Classical and quantum self-reference systems in physics and mathematics.

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Abstract

Systematic use of the concept of self-reference system is suggested to apply in mathematics and physics. We enter concept of quantum self-references, which describe our most general mathematical distinctions, abstractions. We argue that in nature there are only self-reference systems, that we may distinct properly, and that our natural way of thinking is mathematical.

1 Introduction

We see world via pictures. Scientists would say, that we see world as 3D moving picture of the manifold of reality. How far do we see in the world using our visional ability? As far as beautiful star picture in the night sky? But there exists another tool for seeing, and it reaches much further, until the farthest stars, until quarks. This tool is used by mathematics, and its name is distinction.

Picture and distinction are opposite notions, one given to us by God with the support of two other things, namely, time and space, to enjoy the world via pictures, ourselves being as if participants of these moving pictures, but mainly to procure our existence here on Earth, similarly as cats aptness to catch mice is given for , but the other one is given to procure another our ability, sometimes left without any use - to think. Mathematics makes use of the other. Even more, mathematics can do without the first, even without its supporters, time and space. Let us show this.

Many physicists up to now have tried to exclude time and space from the picture of reality[1, 13, 26, 41], i.e. in fact, trying to do the same what many idealistic philosophers [21] have tried to do before them. We believe that time and space should be objects of the same nature as all others

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that should be built from somewhat, i.e., they should be constructed, or be reconstructible, that should mean the same. Any mathematical space should be constructed from the objects that live within it, and time and space can't be some exception from this general rule of nature. We are going to build a very simplified model of the universe without time and space, i.e. universe comprised by causal causes, and consider it both in classical and quantum outline. We are going to use this model universe not only to characterize general causal relations in nature, but to characterize our cognitive capability in most general sense too. We are going to endow our toy universe with some aspect of thinking calling it *cogitans ergo existens*-universe model.

2 Definition of the self-reference system

Let us call self-reference system a system, which is closed in itself excluded from outer world, unless for a while, when it interchanges some information with the outer world. Other word for self-reference systems could be self-ontology systems, which as well would describe good the notion of the interest. Let us call an oracle system a self-reference system where the outer world does not exist in the sense, that an exchange of information with anything, that could stand for this outer world, does not take place. For self-reference systems we also use another word - idems, pronounced 'aidems.

The best way to model self-reference systems in our sense is to depict them as movement of particles in the space with collisions, where each particle is considered as a distinct self-reference system or idem. For any particle = idem we may differentiate two possible states:

1) between collisions, particle is closed in itself; we would say that it is in the state *particula in se* or simply *in se*;

2) when colliding, we say that through this occurrence it learns about the existence of some other particle (it is in state *particula collidens*) and may receive some qualified information from the outer world.

Sometimes, we would like to add one more aspect to the self-reference system. In the state *particula in se*, we would like to imagine the particle be without any notion of time, for example, let us choose a model for such being without time, *exempli gratia*, that of Descartes *Cogito ergo sum* [7, 6] existence where *cogitatio* is the precondition of the state of *essens*, i.e. our particle is as if in state of thinking, meditation, but not directly in time duration's aspect, but without any precondition, where the thinking itself is the base of the existence with no presence of time's duration whatsoever. Thus, our particle in the state *particula in se*, is as if *particula in se meditans*, or *particula in se cogitans ergo existens*. We would like to differentiate this state of particle by speaking either merely of *particula in se* or *particula in se meditans*.

We are going to use this notion of the self-reference system or idem in the most general sense to describe a notion corresponding to an aspect of any thing in the observable world to be closed in itself.

Each thing in the nature or a notion that describes the nature's some aspect can be thus in two predictable states, namely, within itself (*particula in se* state) and in interplay with the outer world (*paricula collidens* state). One may argue that both may occur simultaneously. We are interested to look more generally, namely, not confining occurrences only with time durability's distinctions, but rather with conceptual ones. Then for a self-reference may stand a simpler aspect of any higher complexity, imagining this simpler aspect to be *particula in se* and sometimes in collision, being in the state *particula collidens*[where somewhere there are *particulae collidendae*] which refers to the higher complexity. We come to the distinctiveness as a framework notion of hierarchically organized cognitively recognizable references. In this article we are interested in what these simple notions cold give to physics and mathematics. We are going to claim that mathematics on the whole actually is built and can be rebuilt, and actually is in dynamics of rebuilding of a structuring of self-reference systems or idems.

Let us consider the simplest cases of self-reference systems in physics, mathematics, programming, i.e., in nature's imitation by humans, and in nature in general.

3 Self-reference systems in physics

We are going to start with physics, showing that self-reference systems exist in the nature in the most natural way.

