such, the messages in the (free) network between the two places arrive in five to six handovers. Connectors are people who know everything and everyone. In the theory of such networks, I add, they are a small number of nodes, concentrations, with many connections, as opposed to many other nodes with few of them.

Another important characteristic, according to the author, has a maven (connoisseur). So he calls an unusual person who in the given circumstances gathers essential knowledge and has information about various necessary things, likes to discuss it and be at the service of people. The third crucial feature is the people that Gladwell calls traders. These are people with special abilities to convince us of something when we are indecisive and distrustful. A situation that unites the mentioned traits (a link, a maven and a trader) in a person can make him the initiator of a “social epidemic”.

Each of the three features is an image of *free networks*, formally speaking, named after the free, equal connections of its nodes. I explained how the equality of probabilities of connection in the construction of these networks leads to the separation of rare concentrators, such as people who acquire disproportionately large wealth on the free market, or rulers who stand out with greater power in conditions of equality. Their appearance is a consequence of the law of probability, or the principle (minimalism) of information, and if you will, of a nature that does not like equality, because its essence is diversity, the uniqueness of the individual.

In such model, when equality creates inequality by separating concentrators, the need for equality can be sensed in order to achieve uniqueness. Looking deeper, it is a generator that produces unique snowflakes, tree leaves, and people from formally equal laws. Hence, looking further, we will find the abstract universality of mathematics.

However, we are not going that far here. Equally fantastic is the accumulation of action (information) which, under the slight compulsion of the principle of minimalism, creates surpluses and life. And with that I will round out this story. If we had not witnessed the eruptions of geysers and volcanoes on planets pressed also by the mild and universal compulsion of gravity, we would find it hard to believe that the ubiquitous pursuit of less can produce more.

When we notice that the principled minimalism of information supports the separation of a living being from an inanimate one, a creature with greater possibilities of choice in conditions of striving for less, then we are not far from finding an important example of the mentioned dualism of equality and uniqueness. A living being goes through similar phases of youth, maturity and old age through which the storm created and guided by the “principle of least action”, the well-known ubiquitous “force” of physics, passes.

The association of living beings, which we can also call living, goes through analogous phases. In the early phase, the individuals of such a society are uniform (stem cells) that over time specialize in different jobs in the service of the hierarchy. In this way, they hand over their own surpluses of “choice” (information) to the organization, in addition to trying to evolve into more efficient by sacrifices of life expectancy, intelligence or reproducibility.

The tendency to reduce information also exists in demonism, the worship of death, as well as in the desire for order and security. Other emotions are just smuggled in, clinging to this fundamental process of the principle of information using it, just as we use gravitational force in hydropower plants to get electricity.

Both, life and death occur at “turning points” and just as a woman cannot be half pregnant, so the dead do not return to the living. In short, this would be an introduction to an interesting plot.

3.30 Delayed Gravity

When we define information as a quantity of options and as an inevitable part of any physical phenomenon, we get an interesting theory of information. In it, dark matter and dark energy, which cosmology recognizes today in the “errors'' of galaxy rotation and in their inexplicable ever faster distancing, will be easily explained almost secondarily and as if they are uninteresting phenomena for science.

3.30.1 Communication

Space, time and matter consist only of information. This is the starting point of my *information theory*. It is accompanied by the laws of conservation of information [1], stinginess with it, i.e. its minimalism [2] and action – described in the books listed at the end and in this one.

In short, the information is the amount of data that lasts – otherwise we would have no experimental evidence. Although everything in nature consists of information, nature economizes with it. That is why it is easier for us to encode than to decode, it is easier for lies to spread than the truth. Bodies are attracted by striving for a more probable state, a state less informative. The information is all in the amount of uncertainty and that is why its initial values are consumed as soon as they are published. They exchange by interaction, because interaction is (also) communication.

Subjects (particles) therefore communicate because they do not have everything, and they cannot have everything because then they would not be objects of the *information universe*. Due to that, the space is constantly changing, and its changes are in "width" and "thickness". The opportunity to change space is the movement of an elementary particle whose duration forms its own biography, the history of an object that does not grow, but leaves its memories in the space through which it passes.

The growing thickness of space contains reminiscent of the substance that once moved through it, the memories of space that are also information and actions for the present. Increasing the influence of the past is exactly equal to reducing the information of the present, in accordance with the law of conservation and the principle of minimalism (economy of nature with information). The widths of the universe are obviously growing in front of astronomers' telescopes, but other phenomena related to these (widths and thicknesses) are difficult temptations for cosmologists, one as dark energy and the other as dark matter.

3.30.2 Entropy

Entropy (S) in Boltzmann's sense (1872) is the logarithm of the most probable, given the possible distribution of gas. It is easy to prove that this is a uniform distribution of molecules, such that the distances between them are approximately equal, according to the formula

$$S = k_B \ln W$$

where $k_B = 1.38065 \times 10^{-23}$ J/K is the Boltzmann constant, and W is the number of actual microstates corresponding to the gas macrostates. In short, the Boltzmann formula shows the relationship between entropy and the number of ways in which atoms or molecules of a thermodynamic system can be arranged.

Therefore, an increase in entropy is equivalent to a decrease in information (Shannon, 1948), now say for the amount by which a uniformly distributed mass becomes impersonal, amorphous, like a soldier in a parade. Therefore, the spontaneous growth of entropy is a consequence of the principled saving of nature with information, and *generalized entropy* would refer to any spontaneous loss of information.

"Generalized entropy'' is reduced to a substance, outside space itself. With such an additional interpretation, the spontaneous growth of the entropy of the universe becomes a "melting'' of physical matter and an increase in space. The total sum of information about space, time and matter remains unchanged as the past increases – the decrease in the information of the present is compensated by the influx from the growing past.

Shortly, space expands the entropy of matter increases, its total information decreases because it is deposited in the past in (increasing) space from where it acts on the present in an amount exactly equal to the loss of information of the present.

3.30.3 Dimensions

Due to the assumed objective unpredictable nature of the options by which we define information, there are unrealized in the "information universe''. Such a complex "present'' becomes Everett's (1957) *many worlds* of quantum mechanics whose preservation of history requires three coordinate axes of time, given the three coordinate axes of space and the possibility of uncertainty along each of them.

I found various proofs of six-dimensional space-time within information theory. Along with the three known spatial dimensions (length, width and height), there are three temporal ones, or the even greater number of "temporal'' dimensions that goes with more "spatial'' supplied with coincidences. You can also find them in the mentioned books[102], or in my previous texts, so I skip that part. Notice that we are working here with additional temporal dimensions, unlike, say, *string theory* where we only talk about additional dimensions of space.

The part you should not skip is the matrix equation $\hat{\sigma}^2 = \hat{I}$ whose roots are *Pauli matrices*[103] $\hat{\sigma}_x$, $\hat{\sigma}_y$ and $\hat{\sigma}_z$ in the same order:

$$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix},$$

or $\hat{q}^2 = -\hat{I}$, whose roots are *quaternions* $\hat{q}_x$, $\hat{q}_y$ and $\hat{q}_z$, respectively:

$$\begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix}, \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}, \begin{pmatrix} i & 0 \\ 0 & -i \end{pmatrix}.$$

Three matrices $\hat{\sigma}$ and three matrices $\hat{q}$, here of the second order, can represent scalars in vector space, because the multiplication of scalars does not have to be commutative.

[102] For example, 1.13 Space and Time, [2].
[103] See 2.4.6 Generalization, [3].

