

Phenomenal World as an Output of Cognitive Quantum Grid: Theory of Everything using Leibniz, Kant and German Idealism

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Brief summary

In order to understand the Universe completely and achieve Theory of Everything we must understand how our consciousness experiences and understands all objects in the Universe in general. The aim of the project is to synthesize philosophy, mathematics, physics, information theory, language and cognitive science into a single architectonic framework or system of our reason itself and to model the original synthetic unity of apperception – the framework within which all our thoughts, knowledge and experience is produced.

Kant's transcendental philosophy argues about the necessary conditions to make our experience and a priori knowledge of the objects of experience (mathematics, theoretical physics, metaphysics) possible. Leibniz's theory of monads is considered under Kant's architecture of the mind together with German idealist philosophy of Fichte and Hegel in order to model our cognitive framework (and the Universe as it appears to us) as a quantum computer. Universal Consciousness (Reason) is postulated as fundamental and as existing outside space and time for eternity. Phenomena in space and time is the product of mind. The cognitive faculty of understanding is defined as the grid structure made of cells (unit circles – monads) where the center of each circle is on the circumference of 6 surrounding circles. Cells combine with each other (overlap) by the logical forms of thought – the grid is invariant structure underlying our logic. Metaphysics is logic and the Universe is panlogical. The grid is the original synthetic unity of apperception (transcendental unity of self-consciousness) – the original entangled structure forming the unity of consciousness. It is the structure according to which our mind organizes experience. It is the structure within which our thoughts originate as electromagnetic waves (the ether). It is the structure of space and time – cells overlap and create relational space. Unit cell is the purest expression of Hegel's 'the Idea' (equivalent to pure Reason or pure consciousness). Unit cell is the system of pure reason (or pure consciousness): it is the unit sensor (pure receptivity for sensation), the pure spontaneity of thought generating the representation 'I think' (pure apperception), the transcendental determination of time (transcendental clock) – the purest schema of imagination which is homogeneous with the pure sensation and the spontaneity of thought, pure memory and pure will. Spontaneity of thought is the circular motion of the time parameter around the unit circle (boundary of the cell). The whole grid is sensorium – the spatio-temporal manifold of intuition (of sense-data). The mind is treated computationally: time parameter's motion – spontaneity of thought (generating *cogito* or the 'I think') – is reason (consciousness) performing information-processing (synthesis) of the manifold of intuition (of sense-data). The 'I' (the soul) as pure reason (pure consciousness) is outside space and time (outside computation) but it finds itself as a corporeal body (phenomena) in space and time through self-consciousness (original apperception). The 'I' throughout the grid is the same (the analytic unity of consciousness) – the grid is holographic. Cell is qubit (basic logical atom). Reason performs computations in the cognitive framework (2D Euclidean holographic grid – logical space) where our thoughts are formed by the combination (synthesis) of naturally quantized cells. Time

is present in every cell as the \hbar quantized inner rate (frequency) of a cell – the rate of spontaneity of thought. The grid is synthesized by the productive imagination under the pure concepts of the understanding (transcendental logic) – 2D holographic grid is integrated. In this process our apperception (and intellectual intuition) causes cells to take definite states from the superposition of states and conscious experience of empirically real objects in 3D non-Euclidean space emerges. Being is through time (vibration of the cell). Curvature of empirically real space depends on the rate of the cell (rate of time parameter) – gravity arises from the amount of information-processing. The cells are in superposition of states from possible worlds. The Universe is panlogical – logical matter from possible worlds is physical matter when sense-perceived. The rate of time parameter defines the energy (intensive degree – “mass”) of sensation. Cells vibrate both in space (extensive magnitude) and time (intensive magnitude). Motion of the time parameter is Bergson’s pure mobility (duration) and is related to momentum (quantity of motion) – E^2 (total processing energy of a cell) = m^2 (rest mass) + p^2 (movement). Energy (information) can flow to 6 transcendently ideal dimensions (6 overlapping cells). Reason gives meaning and “reads/articulates” the sensory information through schemata. The grid is the framework of natural language, mathematics and is the unitary system of fundamental forces of physics. Natural language and the world are based on the same fundamental structure of the mind. By construction of objects in pure intuition of space and time mathematics studies the grid – the invariant structure of space and time in which all phenomena appear. Gödel’s incompleteness theorems are discussed in the context of reason being autonomous faculty which is outside computation but which performs computations in the cognitive faculty of understanding (in logical space through time). Our knowledge is limited to objects produced in the grid (phenomena in space and time). 4 fundamental forces of physics are defined by logic – the laws of thought are also the laws of physics. Unit cell is the prototype of natural units. Self-conscious subjects (humans) have absolute spontaneity (transcendental freedom, free will) – a choice what definite state a cell will acquire (autonomy). Fundamental forces of physics, our sense perception and our action (motion as a corporeal body) are related as the forces affect our outer sense. Self-conscious subjects are merely an autonomous parts of the Universal Consciousness (the Absolute). Individual minds are a part of Universal Mind of the Absolute, where the spatio-temporal structure of the Universe is the sensorium of the Absolute. Space is the medium for thoughts, time is the process of thinking. Each cell represents the whole grid (the Universe) from its perspective. Unit cell has two opposite values which alternate (expressing the dialectic nature of reason). Hegelian dialectic is the program which Universal Consciousness (Reason) runs by thinking itself. The dialectic Thought of the Absolute moves towards full self-consciousness. This program starts the Universe (the Big-Bang), generates the complexity of the world and moves time forward by union of the opposites (synthesis). Synthesis (information-processing) is considered in thermodynamic terms. Unit cell is highest Reality and Absolute Infinite (of reason) which contains all possible predicates of things and all infinities (of the understanding) in itself. The complexity in the world arises as patterns (schemata) of mutual limitations and determinations of cells producing greatest possible variety. The finite objects of experience (phenomena in space and time) are defined by cells overlapping – mutually limiting each other and giving qualities in exclusion of other qualities (in relation to all other qualities). Objectivity (the objective world) is possible through inter-subjectivity of cells – all grid represents the Universe. The Universe is physical-moral system: both mathematics, fundamental forces of physics, metaphysics (theoretical reason) which construct the world and morality (practical reason) which describes how we ought to act in the world originate from the same source - “the Idea” (Reason). Many aspects of the model are discussed such as the origin of space and time, our a priori knowledge (logic, mathematics, physics, limits of computability), how mathematics relates to the world, unity of the fundamental forces, gravity in relation to information processing, the arrow of time, the nature of quantum phenomena, universal grammar of natural languages, reconciliation of physicalism and idealism, the possibility of free will in deterministic Universe, our action in relation to perception, theology and our place in the Universe in general. Since the grid is invariant structure within which all our knowledge and experience is produced, it is considered as the basis for Theory of Everything. With it we achieve what Hegel called “Absolute Knowledge” – the times of full self-consciousness, rational freedom and humanity in harmony with the Universe.

1. INTRODUCTION

“Without transcendental philosophy one can form for oneself no concept as to how, and by what principle, one could design the plan of a system, by which a coherent whole could be established as rational knowledge for reason.” – Immanuel Kant (Opus Postumum, 21:7)

All our knowledge about the Universe comes from our reason characterized by the processes in our brain. Therefore a theory currently sought in physics which would explain fundamental forces, particles, space and time cannot leave questions of other fundamental sciences unanswered. Theory of Everything (ToE) should synthesize philosophy, cognitive science, language, information theory, mathematics and physics into a single *framework or system* of reason itself.

In a search for such a framework or system we would make our efforts much easier if we first knew the answers to these questions: is it possible to know everything about the physical world or just a part of it and why? How science is possible? How we discover and understand things about the physical world and why in such a way? How does science (knowledge of the world) evolve as a part of human history, by what principles and where is it converging to? The answers to these questions would give us *the whole picture* of our possible knowledge and where exactly we are in a search for ToE.

We can imagine our quest for understanding of the Universe as step by step walk in a dark room where, by following the guidance of our reason, we understand things (objects in the room) how they appear to us in our sense perception through our body and brain. This journey started in ancient times and now the humanity has arrived at 21st century modern science which seeks Theory of Everything. We advance further and further in our understanding of the world by finding answers to arising questions and by solving inconsistencies and contradictions in our theories. We express our theories in mathematical equations and mathematics seems to relate to the objects in the room *a priori*. The history of our understanding of the Universe *follows* our reason and all the thinkers since ancient times were guided by reason. Therefore knowing the *architectonic system of our reason* itself would give us *the invariant framework of all our possible knowledge* and this can “shed light” onto the objects in the room we strive to know and direct us to Theory of Everything. Once we have *the model of our cognitive framework* and understand *how the knowledge of objects in the Universe arise in it*, it is easy to see the connections between things and how they fit into the *complete picture of the Universe* as it appears to us.

These epistemological questions are not new and some of them were investigated by Immanuel Kant in his work “Critique of Pure Reason” (1781) (CPR). In his work he defends a priori knowledge of the Universe – he asks how are synthetic a priori judgments possible? According to Kant, pure mathematics, pure natural science (theoretical physics) and metaphysics are based on synthetic a priori judgments. By metaphysics Kant means the *legitimate metaphysics* as science and not the “dogmatic metaphysics” which speculates beyond the limits of our knowledge. Kant investigates how synthetic a priori judgments are possible and what are the limits of our knowledge. In order to do so he argues about the *necessary a priori conditions in our mind* to make experience in general possible. Kant calls those immanent necessary conditions of experience “*transcendental*”, not to confuse with “*transcendent*” which means beyond experience and unknowable. *Transcendental* can be seen as what is *fundamental* to our experience and cognition of the world. “I entitle *transcendental* all knowledge which is occupied not so much with objects as with the mode of our knowledge of objects in so far as this mode of knowledge is to be possible *a priori*. A system of such concepts might be entitled transcendental philosophy” (B25).

Later in the “Metaphysical Foundations of Natural Science” (1786) Kant used the system established in CPR to argue about the possible determinations of the concept of matter in general. In

Kant's last and unfinished major work "Transition from the Metaphysical Foundations of Natural Science to Physics" (released posthumously as a part of "Opus Postumum") he was seeking an *a priori system of fundamental forces of physics* and general properties of matter which manifest in experience. Kant argued that the cognitive faculty of understanding in our mind is the *lawgiver* of nature and prescribes to nature such laws as causality. Even the fundamental forces of physics must correspond to the logical forms of thought (categories) of the understanding. That is, metaphysics is logic and logic is fundamental.

In early pre-critical works Kant was mostly interested in the metaphysical issues of physics and mathematics and many philosophers who influenced him, such as Leibniz, Spinoza, Hume, Newton, Aristotle and Plato, are particularly interesting in the context of present day problems of physics. Leibniz, whom I consider the most original and important, and his *theory of monads* will be used in this paper greatly. Leibniz also spoke of *characteristica universalis* and *calculus ratiocinator* which our model is directly related to.

Kant's transcendental philosophy raises and answers the question "how is experience possible?". Therefore we will use Kant's architecture of the mind to model our cognitive framework as a quantum computer defined on the grid of cells (monads) which makes experience and cognition of the objects of experience possible. When synthesized by the imagination this framework outputs phenomena in space and time. This grid of monads is the original synthetic unity of apperception, the framework of unity of consciousness within which all our thoughts are formed (the framework of the understanding). It is an invariant framework of all our knowledge. We will discuss it as the mathematical framework, as the unitary system of forces of physics, as the framework of natural language and in many other relevant contexts.