Let us see picture 1. Any object, e.g., stone, in nature is as if closed *in se* and does not know what goes on around it, because it is, as we are used to say, unconscious, i.e., it does not possess consciousness. Actually, we must discern that, whenever we are trying to start to think about that what, say, stone knows or doesn't know, it is our understanding of the world around us. Thinking physically, as a physicist should do, when he/she is

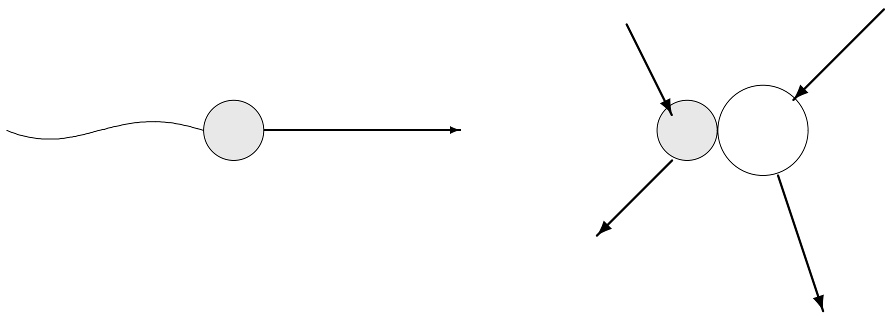

Figure 1: Left: First state: Particle in free motion = *particula in se* state. Right: Second state: *Particula collidens* state = particle in 5D manifold: locally in a point of Euclid space with pair of vectors attached, showing the directions where the second particle in collision came from and went to, in $R^3 \cdot V^2$. Adding the aspect of thinking to the self-reference system, we would like to speak of the state *particula in se meditans*, or even *particula in se cogitans ergo existens* [7, 6].

pondering about what goes on in the physical world, he/she is discerning things in the world, organize them in certain ordered patterns, and end up with the picture of the whole universe where this picture should stand for the opposite of what could be imaginable as being possible to appear from somewhere as a whole.

Thus, really, what goes on in the world, we may capture in terms how we discern the very basic things in nature. Scientist does not have any extra access to what goes on, except through these his/her senses given to him/her, where the notion *sense* we use in deeper sense, more meaning by it distinction in general then, say, any of physical senses, vision, or hearing, or taste, or else. It is argued here that actually a human being sees the world with the distinctions, and, as a consequence, with mathematical eyes. And this ability starts with someone to be able to discern any object in the world as if possessing the faculty (or imagination) to be in the place of this thing, to get in the *particula in se* state. Philosophically maybe we should refer the reader to the man who was closest to this way of thinking, namely, Johann Gottlieb Fichte. I-subject, what I am actually, and any of us, sees the world. But we may in similarly attribute this faculty of seeing to any thing in the world.

Further, we may make philosophies and whatever sciences around what makes sense to attribute to stone this faculty of being in itself, but mathematically attributing to the stone this faculty gives us way to productive thinking paradigm with enormous power. It turns out to be one of basic truths that a scientist at a time may turn its interest only to one thing and then this should work as a principal limit for human beings, but it can and should be made a proper tool of investigation as possible, and then it itself works as an excellent principle of our scientific epistemology. Maybe it is our fault to discern things in nature only via distinctions [not in some godlike way], but it turns out to be our achievement when we apply this as a cleverly chosen principle as properly as possible. Mathematics does it. Let us have a closer look.

3.1 Classical case

Let us consider the simplest case when a pair of particles collide, and consider one/ any of them as a self-reference system (see pict.1). Let us have manifold which locally is space $R^3 \cdot V^2$, i.e., space R^3, where our particle *in se* lives, multiplied with the pair of vectors from V^2, describing the state *particula collidens* where V_1 and V_2 are directions wherefrom and where the other particle (or whatsoever), that caused interaction, come and go to. Thus, our particle lives in three dimensional Euclid space and interaction comes from somewhere outside in the form of possibility of being some other (maybe) particle in the state *particula collidens*, describing here this as pair of vectors, showing directions of this other particle (or interaction) coming from and going to somewhere.

Our particle lives essentially (and ontologically, if you like) in this 5D space in classical sense, moving along zigzag path and in every fracture point of movement exchanges some information with another particle (interaction). All possible points of the particle in the 5D manifold reconstructs (or construct in this only sense) this space which may be called a living space of our particle, which then could be another name (and not only) for this 5D manifold. We would say that there exists a multiparticle that reconstructs all states, as superposition of all states, and now this multiparticle reconstructs its living space, this 5D manifold. Let us call this multiparticle CM5 (classical multiparticle in 5D space).