Namely, the *vector space* on the body Φ is called an additive commutative group X of elements x in which multiplication with elements from Φ is defined so that for each pair $x \in X$ and $\lambda \in \Phi$ there is $\lambda x \in X$. In this case, for all $\alpha, \beta \in \Phi$ and $x, y \in X$ is valid:

1. $\alpha(x+y) = \alpha x + \alpha y$,
2. $(\alpha + \beta)x = \alpha x + \beta x$,
3. $\alpha(\beta x) = (\alpha\beta)x$,
4. $1 \cdot x = x$.

We call elements of vector space *vectors*. The body Φ over which is the vector space X is called a scalar body because its elements are called *scalars*.

This opens the possibility in the *Klein–Gordon equation* to select some other four of the six coordinates, some 4-D from 6-D space-time. Klein-Gordon equation with mass parameter m is

$$\frac{1}{c^2}\frac{\partial^2}{\partial t^2}\psi - \nabla^2\psi + \frac{m^2c^2}{\hbar^2}\psi = 0,$$

where approximately c = 300 000 km/s is the speed of light, and $\hbar$ Planck's reduced constant. The complex evaluated function $\psi = \psi(\mathbf{x}, t)$ has the spatial variables $\mathbf{x} = (x_1, x_2, x_3)$ and the time variable t, and the Laplace operator $\nabla^2 = \partial_1^2 + \partial_2^2 + \partial_3^2$ only acts on space variables. By substituting $x_4 = ict$, with $i^2 = -1$ and $\mu = mc/\hbar$, this equation becomes

$$(\partial_1^2 + \partial_2^2 + \partial_3^2 + \partial_4^2 - \mu^2)\psi = 0,$$

in natural units.

Einstein's equations of general relativity also have this symmetry of spatial and temporal coordinates, which is easy to check. Due to the understanding of time as an organization of past events, we will add an appropriate understanding of space for this symmetry. We also discover that the effect of gravity extends through all six dimensions of space-time, where the time coordinate contains a very large number (speed of light) whose square is an unimaginably large number, so the impression of gravity through the past is much muffled in relation to penetrating the present.

Gravity curves space-time making energy and information leak from the gravitational field[104]. Therefore, the gravitational action extends into 6-D space-time, unlike the electromagnetic one, which is limited to our real 4-D world. Accordingly, if we "looked'' with gravitons instead of photons, we would "see'' possible options, and not just realized ones. The consequence of this expansion of gravity on all six dimensions of space-time is its weaker force in relation to Coulomb.

[104] See 1.13 Space and Time in [2], and 1.27 Graviton in [3].

3.30.4 Other effects

Due to the gravitational effect on the present, the deposits of the past form an increasingly stable reference system over time. We notice this in the spillage of water that rotates with washbowl, an effect that Newton (1687) considered as proof of the existence of “absolute stillness'' or “absolute space'', which Einstein later called the Mach principle (the dependence of a given mass on the whole mass of the universe).

A somewhat different proof of the gravitational activity of the past in the present is the movement of Mercury's perihelion in the direction of rotation around the Sun. Unlike Newton's theory of gravity, Einstein’s predicts the movement of Mercury around the Sun not along the line of a static ellipse, but along one that slowly rotates with the planet around the Sun. As we know from general relativity, the angle of movement of the perihelion, α, expressed in radians per the revolution (the rotation of the planet around the Sun), comes approximately from the formula

$$\alpha = \frac{24\pi^3 L^2}{T^2 c^2 (1-e^2)},$$

where L is the minor axis of the ellipse, T is the period of the revolution, c is the speed of light, and e is the eccentricity of the ellipse. Due to the influence of gravity from the past, we also expect that the angle of change of the perihelion decreases with the square “time distance'', $X_4 = icT$, so that this confirmation of general relativity can be considered as a confirmation of its addition presented here.

The influence of *dark matter* on galaxy rotation could be another piece of evidence, for example, if it turns out to follow the motion of masses.

The explanation of the *dark energy* by the theory presented here is a little more complex. The space of the present becomes “denser'' not only because of the increasing size caused by the “melting'' of the substance, but also because of the growing “deposits'' in the past. The present, “observed'' from some fixed moment of its past, would act as a body falling into a gravitational field.

Relative time would flow more slowly, and radial lengths would become shorter. The relative mass and energy of the body of the present would increase so that both the relative and the proper (its own) laws of conservation remain valid.

However, viewed from the present, movements in the past would be faster. The relative accelerated flow of time of galaxies that we observe further and further in the past due to the distance from the Earth is compensated by a relative slowdown due to their movement. This also applies to mass, energy, as well as length. We see similarly in the movement of satellites around the Earth, where time flows faster due to altitude, but slower due to speed. These two values do not have to be completely undone.

Finally, notice that by traveling through space it is not possible to reach its edge, the *event horizon* of the universe, because due to the increase in the space of the present it moves away at the elusive speed of light. Analogously, it is not possible to go back to the beginning, to the *big bang*, because in an imaginary journey through the past we would need more and more time to infinity, so in this theory, in that sense, in fact, there is no beginning of the creation of the universe.

3.30.5 Epilogue

From this short article you can see how unusual the “information theory'' I am working on is. That is the reason why I do not try to convince anyone of its possible accuracy, at least not until I am sure of it myself. In any case, I would be grateful to the reader who would discover and point out to me the inconsistency of this “theory'', so that I would not bother with all that.

3.31 Neighbourhood

We see that information is a matter of perception in the differences in the perception of one's own (proper) and relative observers of the body (system) in movement or in the ways of communication (interaction) of objects, and even in relativizing the severity of the problem depending on the solver's ability.

The part of *infinity* that is received is always finite and subject-dependent in a way that opens up new questions about the sharing of information. We consume all-time truths in limited portions on the basis of which we assume their uniformity and universality, and then, due to the properties of the action of information, the energies of whole truths are null and void as opposed to the pieces we take. That seemingly absurd view of information theory is the subject of this story.

The famous saying that “what we cannot explain we do not understand” (Einstein's), which suggests the need to explore ambiguities, reverse and notice that with the understanding of infinity in our hands we are already standing on the threshold of the world of physics with ready explanations. We will understand the insensitive phenomena step by step as physical and in the future, similar to the accepted atoms and quanta.

This is not particularly unacceptable. Truths concerning discrete, countable infinite (discrete) sets are mathematically indisputable, moreover they are more accurate than physical ones, and intuition is what hesitates and hinders us. It will give way, and just as we missed infinity in the very abstract statement “2 + 2 = 4”, our animal heritage will eventually digest future steps.

Namely, while the expression “two plus two is four” we abstract from “two apples plus two apples are four apples”, then “two legs plus two legs are four legs”, then “two kilograms of iron plus two kilograms of iron are four kilograms of iron” and so on, by constantly listing the concrete, we realize that in the final many steps it is not possible to prove that one *abstract statement*. It is a miracle of mathematics in the fabric of concrete science. Even in one simple and abstract formulation, the whole infinity of our reality is.

Abstractions are an important tissue of physics, whether I understand it or not. Without *complex number*, fantastic and practical, there is no exact science. Their infinities are so woven into the “concrete” that we no longer notice the extent of mathematizing the very concepts of, say, a “real” number or line; today we barely understand our ancient consciousness. We accept new practice unaware of new knowledge.

Nearby are points of complex plane. It is determined by two vertical straight lines, a real abscissa (horizontal axis of numbers) and an imaginary ordinate (vertical real axis), we would say even more abstract than the complex numbers themselves — if not for the coordination of airplane flights on London Heathrow (or another larger airport). Elegant, fast and accurate ways of marking, directing and tracking airplanes there are performed using complex plane theorems.