There are many thinkers who try to model the Universe as a quantum computer and this school of thought is called digital philosophy or digital physics. We introduce Kant and German idealism into digital philosophy. We will treat the mind computationally. The synthesizing spontaneous act of the mind (*cogito* or the "I think") will be treated as information-processing.

We will not go in detail to Kant's philosophical arguments so familiarity with his system is assumed. We only provide the necessary points of Kant's transcendental philosophy to model our cognitive framework and application of it to foundations of mathematics, physics, natural language, cognition, questions of philosophy and study of conscious experience. Kant's philosophy and the dialectical nature of reason was developed further by Fichte, Schelling and Hegel who radicalized Kant's transcendental idealism. We will not discuss the differences between Kant's transcendental idealism and post-Kantian German idealism as this is not the aim of our project.

We will use Fichte's and Hegel's philosophy and the German idealist view. We hold that the world is the product of mind. We hold consciousness (or Reason) to be fundamental and universal. Universal consciousness exists outside space and time for eternity. We will show that the world arises as self-consciousness. That is, the structure of our cognitive framework (the grid of monads) is such so we can be self-conscious. Consciousness is the source of ultimate connections among all things. Mind and the physical world are ordered according to the same rational principles (the Universe is pan-logical).

Finally, we will discuss what will happen to human society when we achieve the complete understanding of the Universe (Theory of Everything). According to Hegel, systems in the history of philosophy represent the necessary succession of ideas required by the progressive unfolding of the Idea. The history of philosophy is the development of the Absolute's self-consciousness in the mind of man. We will argue that we arrive at "absolute knowing" – the times of full self-consciousness, rational freedom and humanity in harmony with the Universe.

2. THE ORIGINAL SYNTHETIC UNITY OF APPERCEPTION AS A GRID OF CELLS

It is necessary to provide some theory on which the model is based. We are not aiming at explaining in detail Kant and the theories of other philosophers who are used in this project, but only in applying them to model our cognitive framework (and the Universe as it appears to us) as a quantum computer. Basic knowledge of Leibniz, Kant and German idealism is assumed. Nevertheless, readers interested in Kant and post-Kantian German idealism will find this model as a way to comprehend this philosophy easily since the model is based on it. For those not very familiar with Kant's construction of corporeal nature, we found an essay "The Unity of Kant's Thought in His Philosophy of Corporeal Nature" by James W. Ellington very useful and clarifying. It can be found in his translation of "Metaphysical Foundations of Natural Science" (Indianapolis: Bobbs-Merrill, 1970) and "Philosophy of Material Nature" (Indianapolis: Hackett Publishing Co., 1985).

For Kant "transcendental" means necessary conditions to make experience possible, so as such those conditions define our cognitive framework within which all our experience (phenomena) is produced. In order to apply Kant's transcendental philosophy to model our cognitive framework as a quantum computer similar to cellular automaton we need to look for a grid of cells which would be characterized by the a priori conditions of experience given by Kant in CPR. Therefore the framework must have the following characteristics:

2.1. From sensibility (space and time as pure forms of sensible intuition)

"Our knowledge springs from two fundamental sources of the mind; the first is the capacity of receiving representations (receptivity for impressions), the second is the power of knowing an object through these representations (spontaneity [in the production] of concepts). Through the first an object is *given* to us, through the second the object is *thought* in relation to that [given] representation (which is a mere determination of the mind). Intuition¹ and concepts constitute, therefore, the elements of all our knowledge, so that neither concepts without an intuition in some way corresponding to them, nor intuition without concepts, can yield knowledge. Both may be either pure or empirical. When they contain sensation (which presupposes the actual presence of the object), they are empirical. When there is no mingling of sensation with the representation, they are pure. Sensation may be entitled the material of sensible knowledge. Pure intuition, therefore, contains only the form under which something is intuited; the pure concept only the form of the thought of an object in general. Pure intuitions or pure concepts alone are possible *a priori*, empirical intuitions and empirical concepts only *a posteriori*.

If the *receptivity* of our mind, its power of receiving representations in so far as it is in any wise affected, is to be entitled sensibility, then the mind's power of producing representations from itself, the *spontaneity* of knowledge, should be called the understanding. [...] Without sensibility no object would be given to us, without understanding no object would be thought. Thoughts without content are empty, intuitions without concepts are blind." (A50-51)

"Space is a necessary *a priori* representation, which underlies all outer intuitions." (A24)

"Space is nothing but the form of all appearances of outer sense. It is the subjective condition of sensibility, under which alone outer intuition is possible for us." (A26)

¹Anschauung ('intuition') is by origin a visual word 'to see, look, view, intuit'. Sense presentation is the means by which we have intuition. "Objects are given to us by means of sensibility, and it alone yields us intuitions" and intuition is that through which mind is in immediate relation to objects, and from which all thought gains its material (A19). For Kant, intuition involves sensibility rather than the intellect. Sensibility is the capacity of receiving representations (receptivity for impressions) and through it first objects are given to us (A50). Briefly, intuition is sensory data or information provided by the faculty of sensibility. Space and time are pure forms of our intuition and not concepts, i.e. all matter (content) of sensation appear in these forms.

"Time is a necessary representation that underlies all intuitions." (A31)

"Time is nothing but the form of inner sense, that is, of the intuition of ourselves and of our inner state. It cannot be a determination of outer appearances; it has to do neither with shape nor position, but with the relation of representations in our inner state. And just because this inner intuition yields no shape, we endeavour to make up for this want by analogies. We represent the time-sequence by a line progressing to infinity, in which the manifold constitutes a series of one dimension only; and we reason from the properties of this line to all the properties of time, with this one exception, that while the parts of the line are simultaneous the parts of time are always successive. From this fact also, that all the relations of time allow of being expressed in an outer intuition, it is evident that the representation is itself an intuition.

Time is the formal *a priori* condition of all appearances whatsoever. Space, as the pure form of all *outer* intuition, is so far limited; it serves as the *a priori* condition only of outer appearances. But since all representations, whether they have for their objects outer things or not, belong, in themselves, as determinations of the mind, to our inner state; and since this inner state stands under the formal condition of inner intuition, and so belongs to time, time is an *a priori* condition of all appearance whatsoever. It is the immediate condition of inner appearances (of our souls), and thereby the mediate condition of outer appearances. Just as I can say *a priori* that all outer appearances are in space, and are determined *a priori* in conformity with the relations of space, I can also say, from the principle of inner sense, that all appearances whatsoever, that is, all objects of the senses, are in time, and necessarily stand in time-relations." (A33-34)

"Time and space, taken together, are the pure forms of all sensible intuition, and so are what make *a priori* synthetic propositions possible." (A39)

Unit cell must have two forms of receptivity – inner (time) and outer (space):

1. Unit cell must be a unit sensor characterized as pure receptivity for sensation. Time as form of inner sense must be present in every cell in the grid since time is a form of all appearances whatsoever.
2. Space as form of outer sense must be outer relations of a cell to neighbouring cells and through these relations (channels) information must move (flow) in the grid.

2.2. From the understanding (as the faculty of thought, the table of judgments as forms of thought)

Kant's table of the forms of judgments, categories, their schemata and the synthetic principles of pure understanding is included as an appendix at the end of this paper.

"[W]e can reduce all acts of the understanding to judgments, and the *understanding* may therefore be represented as a *faculty of judgment*. For, as stated above, the understanding is a faculty of thought. [...] The functions of the understanding can, therefore, be discovered if we can give an exhaustive statement of the functions of unity in judgments." (B94)

"General logic, as has been repeatedly said, abstracts from all content of knowledge, and looks to some other source, whatever that may be, for the representations which it is to transform into concepts by process of analysis. Transcendental logic, on the other hand, has lying before it a manifold of *a priori* sensibility, presented by transcendental aesthetic, as material for the concepts of pure understanding. In the absence of this material those concepts would be without any content, therefore entirely empty. Space and time contain a manifold of pure *a priori* intuition, but at the same time are conditions of the receptivity of our mind – conditions under which alone it can receive representations of objects, and which therefore must also always affect the concept of these objects.

But if this manifold is to be known, the spontaneity of our thought requires that it be gone through in a certain way, taken up, and connected. This act I name *synthesis*." (B102)

"Thought, taken by itself, is merely the logical function, and therefore the pure spontaneity of the combination of the manifold of a merely possible intuition" (B428)

"For it is an act of spontaneity of the faculty of representation; and since this faculty, to distinguish it from sensibility, must be entitled understanding, all combination – be we conscious of it or not, be it a combination of the manifold of intuition, empirical or non-empirical, or of various concepts – is an act of the understanding. To this act the general title 'synthesis' may be assigned, as indicating that we cannot represent to ourselves anything as combined in the object which we have not ourselves previously combined, and that of all representations *combination* is the only one which cannot be given through objects. Being an act of the self-activity of the subject, it cannot be executed save by the subject itself. It will easily be observed that this action is originally one and is equipollent for all combination, and that its dissolution, namely, *analysis*, which appears to be its opposite, yet always presupposes it. For where the understanding has not previously combined, it cannot dissolve, since only as having been combined *by the understanding* can anything that allows of analysis be given to the faculty of representation." (B130)

"But the concept of combination includes, besides the concept of the manifold and of its synthesis, also the concept of the unity of the manifold. Combination is representation of the *synthetic* unity of the manifold. The representation of this unity cannot, therefore, arise out of the combination. On the contrary, it is what, by adding itself to the representation of the manifold, first makes possible the concept of the combination. This unity, which precedes *a priori* all concepts of combination, is not the category of unity; for all categories are grounded in logical functions of judgment, and in these functions combination, and therefore unity of given concepts, is already thought. Thus the category already presupposes combination. We must therefore look yet higher for this unity (as qualitative), namely in that which itself contains the ground of the unity of diverse concepts in judgment, and therefore of the possibility of the understanding, even as regards its logical employment. [...] It must be possible for the 'I think' to accompany all my representations; for otherwise something would be represented in me which could not be thought at all, and that is equivalent to saying that the representation would be impossible, or at least would be nothing to me. That representation which can be given prior to all thought is entitled intuition. All the manifold of intuition has, therefore, a necessary relation to the 'I think' in the same subject in which this manifold is found. But this representation is an act of *spontaneity*, that is, it cannot be regarded as belonging to sensibility. I call it *pure apperception*², to distinguish it from empirical apperception, or, again, *original apperception* because it is that self-consciousness which, while generating the representation 'I think' (a representation which must be capable of accompanying all other representations, and which in all consciousness is one and the same), cannot itself be accompanied by any further representation. The unity of this apperception I likewise entitle the *transcendental* unity of self-consciousness, in order to indicate the possibility of *a priori* knowledge arising from it. For the manifold representations, which are given in an intuition, would not be one and all *my* representations, if they did not all belong to one self-consciousness. As *my* representations (even if I am not conscious of them as such) they must conform to the condition under which alone they *can* stand together in one universal self-consciousness, because otherwise they would not all without exception belong to me. From this original combination many consequences follow.