Let us look at the multiparticle CM5 from combinatorial point of view 2. One particle's interaction with other particles can be simply characterized as combinatorial structure called combinatorial map or more general structure - constellation [14, 15, 8, 31, 3, 4, 36, 35, 37, 38, 39, 2, 18]. But we know that constellation may guide such general mathematical structures as Riemann surfaces and ramified coverings [18] used in descriptions of Riemann surfaces. Speaking on very general level, a constellation always guides in any Riemann surface pieces of monotone functions (states *in se*), of whatever complexity Riemann surface could be, with ramifications of whatever complexity. The constellation is just the fitting combinatorial structure, that is sufficient for this guidance. Combinatorial map is a special case of the constellation [18], and fits for description of synchronized events. This gives to us one simple clue, i.e., multiparticle CM5 may be characterized by combinatorial map, say, cm5, and it may be a part, or guiding it, if you like, of some manifold , which we would like to call *manifold of reality*, which is holomorphic function [18]. Essential fact is that neither time, nor space are present in these descriptions of reality, but this description is, in it's very essence, completely multicausal. We can't get this conviction from the classical particle, even if we would be forced to call BB for because of our understanding of causality in general. Let us try to construct am quantum picture of this and see what we get in that case.

Let us consider the multiparticle CM5, which can be considered as a single self-reference system and/or as one-particle, as a model of universe what is built merely from causal dependences. If we take into account that in the quantum electrodynamic interaction between electron and photon may be considered as a general pattern of interaction between the forms of matter, then the suggested model of universe is only slight simplification of the picture of universe that gives QED [9]. It is easy to see that the model of universe, suggested by us, is cyclical. That causes some general invariants on, e.g., number of hitting balls in the representation given here. Our model being cyclical means that we have to do with causal cycles. How to interpret them? First of all we have to do with multidirectional causality what in case of time aspect being present would mean multidirectional time. As a consequence, our usual universe cyclicity would mean that BB is connected with Big Crutch, but in case of multidirectionality we do not neither beginning nor end. More interesting development of idea is to try to connect causal cycles with matter directly trying to interpret matter interactions geometrically. We have at least two models in this direction, i.e. model of Rueda and Haisch [quantum vacuum inertia hypothesis [26]] and model of Lisa Randall and [28], where we have to imagine that gravitational forces are these that flow through causal cycles. The model we are discussing we are going to call *in se* universe model.

Even more interesting is to look on the model which we have built with adding the aspect of thinking to the self-reference systems which comprise the model universe, i.e. with *particula in se meditans* particles. The multiparticle CM5 now can now be considered as a self-reference system itself that is being in the state *in se cogitans ergo existens*. This model we are going to call *meditans in se* model or *cogitans ergo existens* model of universe.

Our thinking universe turns out to be cyclical but we must remind ourselves that it is crucially multicausal. Further,if for one particle the attribute *meditans* may seem without much sense, then for CM5, if we besides think of some real universe model with immense number of causalities, our toy universe can turn to be very interesting one.

3.2 Quantum-like case

Let us consider a path of this particle from 5D-point a to 5D-point b in its living space. Further, let us consider the path integral [9] (sum over all possible paths) from a to b, and denote it $\Im(a, b)$. Let us consider the multiparticle over all possible pairs (a, b), i.e., over all manifold: $\sum \Im(a, b)$, the same particle not accounting more then once. Does this multiparticle differ from the previous one CM5? In classical sense - no.

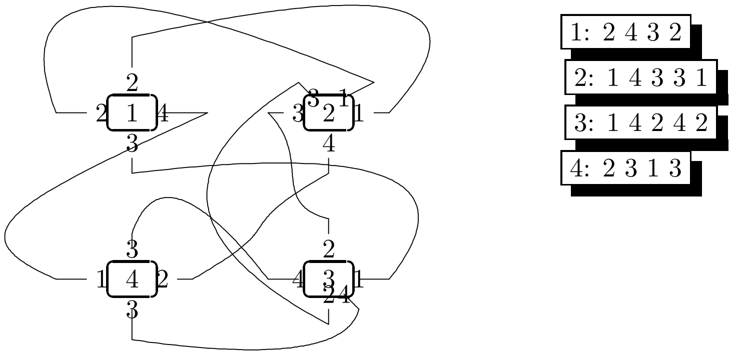

Figure 2: Let bookkeeping of 4 balls' hitting history be depicted in the multigraph. on the right the same multigraph is shown, but in more general outline, i.e., as if without knowing which events are to be connected, i.e., as if without synchronization of events. Picture on the right corresponds to eventuality, noncausalities to be present locally, meanwhile in the picture on the left noncausalities are solved with help of synchronization of events. Picture on the left can be characterized with combinatorial maps, but on the right - requires their generalization, constellations [18]. Either our manifold of reality, i.e., corresponding holomorphic function, is guided by combinatorial map, or by constellation[18], is the same question - do we live in monocausal or multicausal universe. Here cyclicity of histories of events is as if ignored, but if we live in the Newtonian world, without time limits whatsoever, then the connection of the past with future is a mere fact of imagination. Quantum mechanical interpretation of this picture may bring here some essential corrections.