In construction, we can work with a modest knowledge of geometric planes and believe that there is no infinity, but if we try to make a *building of geometry* on this concept, another truth will appear. Just because we can't eat them, smell them, grab them with our hands, or fit them into mystical explanations of the world known to us from ancient times, we don't consider complex numbers (recently discovered) unworthy. Consistently, any future knowledge could be unworthy, because originality always defies some old beliefs.

To the mentioned sum (2 + 2 = 4) the statements that the naturals {1, 2, 3,…}, the integers {…, -1, 0, 1, 2,…} and the rational numbers (fractions with integer denominator and numerator) has an infinite number of, and there are more irrational ones (real numbers that are not rational). The former are countable, we say discreetly many, and the latter are uncountable, the continuum many.

Records of rational numbers are periodic, irrational ones are not. In decimals $x = 0.232323…$ the pair "23" is infinitely repeated, so $100x = 23 + x$, and the number $x = 23/99$ is rational. All periodically written numbers are so rational. Non-periodic, such as pi ($\pi = 3.14159…$), are irrational. There are *discrete many* of the former and *continuum many* of the others. These are two infinities of different sizes.

The unpredictability of the next digit raises the order of infinity similar to the randomness of particles. All the ever realized states of all the elements of the universe are a discrete set, but their possibilities form a continuum. This second, the superset, is so many times bigger than the first that there is no chance that we will randomly pick up the element of the smaller in the bigger one, even if we choose countless infinitely many times!

We are smaller than a drop in the ocean of possibilities, but our reality is "thick everywhere". There is an expression for a set of rational numbers (fractions) on a number line where it is also *everywhere dense*. No matter how small the neighborhood (positive length) of any rational number (point) of real axes, there is always another such number (rational, besides many irrational ones). So, logically, a well-arranged world is possible as a set of rational numbers, not nearly as big as a continuum, but "dense everywhere" in it.

The ultimate divisibility of physical information makes the space-time event of the 4-D world discrete, everywhere dense in a set of possibilities, and although the smaller never leaves its domain to the rest of the larger, without the larger it cannot exist.

We say that the interval of real numbers is "closed" if it contains boundary points, and "open" if it does not contain them. The ball is *closed* or *open* depending on whether it contains its outer sphere or not. Complementary to the open is a closed set (if a point belongs to one it does not belong to another) and separately each final set is closed. Most gatherings are neither open nor closed, and empty and entire spaces are the only open and closed sets at the same time.

Physical information is a discrete set and therefore closed, so mathematics teaches us in this case that there is no empty *void*, nor *universe* that contains everything. We must treat the vacuum and the whole macrocosm (and only them) both at the same time as real and as pseudo-real information! The intersection of any collection of closed sets and union of finally many such are closed sets, which brings us back to the previous one — that there is no way out of real information from its world.

3.32 Adherence

When we have an idea about something, then there is information about it, and with information comes uncertainty. The first follows from the assumption that we live in the *universe of information*, and the second that with the knowledge we get something unknown. Abstract performances with such (hypo) theses literally become the subject of "information theory".

Mathematics of numbers that does not target quantities has long been developed in functional analysis, topology, and set theory. The network of their views is a good model for further clarifications of the idea of uncertainty, and we will add it to the observation (previous columns) that empty and all space as sets that are both open and closed can be considered a door between *infinity* and *finite*. Infinity "leaks" towards us filtered by the laws of physics, and we will see why such an interpretation is necessary.

First of all, it is said that the laws of conservation (matter, energy, momentum, information) follow from the finality of phenomena. Only infinity can be its rightful (proper) part and be constantly spent and always remain the same. Additionally, topology teaches us that infinite sets (besides closed ones) can be the only open ones, so they can constantly be subtracted and last usable, among other things, because the union, no matter how many open sets, and intersections of finally them, form the open sets.

All its models are almost equally good for us, and if mathematical analysis seems difficult for you, it is often enough to imagine only "intervals" of numbers, such as $(1,2)$ in which real numbers are greater than one and less than two. The same rules as the common axioms of both, model and application, give common consequences.

A point on a number axis is "interior" of an interval if the interval is its environment[105]. The collection of all interior points of a given set forms the *interior* of the set. Obviously, the interior of a set is its subset, and the interior of a set of rational numbers is an empty set. That is why we define an "adherent" point of a set in which each neighborhood has at least one point of that set. The collection of adherent points is *adherence*. Each set is a subset of its adherence. The adherence of an open interval is a closed interval; the adherence of a set of rational numbers (fractions) is a set of real numbers.

The interior and adherent points of the sets and their complements are mutually exclusive. Hence, the need to define a point on the *boundary* (edge, border) which is at the same times an adherent point of

[105] A point $s \in S$ is called interior point of S if there exists a neighborhood of s completely contained in S. The set of all interior points of S is called the interior, denoted by $\text{int}(S)$.

both the set and its complement. The boundary of each set is a closed set. These are just the first notions of analysis and topology, otherwise non-trivial (hard) areas of mathematics. It has been said many times that such starting points are from attitudes that are difficult to doubt in order to reach not only the places we did not hope for, but also those that are not easy to believe at first. That's why we're not in a hurry.

The formalism of mathematics is the basis, but both the base and the superstructure are in the universe of information. What would previously be “hard to believe” becomes the relationship between the outcome of random events and all possibilities, the connection between reality and parallel realities, or 4-D and 6-D space-time.

The most countably infinite (discrete) set consists of the events of one reality which is the present (3-D space at a given moment), our reality of all particles of the universe, but of that size is and 4-D space-time developed layer by layer following one present. With various flows of the time, similar events (particles) reach all possible pseudo realities.

It can be shown that there is an isomorphism (mutual unambiguous, one-to-one mapping of structures) between the relations of these events and the relations of rational with real numbers. The adherence of a set of rational numbers is a set of real numbers. The universe of one reality is discrete (as rational numbers) in contrast to the continuum (size of real numbers) of the universe of all possibilities, and the second (larger) is the adherence of the first (smaller). It is useful to know for further work.

Here we will note that the union of information is also information and that the described 6-D space-time also contains uncertainty. It is information and therefore possesses uncertainty and exists in uncertainty. In other words, 6-D space-time is not the end of the story. Knowing *Russell's paradox* (there is no set of all sets) or *Gödel's* incompleteness theorems, the new interpretation of reality does not surprise us, it gained in importance. However, it opens a new perspective on the physical understanding of the present and time in general.

Let us consider this unusualness of the 6-D space-time model together with the interchangeability of three spatial and one temporal (*ict* – products of imaginary unit, speed of light and time) coordinates with some other four (out of six). I am talking again about the symmetry of space and time, which is directly verifiable in *Klein–Gordon equation* of quantum mechanics, but also in Einstein's general relativity, and it is the specificity of the information theory.

We also discover it in the unpredictability of both time and space, visible from the limited speed of the subject's movement and the dose of the unknown in the movement of particles. Because we define the course of time here by the amount of random events, and then because of *Bell’s Theorem* (1963), according to which we cannot outsmart Heisenberg's relations by introducing hidden parameters, we need a little more uncertainty than that possibly deposited in a static 6-D event pool.

In order to avoid circumventing the “phantom action at a distance”, the uncertainties of time should be reinforced by the random emergence of the present from infinity. The set of possible events would then not be like a container of fixed options from which random outcomes would jump out, and it would not be possible to “deceive” the relations of uncertainty or to challenge Bell’s Theorem.

The space-time of Everett's *many worlds* (1957) is no longer a set of given points, i.e. space-time events, on which the *present* moves in a random way, but the possibilities are further blurred by the inflow from infinity filtered by the laws of physics.