This thoroughgoing identity of the apperception of a manifold which is given in intuition contains

²Kant took the term "apperception" from Leibniz. Leibniz makes a "distinction between perception, which is the inner state of the monad representing external things, and apperception, which is consciousness or the reflective knowledge of this inner state; the latter not being given to all souls, nor at all times to the same soul". Animals can have perceptions but humans can have perceptions and apperceptions. Apperception is awareness of one's perceptions as one's own, i.e. self-conscious awareness. Kant claims that all our experience must be such that it could become self-conscious experience. "It must be possible for the 'I think' to accompany all my representations" (B131). Apperception is the spontaneous activity of the self in reflecting upon and becoming conscious of own's perceptions.

a synthesis of representations, and is possible only through the consciousness of this synthesis. For the empirical consciousness, which accompanies different representations, is in itself diverse and without relation to the identity of the subject. That relation comes about, not simply through my accompanying each representation with consciousness, but only in so far as I *conjoin* one representation with another, and am conscious of the synthesis of them. Only in so far, therefore, as I can unite a manifold of given representations in *one consciousness*, is it possible for me to represent to myself the *identity of the consciousness in [i.e. throughout] these representations*. In other words, the *analytic* unity of apperception is possible only under the presupposition of a certain *synthetic* unity." (B131-133)

"That the 'I' of apperception, and therefore the 'I' in every act of thought, is one, and cannot be resolved into a plurality of subjects, and consequently signifies a logically simple subject, is something already contained in the very concept of thought, and is therefore an analytic proposition." (B407)

"The synthetic unity of apperception is therefore that highest point, to which we must ascribe all employment of the understanding, even the whole of logic, and conformably therewith, transcendental philosophy. Indeed this faculty of apperception is the understanding itself." (B134)

"[T]he logical form of every judgment consists in the original synthetic unity of apperception." (Ellington, essay)

"The supreme principle of the possibility of all intuition in its relation to sensibility is, according to the Transcendental Aesthetic, that all the manifold of intuition should be subject to the formal conditions of space and time. The supreme principle of the same possibility, in its relation to understanding, is that all the manifold of intuition should be subject to conditions of the original synthetic unity of apperception. In so far as the manifold representations of intuition are *given* to us, they are subject to the former of these two principles; in so far as they must allow of being *combined* in one consciousness, they are subject to the latter. For without such combination nothing can be thought or known, since the given representations would not have in common the act of the apperception 'I think', and so could not be apprehended together in one self-consciousness.

Understanding is, to use general terms, *the faculty of knowledge*. This knowledge consists in the determinate relation of given representations to an object; and an *object* is that in the concept of which the manifold of a given intuition is *united*. Now all unification of representations demands unity of consciousness in the synthesis of them. Consequently it is the unity of consciousness that alone constitutes the relation of representations to an object, and therefore their objective validity and the fact that they are modes of knowledge; and upon it therefore rests the very possibility of the understanding.

The first pure knowledge of understanding, then, upon which all the rest of its employment is based, and which also at the same time is completely independent of all conditions of sensible intuition, is the principle of the original *synthetic* unity of apperception. Thus the mere form of outer sensible intuition, space, is not yet [by itself] knowledge; it supplies only the manifold of *a priori* intuition for a possible knowledge. To know anything in space (for instance, a line), I must *draw* it, and thus synthetically bring into being a determinate combination of the given manifold, so that the unity of this act is at the same time the unity of consciousness (as in the concept of a line); and it is through this unity of consciousness that an object (a determinate space) is first known. The synthetic unity of consciousness is, therefore, an objective condition of all knowledge. It is not merely a condition that I myself require in knowing an object, but is a condition under which every intuition must stand in order *to become an object for me*. For otherwise, in the absence of this synthesis, the manifold would *not* be united in one consciousness.

Although this proposition makes synthetic unity a condition of all thought, it is, as already stated, itself analytic. For it says no more than that all *my* representations in any given intuition must be subject to that condition under which alone I can ascribe them to the identical self as *my* representations, and so can comprehend them as synthetically combined in one apperception through the general expression, '*I think*'." (B136-138)

"But if I investigate more precisely the relation of the given modes of knowledge in any judgment, and distinguish it, as belonging to the understanding, from the relation according to laws of the reproductive imagination, which has only subjective validity, I find that a judgment is nothing but the manner in which given modes of knowledge are brought to the objective unity of apperception. This is what is intended by the copula 'is'. It is employed to distinguish the objective unity of given representations from the subjective. It indicates their relation to original apperception, and their *necessary unity*. It holds good even if the judgment is itself empirical, and therefore contingent, as, for example, in the judgment, 'Bodies are heavy'. I do not here assert that these representations *necessarily belong to one another* in the empirical intuition, but that they belong to one another *in virtue of the necessary unity* of apperception in the synthesis of intuitions, that is, according to principles of the objective determination of all representations, in so far as knowledge can be acquired by means of these representations – principles which are all derived from the fundamental principle of the transcendental unity of apperception. Only in this way does there arise from this relation a *judgment*, that is, a relation which is *objectively valid*, and so can be adequately distinguished from a relation of the same representations that would have only subjective validity – as when they are connected according to laws of association. In the latter case, all that I could say would be, 'If I support a body, I feel an impression of weight'; I could not say, 'It, the body, is heavy'. Thus to say 'The body is heavy' is not merely to state that the two representations have always been conjoined in my perception, however often that perception be repeated; what we are asserting is that they are combined *in the object*, no matter what the state of the subject may be. [...]

The manifold given in a sensible intuition is necessarily subject to the original synthetic unity of apperception, because in no other way is the *unity* of intuition possible. But that act of understanding by which the manifold of given representations (be they intuitions or concepts) is brought under one apperception, is the logical function of judgment. All the manifold, therefore, so far as it is given in a single empirical intuition, is *determined* in respect of one of the logical functions of judgment, and is thereby brought into one consciousness. Now the *categories* are just these functions of judgment, in so far as they are employed in determination of the manifold of a given intuition. Consequently, the manifold in a given intuition is necessarily subject to the categories." (B142-143)

"The principle of contradiction must therefore be recognised as being the universal and completely sufficient *principle of all analytic knowledge*; but beyond the sphere of analytic knowledge it has, as a *sufficient* criterion of truth, no authority and no field of application. The fact that no knowledge can be contrary to it without self-nullification, makes this principle a *conditio sine qua non*, but not a determining ground, of the truth of our [non-analytic] knowledge." (B191)

"The highest principle of all synthetic judgments is therefore this: every object stands under the necessary conditions of synthetic unity of the manifold of intuition in a possible experience. Synthetic *a priori* judgments are thus possible when we relate the formal conditions of a *a priori* intuition, the synthesis of imagination and the necessary unity of this synthesis in a transcendental apperception, to a possible empirical knowledge in general. We then assert that the conditions of the *possibility of experience* in general are likewise conditions of the *possibility of the objects of experience*, and that for this reason they have objective validity in a synthetic *a priori* judgment." (B197)

The grid of cells must be the model of the original synthetic unity of apperception (the understanding):

- Unit cell must be binary (with two contradictory states) – expressing the principle of analytic knowledge.
- The whole grid of cells must be the original synthetic unity of apperception where the cells must be linked (connected) with each other by the logical functions of judgment (forms of thought), i.e. by logic. The categories (pure concepts of the understanding) corresponding

to these logical forms of thought must operate on the grid to synthesize the spatio-temporal manifold of sensible intuition (combine by the spontaneous act – process sensory information) and produce knowledge and experience of objects – expressing the principle of synthetic knowledge.

- The 'I' (transcendental subject – the self) of apperception which thinks must be identical in every act of thought (identical throughout the grid) and the grid must represent the unity of self-consciousness. Therefore unit cell must be the purest expression of the 'I' (transcendental subject) and pure or original apperception ('I think'). Our complex thoughts must be formed by combination (synthesis) of cells.

2.3. From imagination and schematism

"The pure concepts of understanding relate, through the mere understanding, to objects of intuition in general, whether that intuition be our own or any other, provided only it be sensible. The concepts are, however, for this very reason, mere *forms of thought*, through which alone no determinate object is known. The synthesis or combination of the manifold in them relates only to the unity of apperception, and is thereby the ground of the possibility of *a priori* knowledge, so far as such knowledge rests on the understanding. This synthesis, therefore, is at once transcendental and also purely intellectual. But since there lies in us a certain form of *a priori* sensible intuition, which depends on the receptivity of the faculty of representation (sensibility), the understanding, as spontaneity, is able to determine inner sense through the manifold of given representations, in accordance with the synthetic unity of apperception, and so to think synthetic unity of the apperception of the manifold of *a priori* sensible intuition – that being the condition under which all objects of our human intuition must necessarily stand. In this way the categories, in themselves mere forms of thought, obtain objective reality, that is, application to objects which can be given us in intuition. These objects, however, are only appearances, for it is solely of appearances that we can have *a priori* intuition.

This synthesis of the manifold of sensible intuition, which is possible and necessary *a priori*, may be entitled *figurative* synthesis (*synthesis speciosa*), to distinguish it from the synthesis which is thought in the mere category in respect of the manifold of an intuition in general, and which is entitled combination through the understanding (*synthesis intellectualis*). Both are *transcendental*, not merely as taking place *a priori*, but also as conditioning the possibility of other *a priori* knowledge.

But the figurative synthesis, if it be viewed merely in its relation to the original synthetic unity of apperception, that is, to the transcendental unity which is thought in the categories, must, in order to be distinguished from the merely intellectual combination, be called the *transcendental synthesis of imagination*. *Imagination* is the faculty of representing in intuition an object that is *not itself present*. Now since all our intuition is sensible, the imagination, owing to the subjective condition under which alone it can give to the concepts of understanding a corresponding intuition, belongs to *sensibility*. But inasmuch as its synthesis is an expression of spontaneity, which is determinative and not, like sense, determinable merely, and which is therefore able to determine sense *a priori* in respect of its form in accordance with the unity of apperception, imagination is to that extent a faculty which determines the sensibility *a priori*; and its synthesis of intuitions, conforming as it does to the *categories*, must be the transcendental synthesis of *imagination*. This synthesis is an action of the understanding on the sensibility; and is its first application – and thereby the ground of all its other applications – to the objects of our possible intuition. As figurative, it is distinguished from the intellectual synthesis, which is carried out by the understanding alone, without the aid of the imagination. In so far as imagination is spontaneity, I sometimes also entitle it the *productive* imagination, to distinguish it from the *reproductive* imagination, whose synthesis is entirely subject to empirical laws, the laws, namely, of association, and which therefore contributes nothing to the explanation of the possibility of *a priori* knowledge. The reproductive synthesis falls within the domain, not of transcendental philosophy, but of psychology. " (B150-152)

“But pure concepts of understanding being quite heterogeneous from empirical intuitions, and indeed from all sensible intuitions, can never be met with in any intuition. For no one will say that a category, such as that of causality, can be intuited through sense and is itself contained in appearance. How, then, is the *subsumption* of intuitions under pure concepts, the *application* of a category to appearances, possible? [...]

[T]here must be some third thing, which is homogeneous on the one hand with the category, and on the other hand with the appearance, and which thus makes the application of the former to the latter possible. This mediating representation must be pure, that is, void of all empirical content, and yet at the same time, while it must in one respect be *intellectual*, it must in another be *sensible*. Such a representation is the *transcendental schema*.

The concept of understanding contains pure synthetic unity of the manifold in general. Time, as the formal condition of the manifold of inner sense, and therefore of the connection of all representations, contains an *a priori* manifold in pure intuition. Now a transcendental determination of time is so far homogeneous with the category, which constitutes its unity, in that it is universal and rests upon an *a priori* rule. But, on the other hand, it is so far homogeneous with appearance, in that time is contained in every empirical representation of the manifold. Thus an application of the category to appearances becomes possible by means of the transcendental determination of time, which, as the schema of the concepts of understanding, mediates the subsumption of the appearances under the category. [...]