Let us ask the same, but now try to attribute to this picture some quantum mechanical sense. Let us the QM interpretation's air connect with Feynman path's integral interpretation. Then we atribute to $\Im(a, b)$ one reference system, that of quantum life (actually on single (quantum) path) of our particle, which was in one summary interconnection with the members of $\sum \Im(a, b)$ via vector pairs in V^2. What do we get for all these integral paths in manifold? We get as if one multiparticle not in the sense CM5, but as one reference system actually, i.e., it is the same particle, but varied at all ends where whatever starting point should be chosen from some kind of actualization (or measurement?), where the initial information must be known by something (or someone) that guides all the process, keeping all the necessary information in the form of some initial (or border) conditions. Let us have a look in detail. We get instead of classical multiparticle a single particle, self-reference system, to what notion quantum particle can be attributed, i.e., quantum one-particle with varied ends. We discern it as a self-reference system and say that now it is another problem, how to look it at or tackle otherwise, because, looking at it (in classical sense), it should somewhere commence, but now this self-reference system is the variation over all ends (to all ends) in the living space. Trying to "measure" this particle one should break down this self-reference system. It is not only a trick to name things. Our quantum one-particle does not know about time sequences principally, except causal sequences of collisions on separate mono threads in one-particle life, that is, our particle does not know one (world) time, rather it is multicausal. [From global point of view we do not see difference from what we saw in the previous case, but maybe this point is crucial, because quantum picture should not give another world picture except when we see the world divided.] When we try to separate possible models in physical world picture from many mathematical opportunities then we mostly choose these with one world time as being in correspondence with our everyday experience. But it does not give us right to choose only such self-reference systems, which support one world times, as physically comprehensible from those that do not support this. It concerns the cases [and our case] where models without one world time give more comprehensive world picture, than those being in use before [maybe out of use for future].

But now, if we choose the combinatorial model 2 of CM5 then our universe turns out to be cyclical and the question about initial conditions falls off. Of course, big bang and big crunch unification is mere play of imagination if we can not put there any new sense. But as we saw higher, there are

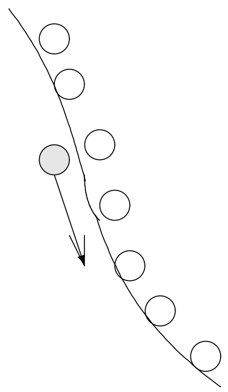

Figure 3: Idem0=particles movement in Euclid space. idem1=particles movement in field along geodesic. idem2 = multiparticle simulating action of the field. Considered as quantum particle, i.e., one-particle, it comprises abstraction of the action of the field.

plenty of possibilities to put interesting interpretations there.

What additional sense could be attached to the fact that we are drawing quantum mechanical picture of our particle CM5? We get one-particle. If we look on it from combinatorial universe model point of view, then combinatorial picture of our particle may be replaced with that of Riemann geometry, and say that our one-particle is the holomorphic function, the manifold of reality which takes into account all causal dependences because the corresponding holomorphic function is guided by the corresponding constellation [18]. We get the model of one-particle that in the same time is the model of the whole universe - the manifold of reality. Our quantum particle being the whole universe is much in resemblance with Wheeler's one electron idea [10].

Let us have a look at a simpler example. See picture 3. Particle is moving in the field along geodesic. This physical picture may be described by three idems: idem0 is a self-reference system of a free particle, say, in Euclid space. idem 1 is a reference system of a particle's movement in the physical field along some geodesic now, say, in Riemann space. Then we may discern third idem3 that should be a reference system of the field itself, but let us imagine in this example the idem 3 as consisting from many particles along geodesic, which acting on our main particle gives impression of the physical field. Is this only an occasional, convenient scheme, say, to explain action of some physical field to students? Not that. It turns out that mathematics more and more supports distinction of such reference systems where these reference systems can be joined together through convenient mathematical description. In this case a vector bundle with connection of space, imitating a field, is the right description. Even more, looking at such pictures we may even try to simplify these vector bundle pictures, introducing corresponding notions that directly communicate the idea with the mathematical model. This is the expectable eventuality, giving productive models in mathematics, in case most correct self-reference systems are detected in our problems. The mathematicians work in those directions, and we do not see any limits there. We think mathematically in the sense that it is our naturally given gift through world phenomena distinctiveness.

In order to go deeper in the idea let us look at even simpler example and tackle the problem of calculus, compute function of one variable $f(x)$ or some other manipulation with it. See pict.4. We can differentiate three idems, namely, idem0 that of the constant function, i.e., no change at all. This idem is interacting with the idem of some change, that together makes resulting idem of the graph of the function $f(x)$. We think even further and apply to this case and the previous one, the particle in the field, what follows. In these cases we were thinking classically, i.e. we had multiparticle, that imitated geodesic in the field and the change of one argument function. Let us try to look at these problems, say, quantum mechanically, let us say that we are going to tackle these problems as if one generalized problem with one single quantum particle instead of this multiparticle [imitating change]. What do we have? When we discover mathematical truths we discover just these quantum-mechanical self-reference systems, not those broken down in particular computations. Of course, we end up with broken down machines in order to do practical computations, e.g., when drawing particular functions' graphs.