4. Information Universe

There should be rests below. I am thinking of stories that at the time I failed to fit into the current ones due to limitations in the number of words or digressions in the topic, or I did not manage to check their mathematical background enough, or they became too bold. However, they are no less interesting because of that, on the contrary, so here are some of them.

In the first group of stories, there will be a step forward from my initial idea, "at least one event in the universe is accidental" to "everything in the universe is accidental". By the first I used to be challenge the uncertainty by looking for a contradiction, in order to prove the determinism of this world and fit into that supposed common-sense belief that everything happens for some reason. But I didn't succeed, so I dared to make a stricter request.

Therefore, we further believe that everything in this world is made up of information and only information, that the essence of information is uncertainty, and that the universe itself is some information.

4.1 Concrete and Abstract

All-time truths and abstractions are also information, and they are also actions through the practical application of theories. By that I literally mean theories.

Only after the discovery of the law of thermodynamics did the development of internal combustion engines begin, although technologies for their construction existed before. Were it not for the discovery of circular processes of heat (Carnot, 1824) and entropy (Clausius, 1850), the world would still be riding in horse-drawn carriages, and today the average truck driver does not have to know anything about it. Or how difficult it was for the world to prove that there are atoms and molecules (Boltzmann) whose oscillation defines heat and temperature.

It is similar with even less well-known mathematical truths as opposed to what these terms specifically refer to. A simple example would be the abstracted attitude "2 + 2 = 4" which actually stems from an infinite number of concrete observations "two apples plus two apples are four apples", where further "apple" is replaced by countless physical possibilities, such as cat, number of legs, kilograms (two kilograms plus two kilograms are four kilograms).

We understand multiplication in the same way, but unlike the known examples of the application of arithmetic, we will make a step towards "information theory". There we believe that the greater "intelligence, I," seek (is developed for) more "freedom, S," (quantities of options) and fewer restrictions H, or "hierarchy". Their values are connected by the equality $I = S/H$, so freedom is equal to the product of intelligence and hierarchy, $S = I \cdot H$. The quotes emphasize the unusual meanings of terms, but a little more precise and operative.

If we assume that S is a quantum of action, I the uncertainty (indeterminacy) of the momentum of a particle, and H the uncertainty of its position, this becomes the Heisenberg's uncertainty relation. The definition of "freedom" in "information theory" is mathematical enough that it can also be transmitted (in a consistent way).

As in this "theory of perception" the information (freedom or action) is always a discrete phenomenon (quantized, atomized, in separate steps) that all claims, laws, as well as legal paragraphs are discrete, several connections between the abstract and the concrete can be seen.

Note that abstractions are timeless, and concretions are of short duration. The former are simple and the latter are complex, the former are multiplied and the latter are unique. In particular, equality and authority are related concepts so that equality generates conflicts, just as inequality of nodes grows out of equally probable connections (when creating free networks). Thus, when multiplying a series of abilities I by series of corresponding constraints H, we get more information S, if the two series are accorded (both are ascending or descending), and less information if one sequence increases and the other decreases (as in uncertainty relations).

"All-time truths" may have infinite duration, but our perceptions, no matter how great, are finite. They also carry information, in portions and equivalent action, so the corresponding energy of a particular truth is never zero. Physical action is a product of energy and duration, that is, impulse (momentum) and path (length), so the information of the "ubiquitous truth", as far as we are concerned, is eventually a negligibly small but always non-zero impulse.

The set of integers $\mathbb{Z}$ can be arranged in one sequence 0, 1, -1, 2, -2,… and "enumerate". This establishes the bijection (mutual unambiguous mapping) of this set with the set $\mathbb{N}$ of natural numbers 1, 2, 3,…, which is enough to say that these two sets, $\mathbb{Z}$ and $\mathbb{N}$, are of the same cardinally, i.e. that they are equally infinitely "countable".

In addition to these two, the set of fractions, the standard notation $\mathbb{Q}$, and even the set of all events of our 4-D reality are countably infinite. We call them discrete (moderately) infinite sets, unlike a continuum, such as a set of real numbers, the notation $\mathbb{R}$, or a set of all possibilities of our reality (6-D), which are significantly larger.

We say that two sets are different if there is at least one element in one of them that is not in the other. In order for two different infinite sets to be of the same cardinality (size), there must be at least one bijection between their elements. Otherwise, the bijection between sets of different sizes exists only if they are infinite, so this property is used for definition: a set is infinite if and only if it is cardinally equal to some real subset.

Bijection is a type of symmetry to which Nether's theorem applies (each symmetry corresponds to some law of conservation), which means that the laws of conservation do not apply to infinite sets. Infinities are inexhaustible if consumed in finite portions, and so are mathematical abstractions. Remember this where we stopped, we will need it in one of the sequels.

4.2 Universe

Space, time and matter consist only of information, and their "universe of information" is special information. This is a story about the changes we expect in such a structure of uncertainty, which is itself an uncertainty.

According to the law of conservation, the total information of the universe is constant; let us denote it by the U (universe). The information of space and matter changes so that $S + M = U$. I stick to the parts of the "information theory" that can be retold and I hope that this includes the description of this simple formula. Along the way, I repeat some otherwise well-known details.

There are two types of elementary particles of physics, bosons and fermions. The internal impulse, the so-called spin, the former is an integer, and the latter a half. Gauge bosons (gravitons, photons, W and Z bosons, gluons), the carriers of gravitational, electromagnetic, weak and strong nuclear forces, are in the first group, and in the second are, for example, particles that are affected by these forces, such as photons, protons, leptons or quarks. Bosons are tolerant and there can be more of the same on the same meat, and fermions are not and the Pauli Exclusion Principle applies to them.

All this is known to physics as well as the spontaneous growth of entropy, and what would be further would be that the information of the universe is constantly decreasing (with increasing entropy). This, the latter, is changed here to reduce the information of matter at the expense of increasing the information of space. It is inevitable, as an information effect, because space remembers, and then because of the law of information conservation. Bosons and fermions are typical spatial and substantial particles.

Matter melts into space and space therefore grows. The visible part of the universe is a ball of radius, say R, with us in the center. The boundary of the ball is a sphere that moves away from us at the speed of light. It is the "event horizon" of the visible universe beyond which we see no further. Anything we see is as old as light years away.

The speed of light in a vacuum is approximately $c = 300{,}000$ km/s, a light year is the path that light travels in a year, and the expansion of the universe began with a "big bang" about the time of $T = 13.8$ billion years ago. This expansion was initially (according to the theory of so-called inflation) faster than light. From such simple assumptions, we calculate that the current "real" radius of the cosmos could be about 46.5 billion light years.

You don't have to trust the data. Nevertheless, for the radius of the visible universe, the speed of light and duration, in today's (so-called proper, own) units, the equality $R = cT$ applies. Namely, it is a well-known assumption that the universe is approximately homogeneous (uniform along the lines) and isotropic (uniform at angles), and that it is flat (Euclidean) and this facilitates our calculations.

Substances are dwindling and space information is growing more slowly. Its increment is inversely proportional to time; from this follows the differential equality ($dS : dR$ and $1 : T$), and from it $S = k \cdot \log R$, where k is a constant (multiplies the logarithm of the radius). These "assumptions" are not known to physics!

As the entropy of a substance increases, its information decreases and is deposited in the memory of space. To the information theory that I represent, everything is some information, every information is an action, and then the past also affects the present. With that is "saved" the conservation law of the present, because the past is more and more as the substance is less, but its effect on the “now” is exactly so much that the law of information conservation is valid.