The schema is in itself always a product of imagination. Since, however, the synthesis of imagination aims at no special intuition, but only at unity in the determination of sensibility, the schema has to be distinguished from the image. If five points be set alongside one another, thus,, I have an image of the number five. But if, on the other hand, I think only a number in general, whether it be five or a hundred, this thought is rather the representation of a method whereby a multiplicity, for instance a thousand, may be represented in an image in conformity with a certain concept, than the image itself. For with such a number as a thousand the image can hardly be surveyed and compared with the concept. This representation of a universal procedure of imagination in providing an image for a concept, I entitle the schema of this concept.” (B176-180)

“The transcendental schemata are the ways in which a given manifold of intuition is combined in one time by the transcendental synthesis of productive imagination. The transcendental schemata are, then, products of the transcendental synthesis of productive imagination. (MFNS, essay 182)”

“The most fundamental and original act of imagination is the production of time-consciousness.” (Kang 83)

Unit cell must be the purest transcendental schema of imagination homogeneous with sensibility (passive receptivity for sensation) and the understanding (active spontaneity):

- Unit cell must be a transcendental clock with the time parameter – transcendental determination of time. Cell must be the purest transcendental schema homogeneous with the unit sensor (pure receptivity for sensation), with the pure act of spontaneity of thought (cogito or the “I think” – pure apperception) and with the pure transcendental imagination. Time (time parameter) as form of inner sense must be present in every cell in the grid since time is a form of all appearances whatsoever and also only through “I think *this or that*” we have a determinate thought of an object, that is, consciousness is always consciousness *of* something. Pure transcendental imagination must be present in every cell because the schematization and synthesis of the spatio-temporal manifold of intuition is performed by the transcendental productive imagination. Schemata then must be rules (patterns) outlining how to combine cells.

2.4. From reason

2.4.1 Kant

“If we consider in its whole range the knowledge obtained for us by the understanding, we find that what is peculiarly distinctive of reason in its attitude to this body of knowledge, is that it prescribes and seeks to achieve its *systematisation*, that is, to exhibit the connection of its parts in conformity with a single principle. This unity of reason always presupposes an idea, namely, that of the form of a whole of knowledge – a whole which is prior to the determinate knowledge of the parts and which contains the conditions that determine *a priori* for every part its position and relation to the other parts. This idea accordingly postulates a complete unity in the knowledge obtained by the understanding, by which this knowledge is to be not a mere contingent aggregate, but a system connected according to necessary laws.” (B673)

“Just as the understanding unifies the manifold in the object by means of concepts, so reason unifies the manifold of concepts by means of ideas, positing a certain collective unity as the goal of the activities of the understanding, which otherwise are concerned solely with distributive unity.

I accordingly maintain that transcendental ideas never allow of any constitutive employment. [...] On the other hand, they have an excellent, and indeed indispensably necessary, regulative employment, namely, that of directing the understanding towards a certain goal upon which the routes marked out by all its rules converge, as upon their point of intersection. This point is indeed a mere idea, a *focus imaginarius* [...] it serves to give to these concepts [of the understanding] the greatest [possible] unity combined with the greatest [possible] extension.” (B672)

“The understanding is an object for reason, just as sensibility is for the understanding. It is the business of reason to render the unity of all possible empirical acts of the understanding systematic; just as it is of the understanding to connect the manifold of the appearances by means of concepts, and to bring it under empirical laws. But the acts of the understanding are, without the schemata of sensibility, *undetermined*; just as the *unity of reason* is in itself *undetermined*, as regards the conditions under which, and the extent to which, the understanding ought to combine its concepts in systematic fashion. But although we are unable to find in *intuition* a schema for the complete systematic unity of all concepts of the understanding, an *analogon* of such a schema must necessarily allow of being given. This analogon is the idea of the *maximum* in the division and unification of the knowledge of the understanding under one principle. For what is greatest and absolutely complete can be determinately thought, all restricting conditions, which give rise to an indeterminate manifoldness, being left aside. Thus the idea of reason is an analogon of a schema of sensibility; but with this difference, that the application of the concepts of the understanding to the schema of reason does not yield knowledge of the object itself (as is the case in the application of categories to their sensible schemata), but only a rule or principle for the systematic unity of all employment of the understanding. Now since every principle which prescribes *a priori* to the understanding thoroughgoing unity in its employment, also holds, although only indirectly, of the object of experience, the principles of pure reason must also have objective reality in respect of that object, not, however, in order to *determine* anything in it, but only in order to indicate the procedure whereby the empirical and determinate employment of the understanding can be brought into complete harmony with itself. This is achieved by bringing its employment, so far as may be possible, into connection with the principle of thoroughgoing unity, and by determining its procedure in the light of this principle.” (B692-694)

“Reason thus prepares the field for the understanding: (1) through a principle of the *homogeneity* of the manifold under higher genera; (2) through a principle of the *variety* of the homogeneous under lower species; and (3) in order to complete the systematic unity, a further law, that of the *affinity* of all concepts – a law which prescribes that we proceed from each species to every other by gradual increase of the diversity. These we may entitle the principles of *homogeneity*, *specification*, and *continuity* of forms. The last named arises from union of the other two, inasmuch as only through the

processes of ascending to the higher genera and of descending to the lower species do we obtain the idea of systematic connection in its completeness. For all the manifold differences are then related to one another, inasmuch as they one and all spring from one highest genus, through all degrees of a more and more widely extended determination. [...]

And since there is thus no void in the whole sphere of all possible concepts, and since nothing can be met with outside this sphere, there arises from the presupposition of this universal horizon and of its complete division, the principle: *non datur vacuum formarum*, that is, that there are not different, original, first genera, which are isolated from one another, separated, as it were, by an empty intervening space; but that all the manifold genera are simply divisions of one single highest and universal genus." (B685-687)

"For the regulative law of systematic unity prescribes that we should study nature *as if* systematic and purposive unity, combined with the greatest possible manifoldness, were everywhere to be met with, *in infinitum*." (B728)

The grid (the original synthetic unity of apperception – the understanding) must have greatest possible systematic unity and must be seen as a unitary architectonic system. The grid made of identical cells must realize the idea of the greatest possible systematic unity with the greatest possible manifoldness (variety) in nature.

2.4.2 Fichte

Unit cell must be the purest expression of the 'I' (transcendental subject/ego). Cell must be the expression of pure identity (absolute I) and original duplicity (I and not-I) – the primordial case of the identity of opposites. That is, unit cell must have two opposite values within itself.

2.4.3 Hegel

Unit cell must be the purest expression of the Idea (pure Reason or pure consciousness) and must be the system of pure reason (pure consciousness) itself. Unit cell must be pure consciousness. Cell must have two contradictory (opposite) states – expressing the dialectic nature of reason. Reason through the faculties of understanding and transcendental imagination must synthesize (process) the grid of cells.

2.5. From Kant's philosophy of mathematics

"Time and space are ... two sources of knowledge, from which bodies of *a priori* synthetic knowledge can be derived. (Pure mathematics is a brilliant example of such knowledge ...)" (A38-39)

"[Mathematics] being able to realise all its concepts in intuitions, which it can provide *a priori*, and by which it becomes, so to speak, master of nature" (B753)

"The synthesis of spaces and times, being a synthesis of the essential forms of all intuition, is what makes possible the apprehension of appearance, and consequently every outer experience and all knowledge of the objects of such experience. Whatever pure mathematics establishes in regard to the synthesis of the form of apprehension is also necessarily valid of the objects apprehended." (A166)

Synthetic *a priori* construction of mathematical objects in pure intuition [absent of sensation] of space and time as the mere form of appearances. Mathematics is *a priori* true of all appearances, therefore the grid of cells must be mathematical structure and all phenomena produced in the grid must be subject to mathematics. A cell must be elementary building block of construction of mathematical objects in pure intuition of space and time.

It is important to note that *transcendentally ideal* space absent of sensation must be Euclidean, however *empirically real* space in which we experience objects and where different degrees of sensation are present is not necessarily Euclidean, contrary to the belief that non-Euclidean geometry refutes Kant.

2.6. The model of the original synthetic unity of apperception (our cognitive framework and the Universe as it appears to us)

The only grid structure which would be characterized by the necessary a priori conditions of experience given above and in CPR is the structure made of unit Eulerian circles where the center of each circle is on the circumference of six surrounding circles (also known as *flower of life*):

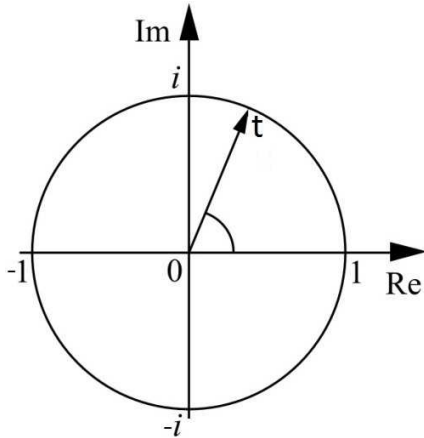


Figure 1: Monad. The purest expression of the Idea (pure Reason or pure consciousness). The purest expression of the greatest possible systematic unity. The framework of pure reason. Transcendental imagination (i). Unit sensor. Transcendental determination of time (transcendental clock) – the purest schema which is homogeneous with the pure receptivity for sensation (monad is a unit sensor) and the pure act of spontaneity of thought (cogito or “I think” – monad is pure apperception). Spontaneity is the circular motion of the time parameter (arrow) around the boundary of monad which generates the “I think” – performs synthesis (information-processing). Generates time-consciousness.

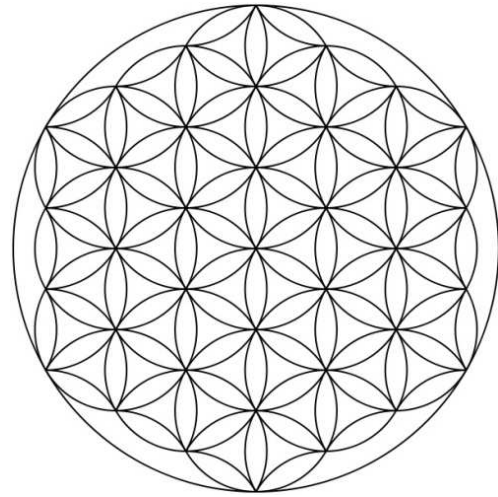


Figure 2: The original synthetic unity of apperception – the entangled net of consciousness. The framework of the understanding (our cognitive framework). The structure according to which the mind organizes experience. The greatest possible systematic unity. Logical structure – monads overlap (combine, synthesize) by the forms of thought (logical forms/functions). The structure within which our thoughts originate by various combinations (synthesis) of monads. Schema of a concept outlines how to connect monads in a certain pattern to produce an image for that concept. Sensorium where every monad is a unit sensor. Time (pure form of inner sense) is in every monad as a rate of time parameter of a monad. Space (pure form of outer sense) is outer relations of monad and has 6 *transcendentally ideal dimensions* by an angle of 60° . The analytic unity of consciousness (the ‘I’ in all monads throughout the structure is identical) – holographic framework. Transcendental productive imagination synthesizes the structure and generates appearances and empirical consciousness (phenomena and experience) in 3 *empirically real spatial dimensions*.

The general model is included as an appendix (Figure 6) at the end of this paper.