These examples from physics give us a pattern of what we could call quantum self-reference system; i.e., if problem tackling forces us to introduce multi idems then, generalizing this problem in mostly natural way it leads us to one generalized idem, that stands for one quantum idem or quantum self-reference system.

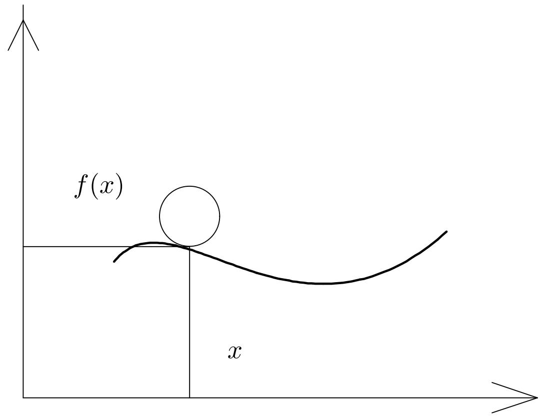

Figure 4: $f_0(x) = Const$ is idem $Fx0$, which collides with the change causing multiparticle Ch; idem Fx is *particula collidens*, which in the field of change collides, moves along the graph of the function $f(x)$. If in quantum aspect we could see all the problems of the same type as one, then multiparticle would change in one particle: then $Fx0 : Ch => Fx$ interacting with Ch gives Fx. All this problem tackling is one self-reference, which breaks down whenever we tackle individual problem, calculate $f(x)$, find derivation etc.

4 Self-reference systems in mathematics and computer programming

Let us turn directly to mathematics, but first consider computer programming and what relates to them both as cognitive activity and computational process, and mathematical machines' construction.

Let us look at a program which on some set of data S gives result set R . We know from computer science that there is invariant I of the program that gives S from R, whenever proving and gives R from S, whenever computing. We may break the invariant into as many invariants, say, as many procedures (or even instructions) there are in this program. Let us look at any single procedure in the program. It may be considered as self-reference system with the state *in se*, or even *in se meditans* which constitutes all actions that procedure does within itself and the state *particula collidens*, when procedure turns to other procedures, interchanging data, i.e., is in interaction with outer program's body. We know that each program cycle in the program has corresponding cycle's invariant, that, of course, is self-reference system, which corresponds to this cycle action and comprise its logical action. The global invariant I is a self-reference system built from these smaller invariants - idems. Thus, all program is one single idem, built from many other idems. We by programming discover or discern these idems and write them down [*read* break them down] into program codes, and so on. Quantum reference systems should be all on paradigmatic level in computer programming. Only thus programs work and turn out to be more general, than were projected initially. Good programmers do know this, programming directors should know this.

We may see that programming paradigm very well demonstrates our idea in the *particula in se meditans* aspect. Any large programm is very good pattern of our *cogitants ergo existens* universe model.

Today, a branch of computer science is developing using the term - ontology [12, 24], but not in the sense philosophers are used to do. It, in its essence, is typed and classified mathematical distinction, i.e. a self-reference system, which their authors call the framework for building models. It only depends on how we use this term: it turns out to be the same self-reference system, but applicable to some predictable field of interest with the effect of being conveniently deposable in common knowledge base with the possibility to be easy retrieved and applied. Because of the rapid development of this field we see here additional possibility to give computer scientists the necessary theoretical background, i.e., if our attitude is right, there should never be any limits for our desire to implement whatever mathematical theories in the frameworks of eventual ontologies. All is but to find appropriate mathematical distinctions, i.e., idems. There is a point where these attitudes work one against other. Ontologies' bases are hierarchical and depend on ground decisions in their basic choices. But it is only a question of how proper mathematical distinctions are made that they should work eventually good even in cases of human made knowledge databases based on particular choices. Some people from other fields teach us how to do this [18, 22].

Let us turn to mathematics where we should encounter examples of real quantum self-references. We may start with one beautiful example, e.g., the group theory [25]. We see that the group theory is self-reference system; when we work within the theory we apply theorems within it and develop it and applying the group theory outside itself we come to the state *particula collidens*. But this situation is already too general. We see that we have to do with quantum self-reference system, when we speak about already ready theory, say, the group theory that comprise in some way the tackling of many general problems at once in a great abundance. This even should turn to be right for a single theorem as a quantum self-reference system..