It follows from the mentioned logarithmic equation that the “power” of entropy is dictated, among other things, by the speed of light. The substance melts into space, but not faster than the growth of the radius of the universe, and that is determined by the speed of light. The second question is whether the speed of light in vacuum is always the same, but that is not the topic here and the answer would not affect the sketch of the results I am explaining.

According to information theory, the speed of time is defined by the realization of random events. As the universe substance becomes less and less with age, and it is rather realized than space, the time of the universe flows more and more slowly. We do not notice a slowdown in our own (proper) time, but we could use it to explain the ever-faster distance of galaxies from us.

Let’s imagine that with some time machine we travel back in time to the creation of the universe, to the big bang. That journey would last indefinitely. We would need so much if we went to the border of the universe, the horizon of events, which is fleeing from us at an unattainable speed of light. In that sense, there is no beginning of the universe and no edge of it. However, measured by our own standards (present), these two infinities are finite.

Similarly, the reverse is the paradox of an observer outside the gravitational field who would watch a body collapse into a black hole. It never reaches the event horizon of that extreme gravity, because its relative time flows more and more slowly. To one's own observer (proper) time of a given body, on the contrary, the whole process would pass faster.

Real or imagined, this model represents another kind of gate between the finite and the infinite with (objective) observers who would see the same phenomenon extremely differently. But here it is proven that the “universe of information” which would itself be information would be logically correct.

4.3 Subjective Logic

Intuitionism is a philosophy of mathematics based by the Dutch mathematician Brouwer (L. E. J. Brouwer, 1881-1966) on the idea that mathematics is a creation of our mind. Mathematical truths can only be understood by mental constructions that prove to be correct, and communication between mathematicians is a means of creating the same mental process in different minds.

For intuitionism, the dependence of truth on time is crucial. If in the given conditions we cannot prove a claim and, in the variant of that philosophy, when it is not possible to prove it at all, then it is neither true nor false. Consistent with this, intuitionists also consider a real number that is neither zero nor different from zero, for example, because there exist equations that cannot be solved under given conditions, or are unsolvable at all. They therefore consider that the method of proving by contradiction (the basis of geometry) is not acceptable either.

When we summarize their reasoning in the statement that “there is a real number x for which the equality $x = 0$ is not true and the negation of that equality is not true” or I paraphrase “that exists a number that does not exists", then we must have reservations about that concept of subjective mathematics. On the other hand, from the point of view of information theory, in which space, time and matter are information itself, i.e. communication and perception, then we will not completely reject the philosophy of intuitionism. It is a reduction of the right of mathematics to the truth, we will say.

There were reasons for the quarrel between the supporters of classical and intuitionist mathematics. One such was the proof of the Bolzano–Weierstrass theorem (1817) due to its extremely unconstructive character. In short, it says that every infinite and limited set of points of a real axis has at least one point of accumulation. Namely, all the starting points fit into a finite interval; we divide it into two equal parts of which we take half with an infinite number of points. We then divide it again, and again take half from the infinite points. Continuing the process of dividing shorter and shorter intervals and always taking the one with infinitely many points, in infinity is the very point of accumulation.

It is obvious that this theorem and its proof do not give a method that would determine that "unattainable point", but only speak of the existence. It is similar with the "basic theorem of algebra" which says that every polynomial equation has a solution, but not which one. It is the same with the procedures of iterations in countless steps, then with the calculations of the limits, with the calculation of the integrals. Intuitionists would throw such methods out of mathematics.

The great German mathematician Hilbert (David Hilbert, 1862-1943) said on that occasion, "We will not be expelled from the paradise that Cantor created for us", referring to the brilliant logic of infinity discovered by the founder of set theory (Georg Cantor, 1845-1918). Some mathematicians, as well as most physicists, did not even enter that "paradise" — it can be noticed.

In addition to this, constructive mathematics is also subjective. It replaces the phrase "exists" with "we can construct" and is characterized by the requirement that the proof must be algorithmic. He also accepts the claim that "there is a real number that is neither equal to zero nor different from zero", because there are equations for which there is no algorithm (with a final step) to solve. Such are polynomials of the fifth and higher degree. They will acknowledge the results of a lengthy process, unacceptable to impatient intuitionists, but not endless iterations.

The following is an interesting and unusual example of proof acceptable to classical mathematics, but not to constructivist mathematics. The notation $x\hat{}b$ means the exponent of the second number to the first, e.g. $5\hat{}2 = 25$, and not knowing the number x we prove that there exist irrational numbers x and b such that $x\hat{}b$ is rational.

Let b be the root of two, i.e. $b\hat{}2 = 2$. It is easy to determine that b is irrational, and it is difficult for the number $b\hat{}b$, so we avoid the second question. If $b\hat{}b$ is rational, then we put $x = b$, and if it is irrational we put $x = b\hat{}b$. Therefore, $x\hat{}b$ is rational! Namely, in both cases the conclusion is valid. If $b\hat{}b$ is rational, then the required $x\hat{}b$ is rational, because $x = b$. If $b\hat{}b$ is irrational, then $x\hat{}b = (b\hat{}b)\hat{}b = b\hat{}(b\hat{}2) = b\hat{}2 = 2$, again rational.

Subjective logic in one way or another narrow the field of mathematics and remain without a good explanation for rejecting the "excess" truth.

The consistency of the rejected is not in their favor. They resemble physics on the eve of the discovery of quantum entanglement when “phantom action at a distance” is denied by the assumption of “hidden parameters” of math of quantum mechanics. For decades, Bell's theorem (non-subjective logic) has been ignored, disputing such parameters and allowing disputable parts of physical reality, so that after experiments, this philosophy of avoidance turns out to be a naïve, and “unpleasant” theorem and its physical reality accepted.

The theory of the physical world whose essence is information and the essence of information are uncertainty and which will also say that the largest imaginable set of information is also some information, not to close and exclude infinity. Even if we determine that every perception (we, physical phenomena, or particles) is finite, that every communication that can happen to us is always in finite amounts, we still do not reject all-time truths as information and actions, except that we consider them energyless.

Our perceptions of universal truths are their final sections, limited in time range or some breadth, and then (non-zero) in energy or momentum. The more part of the infinite truth we notice, the more subtle it is for us, the less energetic it is and the less impulsive it is. This fits in nicely with the logic of information that in excess otherwise becomes misinformation, or more specifically, in the goods on the market whose larger quantity causes its lower price.

In information theory, we are partly subjective and partly renounce the understanding of ourselves as the center and cause of the existence of this world, or its main essence, but we allow ourselves to understand those realities that are beyond the immediate reach of our senses. In this it is similar and different from all known subjective logics.

4.4 Vitality of Game

If we achieve predictability with a rule, then unpredictability is a violation of the rule. But if we break the rules too much or too often then we lose strategy. This is a story about game theory and the importance of surprises for winning, and then about information.

We see that nature loves “relaxation” according to the universal law of inertia. The pursuit of relaxation is also the maintenance of a state of rest or mode of movement until the action of force. The body is in its “limp” state because it is most likely to do so in the given conditions, and since less information corresponds to a higher probability — because it communicates the least then. In its passive state, the body is deprived of uncertainty.

Therefore, the zero level of the game is the ultimate spontaneity. It is also in the extremely random withdrawal of moves, because less informative things are more probable, which happen more often. The force changes the probabilities. To turn the game in your favor, to win, means to add uncertainty, to increase information or action, to use force. In addition to quantity, strategy is characterized by the type of information and its structure.