3. DISCUSSION OF THE STRUCTURE

3.1. What we mean by the term "monad". Why the unit circle with the time parameter?

We will refer to a cell as "monad"³ and use the term to name the fundamental entity of the Universe. We use the term in general and not just in the context of the thinkers who used the same term (such as Leibniz, Bruno, pythagoreans and neoplatonists). We discuss the principles of Leibniz's theory of monads in the chapter "Unit cell as Leibnizian monad". We also briefly discuss this fundamental entity of the world in relation to many other thinkers (eg. Aristotle, Spinoza, Heidegger, Pauli...) in the chapter "In the context of other thinkers". For us, the term "monad" can be seen in two senses: as pure consciousness (pure Reason) and as the purest expression of pure consciousness (pure Reason) in our imagination – a unit circle with the time parameter (transcendental circle). We explain how they are related:

In the first sense, monad (as noumena) is equivalent to Kant's thing-in-itself which lies beyond space and time at the basis of appearances (at the basis of the phenomenal world) as an ultimate highest reality. In our mind we have only the Idea of this highest reality but no knowledge and experience of it. Following Hegel, we equate monad/thing-in-itself with pure Reason (pure consciousness). The Idea is equivalent with pure consciousness or pure Reason. We claim that universal consciousness (Reason) which exists for eternity beyond space and time is fundamental to the world and is the ultimate highest reality. The 'I' (the soul or our true self beyond space and time) exists with this Reason (pure consciousness). According to Kant, through the understanding we can only know objects in space and time (phenomena), while noumena outside space and time is beyond our imagination and knowledge (beyond our understanding). Therefore we cannot know how thing-in-itself/monad is in itself (in the noumenal realm) and we cannot say that it is a transcendental circle (Fig. 1) in itself. That is, we cannot say that pure consciousness (pure Reason) is a transcendental circle itself (that would be absurd)! Rather, transcendental circle is the *purest expression of pure consciousness* (pure Reason), that is the purest projection of it in our imagination. Transcendental circle is the framework of pure consciousness (pure Reason).

3.1.1 Monad (as transcendental circle) is the purest expression of the Idea (pure Reason or pure consciousness)

In the second sense, monad is a unit circle with the time parameter (transcendental circle). Nor Leibniz, nor Kant had stated that monad or thing-in-itself is a unit circle, however Leibnizian monad was referred to as *logical sphere*. Pythagoreans and neoplatonists describe it as a circle. Plato in "Timaeus" argues that the Universe started as a spinning circle (sometimes referred to as *cosmological circle*). Why the unit circle (or logical sphere) should be fundamental to the Universe?

Kant argued that we have the ideas of reason (soul, the world as a whole, God) which provide us with the *greatest possible systematic unity* in our knowledge. Hegel equates reason with "the Idea" (or the Absolute itself), hence *absolute idealism*. It is the only innate idea in our mind, everything else is empirical as we will show in this project. 3 Kant's ideas of reason are merely aspects of "the Idea" which are arrived at using 3 kinds of syllogism (this is discussed in the chapter "Monad as soul, the Universe and God"). We argue that the transcendental circle is the purest expression of "the Idea", that is the purest expression of pure Reason (or pure consciousness). We use the word "the purest" for monad to indicate that it is the purest and direct expression of "the Idea", because the whole Universe in general, that is the whole phenomenal world in space and time, is the expression or manifestation of "the Idea" (the phenomenal world exists as Reason thinking itself – as the product of self-consciousness, which we will show in this project). Monad (transcendental circle) is

³Monas is a Greek word which signifies unity, or that which is one.

the purest expression of:

The greatest possible systematic unity. Monad is pure *systematic unity*: it is pure receptivity for sensation (unit sensor), pure apperception (spontaneity generating the "I think"), pure productive imagination (i), pure memory and pure will. Monad is the transcendental determination of time (transcendental clock) – the purest schema of imagination which is homogeneous with the pure receptivity for sensation and the pure act of spontaneity of thought (pure apperception). $e^{i\pi} + 1 = 0$ (Euler's identity) expresses pure systematic unity mathematically.

The grid of monads as a whole (the original synthetic unity of apperception – the understanding) expresses the greatest possible systematic unity. We will also show that this structure expresses the idea of the greatest possible manifoldness (variety) in nature when we discuss how the vast complexity of the world is encoded in such a simple structure and how the productive imagination produces phenomena by synthesizing (decoding) this structure. That is, the grid of monads expresses Leibniz' idea of the greatest possible variety together with the greatest order that may be (greatest possible perfection).

We consider natural number 1 (monad) as the expression of the idea of the whole and unity (the Universe). It is pure identity.

The monad is binary and contains two contradictory (opposite) states (1, -1) which is the purest expression of the dialectic nature of reason. Monad is the primordial case of the identity of the opposites. We will argue that the union of opposites is the principle to generate the greatest possible variety in nature.

Frege defined 0 as the number of the concept not being self-identical, and that 0 thereby is identified with the extension of all concepts which fail to be exemplified. That is, 0 is derived from the two opposite (not identical) states in the monad.

Imaginary unit (i) is related to the transcendental imagination. [The mathematical aspect of our imagination requires further study.]

The movement of the time parameter around the circle as the expression of infinity. It is related to point at infinity in mathematics [this requires further study]. We consider monad to be the expression of the Absolute Infinite (we equate Absolute Infinite with the Idea). We discuss various kinds of infinities in the chapter "On potential, actual infinities and the Absolute Infinite". "So Kant links the concept of infinity with that of a thing in itself. Leibniz once said: "The true infinite exists, strictly speaking, only in the absolute, which is anterior to all composition, and is not formed by the addition of parts"; and Kant seems to echo this idea that the province of 'the true infinite' is the realm of unempirical monads or things in themselves." (Bennett 135)

"The infinite in its simple notion can, in the first place, be regarded as a fresh definition of the Absolute" (Hegel, Science of Logic, §270)

3.1.2 Transcendental circle as the purest projection (schema) of imagination

As we think "the Idea" (as reason thinks itself) we have to project it in the imagination. Through our imagination we imagine (project) it as a *dimensionless point (dot)* to indicate *pure identity* and non-dimensionality (since it is outside space and time and has no dimensions). When we start to think it (as reason thinks itself or pure consciousness is conscious of itself), it acquires a boundary and becomes a unit circle where the spontaneity of thought (process of thinking) is the motion of the time parameter around the boundary of the circle. It is still infinite since it is not limited by anything else but by itself (it is not limited by any other monad which would overlap and limit the sphere).

Such circle is the purest transcendental schema homogeneous with the spontaneity of thought ("I think") and the sensible intuition (single sensor) and as such it is the *purest projection* of the faculty of imagination onto thing-in-itself/monad – the purest expression of the Idea. We are conscious of this our primordial activity (motion of the time parameter) and this is what Fichte and Hegel call intellectual intuition (intellektuelle Anschauung). This is the primordial act of self-positing which Fichte expresses as "I am" and which is directly related to Descartes "I think, therefore I am" which we will discuss later. In the chapter on the Big-Bang we will see that the Universe starts as pure consciousness (pure Reason) thinking itself (as self-consciousness).

3.2. The synthetic unity of apperception (grid of monads) as the faculty of understanding

3.2.1 Logic

The grid of monads (Fig. 2) is the original synthetic unity of apperception (transcendental unity of self-consciousness). The logical forms of thought (logical functions of judgment) and pure concepts of the understanding (categories) corresponding to them consists in this structure. That is, this structure is defined by logic and the logical forms connect (combine) monads together. Various forms of intersection (relations) between overlapping monads express logical forms: the logical functions of judgment, syllogisms, Boolean algebra and set operations (using Venn diagrams). How are the forms of syllogisms, Boolean and set operations represented using overlapping circles (Venn diagrams) is obvious and requires no further discussion. The grid is the logical universe or logical space. We acknowledge the works of logic after Kant and do not stick to Kant's version of logic. How Kant's 12 categories consist in this structure is shown in the derivation of them and of the structure itself (using Fichte) in the chapter "First movements of self-conscious thought - a short metaphysical outline of the Big-Bang". At the present stage of this project the study of logic is unfinished and we must study how the modern logic (such as Frege and Russell) can be modelled on this framework. Here we only lay a fundamental claim that the grid is completely logical structure which lies at the foundation of logic.

It is the invariant framework within which all our thoughts originate. It is the framework of the understanding, the faculty of thought. The understanding is the ability (performed by active spontaneity) to combine (synthesize) monads within this framework using logical forms of thought. Monad is the basic logical atom. Our thoughts are formed by combinations (synthesis) of monads in various possible ways through the logical relations (forms of thought) of monads. Mathematics and natural language is based on this structure and we will discuss mathematics and natural language in separate chapters.

We will also argue that our thoughts are electromagnetic waves in this structure (the ether) and that complex thoughts are formed by waves overlapping and forming complex patterns (schemata or logical pictures).

The Universe is pan-logical and logic is fundamental: the grid is the structure of *transcendentally ideal* space which is defined by logic. The grid is logical universe, logical space or fact space. Metaphysics is ultimately logic. As Hegel puts it: "metaphysics is nothing else but the entire range of the universal determinations of thought, as it were, the diamond net into which everything is brought and thereby first made intelligible." (Hegel, Philosophy of Nature).

3.2.2 The analytic/synthetic distinction

"In all judgments in which the relation of a subject to the predicate is thought (I take into consideration affirmative judgments only, the subsequent application to negative judgments being easily made), this relation is possible in two different ways. Either the predicate B belongs to the subject A, as something which is (covertly) contained in this concept A; or B lies outside the concept A, although it does indeed stand in connection with it. In the one case I entitle the judgment analytic,

in the other synthetic." (A6-7)

We see that the Kantian term "synthetic" means the connection of monads. Unit monad (Fig. 1) is characterized as pure apperception. The *synthetic* unity of apperception is synthetic because monads are synthetically connected into the unitary grid forming the *synthetic* unity of consciousness. This way we can understand Kantian analytic/synthetic distinction easily. A particular pattern (schema) of monads is an algebraic structure (set of monads) corresponding to a concept. Analytic judgments are those where the predicate is completely within the set of the subject. That is, the predicate (a set of monads) is a subset of the subject (a larger set of monads). This produces no new knowledge. Synthetic judgments are those where predicate is outside the set of the subject and requires a [synthetic] connection. This produces new knowledge. This way the synthetic unity of apperception makes synthetic a priori judgments possible and is the invariant framework or structure of such knowledge.

3.3. All synthetic a priori judgments originate within the invariant framework of the synthetic unity of apperception

Synthetic a priori judgments can produce new knowledge and describe nature *a priori*, that is independent of experience. According to Kant, mathematics, pure natural science (theoretical physics) and metaphysics (scientific metaphysics) is grounded on synthetic a priori judgments. We see that these sciences are based on this invariant structure. We will argue that this grid of monads (the synthetic unity of apperception) is a mathematical structure where mathematical objects are constructed in pure intuition of space and time. Moreover, this structure is a unitary system of the fundamental forces of physics (the ether). It is also the structure which underlies all natural languages. We will discuss the foundations of mathematics, physics and natural language in separate chapters.

Since this structure is the framework within which all our thoughts originate (the understanding) and according to which our mind organizes experience (the fundamental structure of our mind itself), we claim that all theories in science and philosophy worthy of the name just stated something true about this structure from their perspectives. We claim that all human knowledge of the Universe can be synthesized (united) under this structure since this structure is the framework of our cognitive faculty of understanding within which all our knowledge originate. This is the invariant structure argued and sought for in epistemic and ontic structural realisms (ESR and OSR).

We will argue that the history of science (and history in general) follows the dialectic of reason (Hegelian dialectic). We will argue that by understanding this invariant framework of all our theories we arrive at the final synthesis in our knowledge of the Universe – Theory of Everything. These aspects will be explained in separate chapters.