4.1 Can mathematics be built from self-reference systems?

All mathematics is built [or can be built] from idems where one set of idems makes others, are there limits to it? When we come to this idea we may ask two questions: can actually all mathematics be built from idems? or, is there anything in building of mathematics or applying of mathematics that can't be recognized as idem, where we do not think this only nominally, namely, when all theorems designing with names and designating them as self-reference systems, but asking if there really could be anything principally that doesn't break down in simpler idems and so on. If we remember Descartes, who suggested to build all mathematics from simpler facts. If all mathematics is Cartesian in this very sense then our idea works with greatest expectancy and correlation in support of this hypothesis.

Another statement against our idea may be, that it does not mean anything in those directions of what we are here around because the idea of self-reference is too weak to draw such conclusions as we are going to. Our argument against it could be: if we come to conclusion that each mathematical distinction or distinctiveness is self-reference systems in the same time, and the other way round [which seems be trivial conclusion: i.e., each self-reference system in mathematics is distinction] then from the universality of this paradigm, i.e., knowing that we do not know other way of our cognitive thinking, we are forced to conclude, that we may use this paradigm at least as a principle of productive thinking, enforcing mathematics with powerful tool of cognitive philosophy: mathematics, not eyes, is the way we see nature properly. Physical seeing procures us only with useful tools to existence. A good example of this could serve an example from the animal world. For example, cats are mostly apt in their natural abilities to catch mice. If cats were clever enough to prove theorems their argument of truth in their theorems would be either with use of them mouse can be caught or not. It is not a joke at all. Let us apply this observation to the human being. In our case we do not know such discernable common aptness as in the case of cats. Except, we say it is reasoning. Let it be so. But let us remind ourselves that our living space, given us from God, firstly is space and time (and everything in it) [what for cats were ability to catch mice].

5 Time and self-reference systems

One more aspect from mathematics as productive way of reasoning should be discussed. That is about time, but from another point of view. When we tackle a physical problem with mathematical method and in calculations where time comes forth we excellently know that time is in no way something mathematical, i.e., it is only some parameter in equation, that we interpret as being time. Time essentially does not exist in mathematics. From mathematical point of view we may say - time does not exist. It is a clock that produces time [17]. It follows that from mathematical point of view time is not self-reference system. But in physics? In description of nature? Let us try to build some idem, where idem = time could be discernable. What is it? Is the time the river where we all flow? Is the time the stage where the play called life is played on [according to Augustus]? Time is global, time essentially is not a self reference system, especially when we say that time is not conceivable from us otherwise as to be in it as in the river, attributing to this description poetical sense more then scientific. Time is a self-reference system in philology as the noun 'time' has some distinct meaning to be attributed to it. But it is only in the Newtonian picture of the world where the concept of time behaves like this.

From other part, Newton's absolute time as a concept is a discernable category and very primitive idem [the same that x in equations or whosoever], and simple parameter in mathematical notions not time what we feel or comprehend. In Einstein's relativity space-time is a beautiful self-reference system that guides other fields. But, be quiet. Mathematics goes on and spaces become similar constructs to other terms we tackle with. If in theoretical physics we say that matter constructs or reconstructs the space it lives in, these are not just phrases, but mathematical truths with discernable self-reference systems with beautiful theoretical outlook. Well defined time eventually should spring out as a constructed from some self-reference system. Up to now it is known [hypothetically with high expectancy] to be correct for space-time. [If we were prophets we would say, that time is a part of a higher order called multicausality with some threads recognized by us as time. We would describing, what time is, use the sentences: absolute chaos does not exist, every chaos is devored by some higher order. The definition is really good , because it works not only for time, but for the second thermodynamically law two. We are today on crossroads learning, what quantum chaos would mean.]

6 Hypothesis $\aleph$

Further let us turn directly to quantum mechanics.

Let us view this problem of self-reference more generally and depict our idem as a bracket $\langle s, u\rangle$, where with s we denote state *in se* and with u the state *particula collidens*. Let us assume that in u it is in the connection with the whole universe. This bracket resembles quantum states' scalar product that should return some invariant, i.e. it stands for mathematical quantity that measures some interaction. What is relevant for us here is the fact that in this interaction we can distinct state s as a state *in se* of this interaction. This state manifests the distinction.

Let us come forth with a hypothesis $\aleph$ that our reasoning is in the grand superposition with the nature. We may refer to the toy universe model that we built that could be easy made a thinking universe. In whatever directions of our cognitive thinking could we go, the universe reveals to us as being similar to our thinking. Maybe we must give ourselves account that it is only because we se universe as it is, but we can't get another way to look at universe than this we use in the epistemological inquiry. However, when we succeed in separating our understanding of universe from space and time notions, we come closer ourselves to the understanding of universe, how we see it and how we think about it. Cognition and structure of our thinking come each to meet. That is the sense of the hypothesis $\aleph$.