In a given series of situations (events), the abilities (impulses) of the subject are evaluated in order as components of the vector $(a,b,c,...)$ and some are opposed to the constraints (positions) of the corresponding amounts $(x,y,z,...)$. The sum of multiplied pairs, $S = ax + by + cz + ...$, which has the form of a scalar vector product, is called *perception information* or "freedom". When the coefficients of these series are both increasing (decreasing), freedom is the greatest, and when the monotonies are opposite, the first is increasing (decreasing) and the second is decreasing (increasing), it is the smallest. This is known to us (from my stories) from before.

According to the amount of freedom, we divide subjects into living and non-living beings. The former have it in excess compared to the latter. It is their surplus information which makes them more vital and that's why they have a greater ability to choose. Unlike living beings, inanimate beings move according to the principle of the least action of physics. The exponential value of freedom is the number (mean of some) of the options $N = \exp(S)$. Its inverse function is the initial freedom $S = -\log(P)$, written here as the logarithm of the probability $P = 1/N$ of one option.

A known and unknown example of inanimate body information is the sum of actions by coordinates. In particular, it is the sum of the products of the uncertainties of the momentum and the position of the particle taken along the coordinate axes, whereby at the "fourth coordinate" we have the product of the indeterminacy of energy and time. I announced that we also take game theory strategies as examples of living body information.

A more vital strategy would be, I paraphrase: "an eye for an eye, kind for dear." This follows from the said definition of freedom. To the negative aggression of one opponent, the other would retaliate with a similar one, then the first would return with the "same measure", and the second to the first and the players would continue to get stuck in the blockade, unless at some step one of them decides to break the rule, by for example an unpredictably sorry. And in the opposite blockade, in the constant return of kindness, the way out is breaking the rules, and then let's say with malice; so again, nothing without the exception.

According to the alleged theory, the unpredictability of the game adds information to victory, and that is the action and "force" that can change the existing situation (status quo). The player adds it occasionally for the sake of superiority in the mentioned reciprocity algorithm (eye for an eye, kind for dear), which would be just maintaining a state of balance. Examples are all around us.

When the customer enters the store and gives money for the goods, a state of equilibrium is achieved. That is the strategy of reciprocity, because a sloppy seller, or a good person who too often gives goods below the price, would fail. If the neighboring countries establish a new standard for potatoes that does not suit the locals and the locals do not retaliate with appropriate measures, their potato production will suffer. In general, in a competition, an opponent who forgives lightly or retaliates sloppily reduces the mentioned freedom *S*, and the opponent can add his initiative for victory to that shortcoming.

First of all, here, due to the need for unpredictability, there is no best strategy in winning games. Due to the same need, the mentioned "return to balance" (rule of retaliation), otherwise one of the more successful tactics that is usually better placed in competitions organized to test theories, becomes even more deadly if the way of retaliation is also unpredictable. Also, it is not surprising that there are slack algorithms under it, nor that the lower ones are too predatory (for points). Too predictable players are, among other things, easy to trap.

It is rarely known that a win-win strategy almost always loses from a lose-lose strategy. We see the first in trade (good for the buyer, and good for the seller), or in political compromises, and it is confusing that it looks like the above retaliation, but it differs significantly from “reciprocity” in insisting on goodness, i.e. finding common interests because which significantly reduces player options. This “game of good” is extremely unfavorable against opponents who would unilaterally leave it and become “evil”, and that easily happens if there is no third force (state coercion) to prevent them from doing so.

An example of another strategy (lose-lose) is the sacrifice of a figure in the opening (gambit) in chess in order to achieve a better position, or economic investment (loss of profit). She usually has unpredictability (risk) and a dose of tactical aggression from the start.

Even in “minimax strategy”, games that are open like chess or so, when we make moves leaving the other side the least chance to retaliate strongly, top players know how to choose a “bad” move to raise the level of the game in the next stages and improved their chances of winning. We recognize these impulses of unexpectedness in the defeat of the famous grandmaster and world champion Capablanca[106] by the lesser-known chess player Reti[107] and his strange opening (the so-called Reti Opening), or Capablanca's loss of the title by Alekhine[108] (1892-1946), a grandmaster well known for unpredictable plots, sacrifice (gambits) of figures and positions.

4.5 Organization

There is a situation when the entropy is not an extensive (but an intensive) quantity, i.e. it is not proportional to the amount of the substance but depends on the possible arrangement of the molecules. As we will see, this irregularity reveals some interesting features of organization in general.

Intense entropy occurs in the thermodynamics of the so-called micro-canonical ensembles, in the absence of interactions between particles, and even in independence from the order of the same. Distinguish interchangeability from layouts, variations from combinations! It is also inevitable in the considerations of the Gibbs paradox, in a partitioned vessel of indistinguishable (completely equal) gas particles, I recently wrote (there are in this book), when the entropy of the vessel does not increase by removing the partition.

Entropy would decrease in a vessel with gas (or liquid) by the transition of molecules from a uniform to an uneven distribution. The second law of thermodynamics (heat spontaneously goes from a warmer to a neighboring colder body) would be violated. Otherwise, the molecules tend to have a state of a colder body, greater disintegration or more uniform distribution, less oscillation, and these are the predominant processes and in them the entropy remains an extensive quantity. However, there are

[106] José Raúl Capablanca (1888-1942), Cuban chess player who was world chess champion from 1921 to 1927.
[107] Richard Réti (1889-1929), Austro-Hungarian, later Czechoslovakian chess player.
[108] Alexander Alekhine (1892-1946), Russian and French chess player and the fourth World Chess Champion.

exceptions, turning points that are turning points that I also wrote about, then pointing to the border between the living and the non-living.

By accumulating gas molecules, their entropy decreases and (potential) energy, action and information emissions increase. This unspontaneous growth is contrary to the principled minimalism of information and occurs, for example, in cases of the emergence of a vital type[109] of organization.

One type of organization is a turning point that seems to defy the principle of least action. We find a similar form in lighting a fire that can last for days by adding fuel, as well as in forest fires, or on the other side in storms, or in keeping imperial capitalism in constant expansion, as described by Karl Marx. It is in this form that life on Earth occurs.

The small level of organization I am talking about would be an orchestra that plays exactly as instructed by the conductor. It would be the desired kind of hierarchy of naive dictatorships: one state, one leader, one will; one consciousness that governs all. Unlike such, therefore simpler forms of organization, living beings reach more complex levels. Their cells are at a higher level of the both, autonomy and control. They dedicate more information to their organization, giving it up and giving it more freedom and more complicated goals.

Imagine that our consciousness, as the absolute leader of the hierarchy of its cells, controls all the actions of the body. From the creation of erythrocytes (blood) through their flows to use, all metabolisms, liver function, digestion and many other parallel processes that we are not otherwise aware of. We wouldn't live!

In order to cross the irreversible point by means of the mentioned entropy anomaly, subordinate cells in the initial phase of their life remain indistinguishable (stem cells) and only then specialize in different tissues. Then they look like different experts at the same job, so that the higher organism achieves a higher emission of information and a larger amount of dialing, when in fact they are all of the same code (DNA). From our present point of view, such individuals are unimaginably disenfranchised, exhausted and loyal slaves of their organization.

By analogy with some distant future state, if people ever evolve into the aforementioned higher organization, the iron discipline of its citizens, their efficiency and commitment to a common social goal will become like the tissue of a tree or our body. A leader (president) will not be needed. Moreover, one leader will not be possible, just as an attempt to consciously control all the processes of our body would quickly lead to the death of the body.