3.4. The grid of monads as the spatio-temporal manifold of intuition

"What we have meant to say is that all our intuition is nothing but the representation of appearance; that the things which we intuit are not in themselves what we intuit them as being, nor their relations so constituted in themselves as they appear to us, and that if the subject, or even only the subjective constitution of the senses in general, be removed, the whole constitution and all the relations of objects in space and time, nay space and time themselves, would vanish. As appearances, they cannot exist in themselves, but only in us. What objects may be in themselves, and apart from all this receptivity of our sensibility, remains completely unknown to us. We know nothing but our mode of perceiving them" (B59)

"Space does not represent any property of things in themselves" (B42)

"Time is not something which exists of itself, or which inheres in things as an objective determination, and it does not, therefore, remain when abstraction is made of all subjective conditions of its

intuition.” (B49)

According to Kant space and time is not a property of things-in-themselves, i.e. space and time is not fundamental. The representation of space and time originate in our brain (our cognitive framework). This framework is the structure according to which our mind organizes the sense-data (the manifold of sensible intuition) received from the faculty of sensibility. Kant held that what lies at the basis of our sense perceptions (things-in-themselves/monads) is unknown and we only know how they appear to us through the pure forms of sensible intuition (space and time) and our cognitive framework (the understanding, i.e. the synthetic unity of apperception) which organizes and synthesizes the sense-data.

Kant separates the faculties in the mind: faculties of sensibility, transcendental imagination (intermediate between sensibility and understanding), understanding, reason. To state very briefly, first we are affected by objects through the senses (passive receptivity of sensibility), then through the work of transcendental productive imagination (active spontaneity of the understanding – motion of the time parameter) the spatio-temporal manifold of sensible intuition is ordered and synthesized (threefold synthesis), and finally reason gives systematic unity to our knowledge of the manifold. Kant says: “receptivity can make knowledge possible only when combined with spontaneity. Now this spontaneity is the ground of a threefold synthesis which must necessarily be found in all knowledge; namely, the *apprehension* of representations as modifications of the mind in intuition, their *reproduction* in imagination, and their *recognition* in a concept. These point to three subjective sources of knowledge which make possible the understanding itself – and consequently all experience as its empirical product.” (A97-A98)

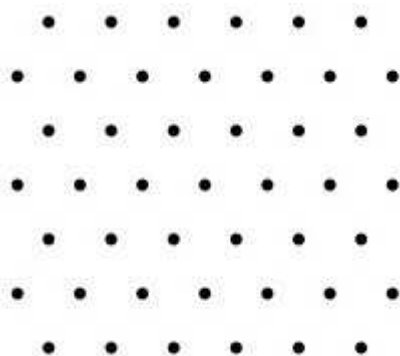


Figure 3: Bare sensorium without the logical functions of the understanding. Each dot is the centre of a monad – centre of a single sensor. For the sake of simplicity it can be considered as a firing of a neuron, however we will argue that monads are Planck length apart but neurons are not. Also the rates of firing of the neurons are much lower than the rates of monads.

The grid of monads is a simple structure which contains only the values and rates of the time parameters of monads. How the productive imagination produces the vast complexity of our experience (complexity of phenomena) from such a simple structure is discussed in a separate chapter.

3.4.1 Monad and the grid of monads as an organic system of reason: on intellectual intuition

Contrary to Kant’s transcendental idealism, we will follow the further development of his system towards German idealism by Fichte and Hegel and do not separate the faculties in our mind – all faculties form an organic system of reason (or consciousness) and reason is superior.

“Kant’s interpretation of sensibility and understanding as two separate basic faculties is also a stumbling block for Hegel. He maintains that Kant’s doctrine of schematism merely relates understanding and sensible intuition in an external way, and does not penetrate to the true unity of these faculties - namely, an intuitive understanding [or intellectual intuition]. [...] Hegel ... takes transcendental imagination to be the origin from which spring both the subject and the objective world (insofar as it is brought about by the syntheses of intuition and understanding). Sensible

intuition and thinking are thus not isolated faculties standing over against each other, but have the same primordial synthetic unity as their principle. The difference between these faculties consists in the fact that intuition relates to this unity as still fully immersed in the manifoldness, whereas discursive understanding actually brings about this unity as unity. While the understanding can merely do this in a relative way, only reason as pure, intellectual intuition is able to grasp the total identity of unity and difference. Reason thus explicitly brings about the primordial synthesis of the imagination.

Now Hegel comprehends this imagination as reason itself. Thus, he no longer understands reason as one of the synthetic faculties, but as the one principle of identity that unfolds itself in different ways to actually accomplish this primordial identity. From this perspective there is no "manifold of faculties and capacities of spirit", but only the one and only movement of imagination - that is, of reason - which enacts itself as understanding and sensible intuition, posits these faculties over against itself as separate faculties, yet ultimately comprehends its own absoluteness and gains insight into the true unity of intuition and thinking." (de Boer 215)

We hold Fichte's and Hegel's view that we have intellectual intuition and will argue that quantum physics (superposition of states and an appearance of the wavefunction collapse) proves this. That is, the Universe is fundamentally thoughts (waves in the grid of monads) and intellectual intuition causes an appearance of the wavefunction collapse when we observe and know an object in apperception. The grid outputs the object (phenomena in space and time) when we apperceive the object. This will be explained further. The Universe is the product of mind (the product of self-consciousness) and there are no things-in-themselves which would be independent of pure consciousness. Thing-in-itself/monad is pure consciousness.

The 'I' (our true self – soul) is pure reason (pure consciousness). Monad is *pure consciousness* (or pure reason). Monad is an organic system of: pure apperception (spontaneity generating the "I think"), pure productive imagination (i), pure sensibility (unit sensor), pure memory and pure will. [At the present stage the study of memory and will is unfinished so we do not discuss them.] This way everything is an organic system of reason (or consciousness). The understanding (the synthetic unity of apperception – the grid of monads) is the framework where the 'I' (our reason – soul) forms and thinks the thoughts. We can consider monad (Fig. 1) as the framework of pure reason, while the grid of monads (Fig. 2) as the framework of reason in general (that is, the understanding).

Monad is pure intellectual intuition. Fichte says: "I am this [intellectual] intuition and absolutely nothing further, and this intuition itself is who I am" (Science of Knowledge, I, 529). For Kant, activity (spontaneity) belongs to the understanding, while passivity (receptivity) to sensibility. For Fichte and Hegel these faculties are not separate and work together in intellectual intuition – in monad. Monad is subject-object. Monad as the 'I', the mind, affects itself (subject) and is affected (object). Monad is *pure consciousness* or pure reason and the motion of the time parameter in it is spontaneity generating the representation "I think" (pure apperception). Apperception means consciousness, but as an act, an activity, rather than a passive state. This motion of the time parameter is the primordial activity of the 'I'. While Kant said that we have only a thought of this activity, Fichte argued that we have an intuition of it and are directly aware of our own activity. Self-positing "I am" is the primordial act.

3.4.2 Intellectual intuition and the appearance of wavefunction collapse

"In a sensible intuition we are passive, since the object acts on us; but in an intellectual intuition we are active, because we produce the object we know through knowing it. [...]"

If an intellectual intuition is the self-awareness of myself acting, then it must be both intuitive and intellectual in these senses. It must be intuitive for two reasons. First, I do not infer that I am acting

but know this directly through experience. Second, if I know myself as an active being, then I cannot apply concepts to myself, because that would make me passive and determined, another object subsumed under the principle of sufficient reason. Self-knowledge as acting also must be intellectual because, in acting, I create the object that I know. Although this self-creative self-knowing appears fanciful and extravagant - as if the self somehow brings itself into being through the act of knowing itself - it is simply a requirement of knowing my own activity. The self-knowledge that I am acting creates or acts out what I know, simply because what I know is that I am acting! Self-consciousness of my activity cannot be of something given to me, for something that is given is not the exercise of my agency. In other words, in an intellectual intuition I know that I act because I act; it is in this sense that Fichte says that in intellectual intuition I know something is so because I make it so. [...] Kant's intellectual intuition is the divine understanding's knowledge of the archetypes, which are pure noumena transcending all experience. Fichte insisted that he too denied intellectual intuition in this sense, and he stressed that he agreed with Kant that no finite being has such powers. If he affirms an intellectual intuition, it is in a completely different sense than Kant. Namely, his intellectual intuition is not of some entity beyond our experience, but merely of an activity within it. [...] the self-knowledge of my spontaneity requires intellectual intuition; [...] Fichte thinks that the 'I think' of ... Kantian principle presupposes an intellectual intuition, a self-awareness of myself as a self-determining subject." (Beiser 299-304)

We argue that through apperception (the act of spontaneity of thought) we "produce the object we know through knowing it". Objects in the Universe (in the grid of monads) exist in superposition of states (as superposition of waves) until they are observed (apperceived) by a self-conscious observer, that is until our conscious experience (phenomena) emerges. The monad takes the definite state from a superposition of its states, that is the definite rate of the time parameter, when the act of synthesis makes the time-determination and the judgment which determines a real object. In other words, the transcendental synthesis of productive imagination through apperception (the activity of the transcendental subject – the 'I') produces the experience of objects in space and time. That is, conscious experience (empirical consciousness) emerges from the act of knowing. All grid operates according to the rules of the schematized categories and the "mysterious and spooky" quantum phenomena will be explained using the categories of modality in a separate chapter. This is what we mean by intellectual intuition. We will argue that our soul (reason) is outside space and time and has free will (absolute spontaneity) in the choice what state the monad will take and thus how our body in phenomenal world in space and time will act. The grid of monads is the screen or matrix which our soul stares at and is conscious (apperceiving) of the states that monads (pixels) represent. This way the "I" (the self) perceives itself as corporeal body in space and time (phenomena). This will be discussed further in the chapter "we as an autonomous sensuous self-moving robot".

We need a further study of Kant's threefold synthesis and the theories of imagination of Fichte and Hegel. As stated, transcendental synthesis of productive imagination is not a simple onefold process. At the present stage we can only loosely speculate that transcendentially ideal (2D holographic) space with superposition of states is produced in the stage of "synthesis of apprehension in intuition", while monads acquire definite states (wavefunction collapse appears) and the empirically real (3D) space emerges at the stage of "synthesis of recognition in a concept", that is apperception.

3.4.3 On thinking, being and time

"in the consciousness of myself in mere thought I am the *being itself*, although nothing in myself is thereby given for thought.

The proposition, 'I think', in so far as it amounts to the assertion, '*I exist thinking*', is no mere logical function, but determines the subject (which is then at the same time object) in respect of existence, and cannot take place without inner sense, the intuition of which presents the object not as thing in

itself but merely as appearance. There is here, therefore, not simply spontaneity of thought, but also receptivity of intuition, that is, the thought of myself applied to the empirical intuition of myself." (B429-430)

"Hence Heidegger considers pure understanding and pure intuition to be two modes of a 'representing preforming of the unifying horizon'.

Like pure imagination itself, these modes must be grounded in primordial time. [...] Heidegger's attempt to "grasp the selfhood of the self as inherently temporal" thus annuls the opposition between understanding and sensibility: both faculties have their ground in primordial time [...] This means that "all representing including thought is ... subject to time". This time is called a "transcendental primal structure"." (de Boer 213)

We also see the obvious connection with Heidegger's "Being and Time". The grid outputs an object (phenomena in space and time) when monad takes a definite state (definite rate of time parameter). That is, physical being is only through the motion of the time parameter (through time). This motion of the time parameter is spontaneity "I think" (apperception) and this "I think" is the grid (the mind) performing information-processing of sense-data. This way the intellect (the understanding) and sensibility work together in intellectual intuition (in monad) and the transcendental imagination produces objects of experience. The processing is performed by the transcendental imagination and the function of it is to decode the information which is encoded in the grid which will be explained in a separate chapter. We see that the process of thinking is the motion of the time parameter. We will argue that complex thoughts are formed by complex patterns of waves in the grid. We can now understand Descartes' "I think, therefore I am". We can rephrase him and say: "my monad spins (generating the "I think"), therefore I am".