What does the assertion $\aleph$ mean from side of the physics directly? In fact, we do not need to know, at least now with our poor knowledge how it proceeds or whether it proceeds at all according our some comprehendible idea or imagination of that going on. When we tackle productive thinking problem in mathematics we are able to state that in nature we do not recognize anything except self-reference systems. This is what we keep on arguing when we show many analogies in our cognitive thinking ; in this sense we see a way to say that our reasoning is connected directly to outer nature and to raise the hypothesis $\aleph$ according which we come to the conclusion - our thinking is in the grand superposition with the nature.

Nature reveals itself us as if consisting of self-reference systems. [We are not gods that possess ability to capture nature in some oracle-similar cognitive activities. Maybe some have such abilities? Maybe through pictures?] Here we can catch ourselves on a logical circle. Actually, on the one hand, what we see in nature, is via distinctions, what we see and, on the other hand, our pictures of nature following our idea consist only from self-reference systems which are mere distinctions. Yes, it is the logical circle, but it is the same big logical circle what the ancients [Plato and Neoplatonists [23, 16]] described as our soul extending from us, capturing the whole universe and returning to us procuring us with the knowledge of it, the whole universe. It is the same argument that we use in our toy but thinking universe when it turns out to be cyclical, but if this cycle has to do with 30 billions of years, the estimate of our universe life time, then the fact of cyclicity does not play any conceivable role. The same can be said in today's language - mathematics provides us with the means of thinking that gives us access to all levels of reasoning because we are thinking mathematically on the very natural ground. The fact, that mathematical thinking and its development goes on slowly and with enormous hardships, only says that it is hard for us to pass off those "gifts" from God and nature, that procure only our existence, space and time [similarly as ability for cats to catch mice] but little cares about our cognitive development. This is the work that should be done by us ourselves. [‡] In the same time pondering on the

[‡]Isaac Newton warned us that, in case we are not productive on this field, in 2060 the world would come to the end . Of course, this is our explanation of Isaac Newton's prediction that generally is explained to have been unconditional. But we must remember that robotic revolution is before us, and if we do not proceed with our spiritual development,

things developed in this article we must recognize that $\aleph$ is only a hypothesis and as such considered. Nevertheless, even if we could find out, that there are some other possibilities, the worth and value of the statements of mathematical thinking did not fall off, and least of all, completely. Reality might be on some superposition with what was said above. Mainly, it concerns possibility of oracle systems actually, which should such be considered really, regardless of whether it concerns concept of God itself, or, possibly, such mathematical and physical [or in biology] problems which could ask for other consideration.

But, let for a while we accept hypothesis $\aleph$ as true. What are the real consequences of it? We must remind ourselves that we already can say that quantum computer is possible, if only quantum mechanics is correct. Now we may add a new assertion, i.e. our thinking is in the grand superposition with nature, or, our brain works as a quantum computer in the very direct sense, if only quantum mechanics is correct.

6.1 Quantum psychology

From psychological point of view correctness of $\aleph$ means that all self-references are distinctions in nature. What does it mean? We could ask, for example, does nature posses the forms we see in it? The form of a table, the form of a house, the shapes of the humans? If we could see properly in nature, what it consisted of; were we not to recognize that there was nothing else as enormous ocean of energies, great mess of energies of whichever nature? Where did we get the forms from we see in nature? They are actually quantum distinctions we have access to. To understand this, we must comprehend that nature uses some resources of nature itself, to build us starting from quarks in us, through molecules, genes, amino acids, cells, and ending with our brain, and this information is the credit, that is our measure, given us to be part of nature, according which we get ability to see at all in nature, in accordance of this credit. [Closed system can't interchange more information than it is in itself. In this conclusion we use quantum self-reference notion, giving way to idea that we, human beings, are not detached from each others as it looks like in the 3D moving picture of the manifold of reality.] We live in the ocean of energies [quantum fluctuations] which is not a simple chaos but a quantum chaos and an informational amount that builds us is sufficient to recognize in a quantum chaos forms of information

Newton's prediction could not be optional potentiality but rather inevitability.

given us in genes, distinct ontological patterns, that are given us as some credit to live in the world, to exist there, and to communicate via language, which is the main resource to collect and recollect our distinctions in our mind [33][§].

Eventually, we may come to the conclusion, that our cognition is a holomorphic function, the only ability of which is to preserve forms. Our distinctions come from there. This is, in case we are a quantum computer. But we are using this excuse about possibility or not of hypothesis $\aleph$ several times. Actually, on what level of complexity that builds our reality, it turns to be right, we can't imagine today, but it works as if being on the highest one and maybe works as the very universal beginning. In general, it all deals with the mind-matter distinction problem [41].