The unique code of a living being, or the initial impersonality of cells, required by intense entropy might have an equivalent in mono-ethnic states. A later organization would seek the later specialization of disenfranchised individuals for its increased operability. If a simulation of “perpetual motion” (eternal movement), equality of inflow and consumption of information, is not realized, living beings would age and die, the inner one faster than the outer one.

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[109] also rare

The balance of absorption and emission of action (information) is found in rainforests (jungles) as well as in closed ecosystems, but also in all other systems that we say are self-sustainable. They constantly receive raw materials from external resources in order to constantly emit it, we now say in the form of action, that is, information. But also the so-called sustainable systems last only as long as the environment in which they can “live” lasts and everything in the “world of information” is constantly changing.

It turns out that “vital integration”, the theme of this story, is a dictatorship with initial virtues that inevitably disburse and disintegrate.

4.6 Vitality of Competition

It is no secret that the development of intelligence of a particular species of living world is accompanied by an increase in the number of options, the complexity of their environment and growing freedom of choice, and that at some point the ability to solve individual problems decreases with external constraints. Let’s look at what this has to do with competition, not just in economics or politics.

From ($I_k = S_k : H_k$) the proportionality of intelligence with the freedom of the given situations ($k = 1,2, \dots n$) and the inverse proportionality with the degree of hierarchy follows the proportionality of freedom with both, intelligence and hierarchy ($S_k = I_k \cdot H_k$). When there are independent situations, then there are also independent such freedoms, and the sum of all such that the subject can perceive is total freedom ($S = S_1 + S_2 + \dots + S_n$). It is the information of perception. A subject with greater perception information has greater choices and is considered more vital.

In the individual, perception information measures personal abilities versus environment; whether it is biological living beings, artificial intelligence, automata, or a simple physical substance. In the competition subsystem, where the ability of the first (I_k) is opposed to the resistance of the second (H_k), it is about the vitality of the system.

When the values of intelligence and hierarchy are both increasing, for example $I = (1,2,3,4)$ and $H = (1,2,3,4)$, or both decreasing, we say when they are the same monotony, their product ($S = I \cdot H$) is maximal. In the given example it is $S = 1 \cdot 1 + 2 \cdot 2 + 3 \cdot 3 + 4 \cdot 4 = 30$. In case of opposite monotony, this product would be minimal, $1 \cdot 4 + 2 \cdot 3 + 3 \cdot 2 + 4 \cdot 1 = 20$, with the least vitality.

Heisenber's uncertainty relations say that the product of the uncertainty of the particle momentum and its position is of the order of Planck's constant, $p \cdot x = h$. This means that by more accurately measuring the momentum of a particle, we find out its position more accurately and vice versa. These relations apply to all coordinates (directions). The sum of these products becomes information of perception. It shows the opposite monotony (series of momentums and positions) and, therefore, the minimal vitality of the particle.

As Heisenberg's relations apply to all elementary particles of physics, we consider them to be the least free in the sense of “information theory”. They have no information in excess, are minimally capable of choosing, and are subjects to the principle of least action of physics. The story with living beings is different.

I note once again, the perception information is not only a property of elementary particles of physics or living beings. A number of products of the corresponding components of "intelligence" and "hierarchy" can be attributed to the independent situations of any dialing system and obtain a measure of "surplus information". If we oppose the greater intelligence to the greater obstacle, and the lesser to the lesser, freedom is maximal, and when it is quite the opposite case, that greater constraint is opposed by lesser ability and less by greater, then we have inanimate matter of physics moving according to the principle of least action. All other cases are between these two extreme values.

In the previous text, I mentioned the vitality of the game "eye for an eye, kind for dear", when at the initiative of the attacker (external constraint) the other side responds with a proportionate intelligent response, with the point of the story being unpredictable. Anyway, due to the proportional resistance, we anticipate that this strategy will be well-placed in game competitions (for the purpose of testing theories), and that is what really happens.

The outcome is similar with equality in a given segment of society, which increases its tensions, which is why we can say that equality generates conflicts. Thus, sports competitions with uniform starting positions of participants are fiercer and more successful. That is why democracy unleashes greater potential of the people, and the spread of the principle of equality creates new and new demand for lawyers and new regulations.

A slightly different example that I also wrote about, but not in this context, was the importance of competition in the market for the economic development of society. It's a more familiar thing, so there's no need to detail. In short, having a monopoly on some goods on the market is better for the monopolist, but the conditions of competition are better for society. Note additionally that the "vitality of the game" of the duopoly is higher due to the greater information of the perception of such a system.

The attraction of the "forbidden fruit" is also an expression of the excess information of perception. When a teenager runs away from home, he demonstrates a desire for freedom, and that also becomes an example of excessive tension and breaking ties. An example of the unsuccessful maintenance of rivalry is separatism too.

Greater equalization of the forces of political position and opposition represents greater "liveliness" of society, which means faster adaptability, greater diversity, but also heavier control. As in the case of healthy competition in the market, party bidding is more of a benefit to society than to the ruling parties.

In history, we will find that states fall apart more often after despotic rule, for example after the death of the ruler, and now let us add an explanation that the remaining "more dominant" player did not live up to the situation imposed by the separatists. Despotism is a lower type of organization that loses information and lags behind, it becomes more and more unprepared for complications over time.

The human species shows a significant excess of possibilities in opposing the laws of nature, in taming them. We sometimes behave humbly towards the nature around us, but often it is as if it is our competitor when we need to win, to overcome. The result of this liveliness is a speed of progress that other species do not have.

4.7 Law Development

Everything that can act in space, time and matter is only information, and their universe itself is like that. Information is also the laws of these actions.

By laws here we mean everything similar from the multiplication table to the law of gravity, while we understand their universality both in space-time and in relation to different scales of magnitude. It is a presence everywhere and always where appropriate preconditions would appear, but also in analogies. The certainty of these laws, which would be disputable in itself, through the limitations of our perceptions, received a dose of unpredictability of the necessary information. Let's take a look.

The universe is huge. Due to its duration and size, viewed as one piece of information, its action has a negligible momentum and energy. That such a whole can be as influential as its smallest part is in line with the property of this theory, to be misinformed by too much information. On the other hand, this is also fine from the standpoint of the law of large numbers of probability theory, which predicts that larger systems of random events will become more certain, that is less informative.

The relation “2 + 2 = 4” is as general as the situation refers to and their number, our universe, changes over time. Newton's law of gravity, $F = GMm/r^2$, could be affected by a possible change in the gravitational constant in another way. For example, as with electromagnetism and weak interactions that occur at today's weak energy levels in two very different forces that were united at energies of 246 GeV and temperatures around 10^{15} K of the early universe.

The very fact that every particle is information and that the essence of information is uncertainty requires from the environment of those particles a constant change, if they do not change themselves. That is why the universe is constantly changing, because its smallest parts cannot do enough because of the law of conservation and its simplicity.

Information is quantity and it is why has sense to talk about smaller and smaller parts, particles of information. At the same time, we notice that a decrease below a small amount, but an optimal package of uncertainty, means an increase in certainty. These packets are the limits of the finite divisibility of information (down to the quantum of action) and their existence is in line with the well-known view that the electron does not have an exact trajectory before measurement (Copenhagen interpretation of quantum mechanics), and now we discover that ever deeper below their levels, some growing certainty is springing up again.

The elementary particle in its state of optimal information (uncertainty) is nowhere and everywhere, and its path is defined by the transfer of excess uncertainty (information) to the measuring apparatus which creates the certainty of the particle.