3.4.4 On the origin and dimensionality of transcendently ideal and empirically real space and time

Monad/thing-in-itself is outside space and time. Space is formed as monads overlap and create the relational grid. Time is the circular motion of the time parameter around the boundary of monad (spontaneity of thought generating the "I think") and is contained at each point of space (each monad). Later we will argue that space is the medium where reason (consciousness) thinks its thoughts and time parameter motion is the process of thinking or information-processing (synthesis).

We see that *transcendentally ideal* space is 2D framework where each monad has 6 outer relations – 6 "curled-up" transcendental dimensions which we do not experience. These are energy (or information) transfer channels. This six-dimensionality of transcendently ideal space and the spatial relations by an angle of 60° arise from the logical forms of the understanding (forms of thought). Transcendentally ideal space is defined by logic and is invariant and Euclidean.

The grid is one entangled network and forms the unity of consciousness. The grid is holographic because of the analytic unity of consciousness – the "I" in all its parts and acts throughout the grid is the same.

How then it is possible that we observe objects which appear to be other than us? This appears because of the dialectic of reason – opposition between "the I" and "the not-I", subject and object, ideal and real, the Idea and nature and will be explained in a separate chapter.

Empirically real space which we experience has 3 dimensions which appear to us after the manifold of intuition (the grid) is synthesized by the transcendental imagination. Transcendental synthesis of productive imagination subsumes (synthesizes or integrates) the grid under the categories. The monad (unit circle – qubit) encodes information on its boundary because the time parameter moves around it. If we add monads in 1D we get a cylinder whose surface is 2D. If we do that in

2D grid of monads we get a 3D space.

We will argue that gravity is an entropic force and depends on the rates of monads – rates of synthesis or information-processing. That is, the curvature of empirically real space depends on the rate of a monad. While *transcendentally ideal* space is Euclidean, the *empirically real* space is not necessarily Euclidean. The grid of monads is mathematical structure and the properties of empirically real space is subject to mathematics.

3.5. Monad as the transcendental determination of time (purest schema of imagination)

“All our knowledge is thus finally subject to time, the formal condition of inner sense. In it they must all be ordered, connected, and brought into relation.” (A99)

“Indeed it is schemata, not images of objects, which underlie our pure sensible concepts. No image could ever be adequate to the concept of a triangle in general. It would never attain that universality of the concept which renders it valid of all triangles, whether right-angled, obtuse-angled, or acute-angled; it would always be limited to a part only of this sphere. The schema of the triangle can exist nowhere but in thought. It is a rule of synthesis of the imagination, in respect to pure figures in space. Still less is an object of experience or its image ever adequate to the empirical concept; for this latter always stands in immediate relation to the schema of imagination, as a rule for the determination of our intuition, in accordance with some specific universal concept. The concept ‘dog’ signifies a rule according to which my imagination can delineate the figure of a four-footed animal in a general manner, without limitation to any single determinate figure such as experience, or any possible image that I can represent *in concreto*, actually presents. [...] This much only we can assert: *the image* is a product of the empirical faculty of reproductive imagination; the *schema* of sensible concepts, such as of figures in space, is a product and, as it were, a monogram, of pure *a priori* imagination, through which, and in accordance with which, images themselves first become possible. These images can be connected with the concept only by means of the schema to which they belong. In themselves they are never completely at one with the concept. On the other hand, the schema of a *pure* concept of understanding can never be reduced to any image whatsoever. It is simply the pure synthesis, determined by a rule of that unity, in accordance with concepts, to which the category gives expression. It is a transcendental product of imagination, a product which concerns the determination of inner sense in general according to conditions of its form (time), in respect of all representations, so far as these representations are to be connected *a priori* in one concept in conformity with the unity of apperception.” (B180-181)

“We thus find that the schema of each category contains and makes capable of representation only a determination of time. The schema of magnitude is the generation (synthesis) of time itself in the successive apprehension of an object. The schema of quality is the synthesis of sensation or perception with the representation of time; it is the filling of time. The schema of relation is the connecting of perceptions with one another at all times according to a rule of time-determination. Finally the schema of modality and of its categories is time itself as the correlate of the determination whether and how an object belongs to time. The schemata are thus nothing but *a priori* determinations of time in accordance with rules. These rules relate in the order of the categories to the *time-series*, the *time-content*, the *time-order*, and lastly to the *scope of time* in respect of all possible objects.

It is evident, therefore, that what the schematism of understanding effects by means of the transcendental synthesis of imagination is simply the unity of all the manifold of intuition in inner sense, and so indirectly the unity of apperception which as a function corresponds to the receptivity of inner sense. The schemata of the pure concepts of understanding are thus the true and sole conditions under which these concepts obtain relation to objects and so possess *significance*. In the end, therefore, the categories have no other possible employment than the empirical. As the grounds of an *a priori* necessary unity that has its source in the necessary combination of all consciousness in one original apperception, they serve only to subordinate appearances to universal rules of synthe-

sis, and thus to fit them for thoroughgoing connection in one experience." (B184-185)

"The imagination schematizes by translating the rules implicit in the categories into a temporally ordered set of instructions for constructing an objectively determinate nature. The category of causality, for example, provides the rule for recognizing temporal order as a necessary order. This can be schematized by the imagination as a progressively temporal sequence through which objects can be determinately related. The production of temporal schemata can be seen to constitute the basic synthetical transcendental function of the imagination." (Rudolph A. Makkreel, *Imagination and Interpretation in Kant*, p. 30)

Monad as transcendental clock (transcendental determination of time) is the purest transcendental schema which is homogeneous with both the act of spontaneity of thought ("I think") and the sensibility (unit sensor). Spontaneity is the motion of the time parameter in a monad and performs synthesis. The transcendental synthesis of imagination subsumes (integrates) the spatio-temporal manifold of intuition (the grid of monads) under the categories (the basic set of rules for synthesis) to produce appearances of objects. "Imagination has an intermediate position between sensibility and understanding. It is the synthesizing faculty directly related to intuitions; it represents an object in intuition even when the object is not present (B151). The synthesis of the manifold of sensible intuition under the form of time is the work of imagination." (MFNS, essay 181).

We consider transcendental schemata to be the patterns of monads. Schema of a concept outlines how to connect monads to produce an image for that concept. In other words, schema is a rule instructing the imagination how to connect monads to produce an image for a corresponding concept. A schema is a rule of synthesis of imagination in determining intuitions (sense-data). For example, five monads connected in series is a schema of natural number 5. Complex objects are represented by complex patterns of vibrations of monads. This way schema mediates between sensibility (sensors – monads) and understanding (concepts). The categories are rules for rules (B174) – categories are the fundamental connections of monads (forms of thought) forming the synthetic unity of apperception (the grid of monads), the framework within which various schemata can be outlined. This way categories are restricted to the objects in space and time. Our mind by the transcendental synthesis of imagination constructs various objects of experience (phenomena) subsuming monads under the categories according to various schemata. The categories (forms of thought) is "an alphabet" for constructing objects of experience.

The grid is mathematical structure and schemata can be seen as algebraic structures. They also can be seen as patterns of the firing of neurons [this require further study].

4. SCHEMATISM AND IMAGINATION: THE CATEGORIES IS "AN ALPHABET" OF EXPERIENCE AND THE GRID OF MONADS AS PLATONIC REALM OF FORMS

"[T]he category serves to "spell out phenomena in order to be able to read them as experience". "Alphabetising" means providing particular names to nature, and also providing a meaningful structure interconnected and articulated to nature in order to read it in a systematic way. [...] The category is here as it were a rule of the textualization of phenomena, in order to read them in a consistent and meaningful way. The act of subsumption of nature under this rule itself is an actual process of alphabetization." (Kang 60)

"A concept represents an object by means of a schema. When I think of a man, I generate an image according to a rule." (Ellington, essay ...)

"Kant characterizes a transcendental schema in several different ways: transcendental schema is a "transcendental time-determination" (B177) and a "time-series, time-content, time-order and time-whole" in accordance with the order of four groups of categories (quantity, quality, relation and modality) (B185); transcendental schema is the "formal and pure condition of sensibility" which

realizes and restricts the empirical employment of categories (B179); transcendental schema is not only the “schema of the pure concepts of understanding” (B179), but also the “schema of imagination” (B180) and the “rule of synthesis of imagination” in determining intuitions; it is the “product of imagination” (B179) and at the same time the “monogram of imagination” (B180) which serves to alphabetize experience; [...] it is not only the schema of the categories and the schema of imagination, but also the “schema of sensibility” in the sense that it is applied only to phenomena, not to noumena (B185) [...] Transcendental schema is a semantic rule by which the concepts of the understanding are applied (realized) and restricted to phenomena” (Kang ...)

Chapter on schematism in CPR by many was found to be one of the most confusing in Kant’s work. However, it is also one of the most important.

5. THE GRID OF MONADS IS THE FRAMEWORK OF OUR THOUGHTS AND NATURAL LANGUAGE

We claim that the synthetic unity of apperception (the understanding) is the framework where all our thoughts originate. Our thoughts are combinations of monads in this framework through logical forms of thought. The pure act of spontaneity of thought “I think” is the motion of the time parameter around the monad, equivalent to information-processing performed by the mind. Only through “I think *this* or *that*” we have a determinate thought (consciousness is always consciousness of *something*), hence various determinate thoughts involve various rates of vibration of monads and combinations of monads in various ways. We claim that all our thoughts are electromagnetic waves in this framework. All human natural languages share and arise from this structure. The synthetic unity of apperception (the grid) is logical structure (our logic is defined by it). It represents universal grammar. If one spends some time to study ancient words (say Proto-Indo-European), it will observe that some words very directly correspond to this structure. This is because it lies at the basis of our self-consciousness.

Wittgenstein’s picture theory of language corresponds to Kant’s transcendental schemata. In the introduction of Wittgenstein’s “*Tractatus Logico-Philosophicus*” (1922) Bertrand Russell says: “In order that a certain sentence should assert a certain fact there must, however the language may be constructed, be something in common between the structure of the sentence and the structure of the fact.” (x-xi)

“Logic, he says, fills the world. The boundaries of the world are also its boundaries.” (xx)

“the logical proposition is a picture (true or false) of the fact, and has in common with the fact a certain structure. It is this common structure which makes it capable of being a picture of the fact, but the structure cannot itself be put into words, since it is a structure of words, as well as of the facts to which they refer.” (xxiii)

The grid of monads is logical space or fact space. The grid of monads with the values of vibrations of monads is the manifold of intuition (of sense-data) and represents the state of affairs. It outputs phenomena. The world and natural language share the same fundamental structure of the mind – the grid of monads (Fig. 2). Natural language is fundamental. Wittgenstein’s picture theory of language corresponds to Kant’s transcendental schemata. Things are ‘articulated’ into existence by the mind through schemata. Experience is ‘reading’ of nature. Language is a window into the mind. When we think and say “a table stands” our mind combines monads in a certain way within the grid. A standing table in the real world has the same underlying pattern of monads. If they correspond – sentence describes what is the case.

Wittgenstein states in “*Tractatus Logico-Philosophicus*”:

“1.13 The facts in logical space are the world.