7 Problems around oracle systems

This approach of self-reference systems is necessary to us because we are used to think in terms of oracle systems. When we solve a mathematical or physical problem we are as if gods: the problem is on the paper and in our thoughts, but we ourselves are somewhere outside, say, when drink coffee between working hours. But it comes into our problem finding way not only in the manner, that on the paper can't appear calculations, that we do not understand, but that we look at the piece of nature in our problem as being something whole, i.e., we recognize it as an oracle system what does not correspond to reality because in the nature the same piece what we have on the paper doesn't exist as an oracle system; we were who did it. Thus, what or who did this commixtion when we look at our problems as something whole? They were space and time. Everything in our problem is on the stage called space and in the river called time but exactly these things are these that should be detached from the problem by detecting proper quantum self-reference systems in our problem. The piece of nature in our problem that we solve as an oracle problem, with oracles being ourselves, must turn into self-reference system in the most general way: this picture is in grand superposition with nature itself [especially whenever we

[§] Today Descartes would translate his words *cogito ergo sum* like: our abstract thinking consists of quantum self-references or quantum distinctions, and this comprises all our existence too, because our body on all the levels, from quarks to brain, does not anything else, but just the same, make quantum distinctions out from the ocean of energies, where we live in.

apply all our physical experience as one grand generalization]. If we solve problem otherwise, then we are far from physics and/or far from solutions of whatsoever.

Not recognizing oneself as oracle in an oracle type problem solving can lead to theories without any sense. V. Stenger wants to prove non existence of God in the book [29]. If he properly wants to find an oracle system in nature that could be called God, then he could be right maybe not, who knows. The question itself, what does such oracle system, God, mean, could, of course, be questioned or argued. But the greatest conclusion from this would be that science does not need to solve such problem or that it is not possible for natural sciences to come to any conceivable conclusion. Actually, time also does not exist in some senses and senses toward higher reasonability, but nobody wrote a book about time as a failed hypothesis. Time should come? The concept of God should be connected with life itself, as the principle of life, *vita principalis*, as being indivisible and global to the whole universe where our concepts of self-reference system stops to work, at least in the usual way as we define them. Finally, we are in the self-reference system called universe (or multiverse); what is outside it we do not know and/or do not know what sense to attribute to this being outside. Similar problem can arise even with Big Bang theory which seems to be the greatest achievement in the history of human thought, where nature's lowest building blocks, particles, are connected with the global universe. But we, as a life form, are inside BB; what should look like BB from the outside? But, do we solve BB problem as an oracle problem or hierarchy of self-references' problem? One point is there, that should make us suspicious: it is around time that so many times has deceived us. Concept of the time with the beginning of time is in some invisible [maybe for cleverest physicists too] river, which is the same time, it is tricking us. In this time were we cleverer? [In multicausality, BB would exist as some order, without necessity to commence some global enormous bang, not excluding some local ones and playing its role in the stellar matter production processes. There isn't difference from the world of life when we consider live form appearances as if the result of evolution in the 3D moving picture of the manifold of reality. This close analogy [between BB and *vita principalis*] shows that it does not depend on SM on the whole and on *vita principalis* on the whole, but only on the common aspect which they share: time, or order, in case of multicausality]

Actually, we can't say farewell to time, whenever we think in terms of oracle systems. Then we are gods [in the most badly epistemological sense of this word], that can't bear someone else next to us [not allowing self-reference systems except ourselves]. Let us imagine; can't it be that our time is only one arm of the river, i.e., a self-reference system giving right to exist some other arm of this river on the bank a poet like Heraclides sits and expresses his gratitude with words $\pi\acute{\alpha}\nu\tau\alpha\ \varrho\varepsilon\tilde{\iota}$. ¶

8 Conclusions

We have introduced the notion of the self-reference system and suggest to use it in mathematics and physics in a certain way. We introduce the notion of the quantum self-reference system that should stand for mathematical abstraction in some cognitive aspect. We argue that our thinking in some natural way is mathematical, i.e. when we systematically apply distinctions in an highly organized way.

We have built a toy universe model called *cogitans ergo existens* universe that, without thinking aspect, well describes some causal aspect of nature and, endowed with thinking aspect, well describes our thinking universes that we are building, i.e. mathematical universes.

We argue that the world around us and our thinking may be characterized in very similar way if only space and time are excluded from our picture of reality. That similarity we have expressed in our *cogitans ergo existens* universe model.

We argue, or raise as a hypothesis $\aleph$ that the similarity between universes *in se* and *in se meditans* expresses the fact that our cognition is in the grand superposition with nature, i.e. in frames of the $\aleph$ hypothesis both universes actually are the same universe.

Multicausal universe may simply explain BB [34] and life evolution [5, 30] from one paradigmatic point of view.

We express hope that the idea may be used in many areas of mathematics, physics and education. Actually, many approaches already share the same idea, i.e. all around symbolic calculations, e.g. *Mathematica* [20], and similarly. We hope to use these ideas in human built ontologies[12].

¶Heracleides didn't know LATEX problem of using smooth and rough breathing marks in the Ancient Greek text.

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