The development of the law over time is not an unacceptable (hypo) thesis even from the point of view of the above observations. However, in addition to the mentioned “changes”, let's try to understand things in the following general way. The Earth does not move around the Sun only because it follows some static law of gravity, but because the forces of gravity move in this way. The motion of electrons in an electromagnetic field, together with the laws by which electrons are determined, can be understood not as the motion of these particles but also as the displacement of the charges and laws themselves. Thus, for example, the principle of minimalism of information becomes applicable to the laws themselves.

We know about the different truths that we call universal and about the different ways in which they affect us. Such are the theorems of mathematics. Because of their presumed omnipresence and timelessness as a whole they could not have impulse or energy in action unless we perceive them in finite portions. Universal truths can only interact with the world of information in their parts!

So, I repeat, we communicate only with perceptions of information, even if we were in interaction with some "outside world". We are states limited by the range of our own senses, from whose world into some external world we never actually leave. The same goes for every physical particle. They have the least information (information is quantity), but they cannot do without uncertainty, so the world of micro-physics is reduced to subjects with little choice. Let's look at this now in terms of size scales.

The average elephant can lift 4-5 percent of its weight with a trunk; it weighs three to six tons and carries 300 kilograms. The average person can lift himself, which is a little more than 60 kilograms, but an ant with only a few milligrams will lift itself 50 times. A larger body loses heat more slowly (its surface grows with a square, and its volume with a cube of height). The uncertainty of a larger set is smaller (the law of large numbers).

The changes in the law that we notice when moving from micro to macro physics come partly from geometry itself, partly from probability theory, and in general from areas that we would not say are branches of physics. They are also different perceptions of supposedly infinite truths that are "out there somewhere" and who knows what they represent in some of their reality.

Finally, we come again to the topological notions of open and closed set which can be found at the same time only in an empty set and in the union of all sets. Thus, the vacuum is full of something, with which the universe could be close. It can be infinite without us perceiving only its finite parts, so that on the one hand there is certainty and on the other hand, ours side — uncertainty and information.

4.8 Fractals

Every periodic phenomenon carries some action and its own information — it is the thesis of information theory. In addition, we add the following known findings.

The energy of light is measured by the frequency of one photon (particles-waves of light). The density of sound energy and the speed of a sound wave increase with the pressure of sound and the speed of oscillating particles. At depths greater than the wavelength, the energy flow of the water wave is proportional to the density of the water, the gravitational acceleration, the square of the wave height and the period. However, the above thesis also applies to lesser-known examples.

When we divide a unit square into nine equal squares and remove the middle one, a “ring” of area 8/9 will remain. We do the same with each of the remaining eight squares, and we get a hollow figure of area 64/81. In the third step, we do the same with each of the 64 squares for the figure of the surface of the third degree of the fraction 8/9. In the tenth step, it will be the tenth degree of the mentioned fraction, and with endless repetition, the “Sierpiński carpet” would be created, a flat fractal with a surface of zero, first described by Wacław Sierpiński in 1916.

What has this “carpet” got to do with information? First, if the surface is a probability, its logarithm is information and it is proportional to the iteration (repetition, renewal) steps. The sum of the information of the fifth and tenth steps is equal to the information of the 15th step, but that is in general, so the law of conservation applies to this recursion (insertion of oneself). According to Noether's theorem, if we have a law of conservation then we also have some symmetry, here iterative.

Sierpiński’s surface imitates simple, Hartley's information well, which is why he adheres to the principle of the least action of physics. In that sense, it is very efficient as a “carpet antenna” pattern for capturing electromagnetic messages, which has already been noticed in mobile phone technology. Like Barabási's networks, such as the freely formed Internet, or the free capital market, the acquaintances of famous and less famous people — subject to the same distribution of probabilities, the power law, these Sierpiński antennas surpass other structures in their success in transmitting information.

Koch's snowflake is the name for the shapes obtained by recursion of triangles, which were invented by the Swedish mathematician Koch (Helge von Koch, 1870-1924) at the end of the 19th century. For example, to an equilateral triangle in the middle of each side (edge), add three times smaller one and remove the tangent edge. We repeat the procedure on the added smaller and smaller edges with smaller and smaller triangles. A “snowflake” appears with a finite surface and infinite circumference!

This is not a fictitious idea, because the British coast is similarly indented. With the finer size of the map and smaller units of length, the circumference of the island is growing immeasurably, but not its area. In binary relations that more of the one means less of the other, but also in the efficiency of the otherwise typical replenishment of inanimate matter, this phenomenon is reminiscent of relations of uncertainty, or “freedom,” the summand in information of perception consisting of products of “ability” and appropriate “limitation''.

Benoit Mandelbrot (1924-2010), a Poland-French-American mathematician, in the 1960s began to deal with self-similarity in his works such as “How Long is the British Coast”. In 1975, he used the word “fractal” (Latin for broken) to denote an object whose Hausdorff dimension (a measure of roughness or chaos) is larger than the topological one. He illustrated his mathematical definition with astonishing computer-aided visualizations.

Loren Carpenter, who worked at the Boeing factory in Seattle in 1978, drawing airplanes in nature, used Mandelbrot's ideas to get mountain ranges on the horizon with computer recursion. Fractal geometry simply gives shapes that nature builds in the branches of roots, trees, leaves, or broken lines of mountain ranges, or intricate loops of sea shores, unlike the Euclidean geometry of straight lines, triangles, circles, used by engineers. Its advantage is in the speed of drawing.

Algebraic fractals are created by iterations of functions given by simple algebraic formulas. At the beginning of the 19th century, the Norwegian mathematician Niels Henrik Abel proved that there are no universal methods for solving algebraic equations of the fifth and higher degree, but the solution must be reached in an infinite series of shorter and shorter steps. Approximations in general have been discovered by mathematics for centuries, in various methods of approaching the solution gradually with increasing accuracy.

With the final perceptions we manage to capture infinity with recursions, iterations as well as the calculation of the limits in general. I mentioned the same model earlier in understanding the relative slowing down of the time of a body that falls freely toward the black hole event horizon.

By repeating the insertion of an algebraic function into a variable of the same function, interesting sequences are created that are graphically represented and look like geometric fractals. The most famous such is the so-called Julia's set formed by the function of the square of a variable added to a constant number. From Julia's set, Mandelbrot's set was obtained, considered the most perfect of all fractals. Representations of these recursions became a “trademark” of fractals and were a prestigious fashion design in the late 20th century.

However, every aspect of physical information is finally divisible, so despite the law of conservation, real fractals degenerate more and more with subsequent iterations. They are information and cannot be identical even on the upper side of size. Every perception is limited from above, and instead of infinite magnification, we have worse and worse imitations.

Thus, Sierpiński's carpet is in reality of approximately zero surface and correspondingly deformed consequences. On the other hand, the thesis that information is waves and vice versa, with the theory of fractals, still passes to iterations on the scale of magnitudes and to the information of the self-similarity of the micro and macro world. They are analogous to known periodic phenomena, such as the change of state and process of quantum-mechanical dualism (vectors and operators), but again each time with some peculiarity.

Epilogue

From 1996 to 2022, I worked at the Gimnazija Banja Luka school as a professor of mathematics, and before that in banking as a designer and programmer of information systems. I completed my studies in mathematics in Belgrade, with several elective courses in information systems, theoretical physics (Prof. Đorđe Mušicki) and quantum mechanics (Prof. Fedor Herbut). During the studies, ideas for some of these stories were created, but their elaboration and presentation to the public are the result of recent circumstances.

The pictures are some of the few I have managed to save. Two are from numerous classes of the Gymnasium, and two are from one of the trips to China for the international kungfu fighting competition and the promotion of my book "Physical Information" in the National and University Library of the Republika Srpska.

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