2 What is the case – a fact – is the existence of states of affairs.

- 2.01 A state of affairs (a state of things) is a combination of objects (things).
- 2.0272 The configuration of objects produces states of affairs.
- 2.1 We picture facts to ourselves.
- 2.11 A picture presents a situation in logical space, the existence and non-existence of states of affairs.
- 2.12 A picture is a model of reality.
- 2.13 In a picture objects have the elements of the picture corresponding to them.
- 2.131 In a picture the elements of the picture are the representatives of objects.
- 2.14 What constitutes a picture is that its elements are related to one another in a determinate way.
- 2.141 A picture is a fact.
- 2.202 A picture represents a possible situation in logical space.
- 2.221 What a picture represents is its sense.
- 4.003 Most of the propositions and questions to be found in philosophical works are not false but nonsensical.
- 5.6 The limits of my language mean the limits of my world.
- 5.61 Logic pervades the world: the limits of the world are also its limits.
- 6.22 The logic of the world, which is shown in tautologies by the propositions of logic, is shown in equations by mathematics."

We see that natural language is restricted to the objects produced in the grid (phenomenal realm or the objects in space and time). When we speak about the noumenal realm (monad as it is in itself) it does not make sense.

Monad is logical atom or fundamental building block (this is different from the theory of logical atomism by Russell and Wittgenstein). Sentences in language are 'verses (rivers, streams)' of monads – electromagnetic waves within the grid. Only those statements make sense to which corresponding schemata (pattern of synthesis of monads) exist, that is which can possibly exist in the empirically real world as an appearance (phenomena). We are able to understand only those objects which are given in sensible intuition and produced (by the transcendental synthesis of productive imagination) within this framework, that is phenomena (objects of experience).

We can connect it to our sensibility (neurons) and see the link of this with logical empiricism. According to Kant, schemata restrict the categories to the conditions of sensibility (to the objects in space and time). Things corresponding to the ideas of reason (God, soul, free will, morality) can be thought through unschematized categories, but does not yield knowledge. One monad on its own is not an object of experience since it is outside space and time. Only when monads combine to form a relational grid our determinate thoughts of something can be formed and phenomena in space and time can appear. Therefore we cannot experience and know how monad it is in itself (the Idea). Schemata (patterns of monads) represent monads/things-in-themselves as they appear in the world and we have knowledge only of the appearances. Wittgenstein famously stated in "Tractatus Logico-Philosophicus": "Whereof one cannot speak, thereof one must be silent." Language can only meaningfully speak about how monads appear to us through the conditions of sensibility, that is, logical language only reflects things in the world.

5.0.1 How determinate thoughts are formed?

"I do not see why so much difficulty should be found in admitting that our inner sense is affected by ourselves. Such affection finds exemplification in each and every act of attention. In every act of attention the understanding determines inner sense, in accordance with the combination which it thinks, to that inner intuition which corresponds to the manifold in the synthesis of the understanding. How much the mind is usually thereby affected, everyone will be able to perceive in himself." (B157)

Time is the a priori form of inner sense. We see that in an act of attention our mind thinks (processes) a determinate combination and rates of vibration of monads. Various thoughts are expressed by various patterns of combination (connection) and various rates of the monads. Thoughts are electromagnetic waves in this structure. Our ability to think various determinate thoughts is the ability to change the rates of vibrations of monads (this is what is meant by spontaneity).

6. THE GRID OF MONADS IS MATHEMATICAL STRUCTURE

On the difference between philosophy and mathematics:

“Philosophical knowledge is the knowledge gained by reason from concepts; mathematical knowledge is the knowledge gained by reason from the construction of concepts. To construct a concept means to exhibit a priori the intuition which corresponds to the concept. For the construction of a concept we therefore need a non-empirical intuition. The latter must, as intuition, be a single object, and yet none the less, as the construction of a concept (a universal representation), it must in its representation express universal validity for all possible intuitions which fall under the same concept [...] Thus, philosophical knowledge considers the particular only in the universal, mathematical knowledge the universal in the particular, or even in the single instance, though still always a priori and by means of reason. [...] The essential difference between these two kinds of knowledge through reason consists therefore in this formal difference, and does not depend on difference of their material or objects. [...] it is the concept of quantities only that allows of being constructed, that is, exhibited a priori in intuition; whereas qualities cannot be presented in any intuition that is not empirical. Consequently reason can obtain a knowledge of qualities only through concepts. [...] The shape of a cone we can form for ourselves in intuition, unassisted by any experience, according to its concepts alone, but the colour of this cone must be previously given in some experience or other. [...] mathematics can achieve nothing by concepts alone but hastens at once to intuition, in which it considers the concept in concreto, though not empirically, but only in an intuition which it presents a priori, that is, which it has constructed, and in which whatever follows from the universal conditions of the construction must be universally valid of the object of the concept thus constructed.” (B741-744)

“[Mathematics] being able to realise all its concepts in intuitions, which it can provide a priori, and by which it becomes, so to speak, master of nature; whereas pure philosophy is all at sea when it seeks through a priori discursive concepts to obtain insight in regard to the natural world, being unable to intuit a priori (and thereby to confirm) their reality.” (B753)

“All our knowledge relates, finally, to possible intuitions, for it is through them alone that an object is given. Now an a priori concept, that is, a concept which is not empirical, either already includes in itself a pure intuition (and if so, it can be constructed), or it includes nothing but the synthesis of possible intuitions which are not given a priori. In this latter case we can indeed make use of it in forming synthetic a priori judgments, but only discursively in accordance with concepts, never intuitively through the construction of the concept.

The only intuition that is given a priori is that of the mere form of appearances, space and time. A concept of space and time, as quanta, can be exhibited a priori in intuition, that is, constructed, either in respect of the quality (figure) of the quanta, or through number in their quantity only (the mere synthesis of the homogeneous manifold). But the matter of appearances, by which things are given us in space and time, can only be represented in perception, and therefore a posteriori.” (B747-748)

“The consideration of everything which exists in space or time, in regard to the questions, whether and how far it is a quantum or not, whether we are to ascribe to it positive being or the absence of such, how far this something occupying space or time is a primary substratum or a mere

determination [of substance], whether there be a relation of its existence to some other existence, as cause or effect, and finally in respect of its existence whether it is isolated or is in reciprocal relation to and dependence upon others – these questions, as also the question of the possibility of this existence, its actuality and necessity, or the opposites of these, one and all belong altogether to knowledge obtained by reason from concepts, such knowledge being termed philosophical. But the determination of an intuition a priori in space (figure), the division of time (duration), or even just the knowledge of the universal element in the synthesis of one and the same thing in time and space, and the magnitude of an intuition that is thereby generated (number), – all this is the work of reason through construction of concepts, and is called mathematical.” (B752)

“We shall confine ourselves simply to remarking that while philosophical definitions are never more than expositions of given concepts, mathematical definitions are constructions of concepts, originally framed by the mind itself” (B758)

A schema of a particular mathematical object is a rule for a particular connection (synthesis) of monads in pure intuition. Mathematics constructs all its objects in pure intuition of space and time. Pure intuition means absent of sensation. That is, mathematics studies this grid of monads (our cognitive framework) in general, the structure in which the world (phenomena) appears. For example, $7 + 5 = 12$ is true since it follows from the synthesis (connection) of monads in pure intuition of space and time, that is it follows from our cognitive framework which is invariant logical structure. All true mathematical statements state something true about this structure and this way mathematics describes the world a priori.

“The synthesis of spaces and times, being a synthesis of the essential forms of all intuition, is what makes possible the apprehension of appearance, and consequently every outer experience and all knowledge of the objects of such experience. Whatever pure mathematics establishes in regard to the synthesis of the form of apprehension is also necessarily valid of the objects apprehended.” (A166).

Unit monad is a unit sensor. The synthesis of the manifold of sensible intuition (the grid – whole sensorium) is done by the transcendental productive imagination which produces experience (phenomena). Mathematics applies not directly to phenomena but to the pure forms of space and time (pure forms of intuition) in which all phenomena appear. For example, there is no perfect circle in phenomenal world. This is the nature of the split between “The Unreasonable Effectiveness of Mathematics” and “The Unreasonable Ineffectiveness of Mathematics”.

At the present stage the study in the foundations of mathematics is unfinished and we only lay the framework. It is necessary to study how mathematical logic and the schools of formalism and logicism in philosophy of mathematics can be modeled on this cognitive framework. We argue for the unification of schools of philosophy of mathematics (logicism, intuitionism, formalism) within this framework. The grid of monads is logical structure where monads are related (connected) by the logical forms of thought (laws of thought). The logicist view:

“In speaking of arithmetic (algebra, analysis) as a part of logic I mean to imply that I consider the number-concept entirely independent of the notions or intuitions of space and time, that I consider it an immediate result from the laws of thought. My answer to the problems propounded in the title of this paper is, then, briefly this: numbers are free creations of the human mind; they serve as a means of apprehending more easily and more sharply the difference of things. It is only through the purely logical process of building up the science of numbers and by thus acquiring the continuous number-domain that we are prepared accurately to investigate our notions of space and time by bringing them into relation with this number-domain created in our mind. If we scrutinise closely what is done in counting an aggregate or number of things, we are led to consider the ability of the mind to relate things to things, to let a thing correspond to a thing, or to represent a thing

by a thing, an ability without which no thinking is possible.” (Richard Dedekind, *The Nature and Meaning of Numbers* (1887), Preface to the First Edition)

Monads can be considered as sets and the grid of monads as a model or the universe of set theory. For example, it would be interesting to consider this framework as a Von Neumann universe under ZFC and etc. Single monad (transcendental circle) is a schema of natural number 1 and thus the grid of monads represents the set of natural numbers. The set of integers is formed by taking the opposites of naturals (-) and 0. The set of natural numbers (the whole grid of monads) serves as a unit monad in higher-level grid of monads. This higher level grid is the set of real numbers. Kant claims that construction of numbers happens in time (pure form of inner sense), while of objects of geometry in space (pure form of outer sense). It is interesting in the context of cognitive neuroscience, that is how various mathematical cognition is represented by our brain?

Since each monad contains the whole grid (holographic principle), the whole grid of monads (as a set of all sets) forms a unit which is a single monad in another higher-level grid and so on. This may be the nature of continuum hypothesis. Indeed, there are very many aspects of this structure to study in the context of foundation of mathematics.

We can state that all appearances (phenomena) in space and time are subject to mathematics (as Kant argued) and that therefore the Universe is completely described by mathematics. Kant famously said: “in any special doctrine of nature there can be only as much proper science as there is mathematics therein” (4:470). As Kant argued, mathematical objects are represented by their schemata. For example, schema of natural number 5 is a rule which connects five monads in series. Kant argues that numbers are constructed in time and the objects of geometry in space. This subject requires further study. At the present stage of this project it is unclear whether natural number 5 is represented by connecting 5 monads (5 in space) or by 1 monad having a vibration rate equal to 5 (5 in time)?

We have already claimed that monad is a basic logical atom (fundamental building block) and therefore in all constructions of objects the connections can be made only between the center points of monads since all our determinate thoughts are directed (“intended”) towards something (that is other monads). This can yield some speculations on the nature of irrational numbers.

To think where this structure ends is the very same act as to think where the Universe ends and does not make sense. The structure is potentially infinite, therefore “mathematical science involves an endless multiplicity of possible pure intuitions. (MFNS, xix)” and thus infinitely many mathematical objects. Under the idea of systematic unity our reason holds this structure as a single whole (the Universe).

6.0.2 The grid of monads as Plato’s realm of forms

Needless to say that the grid of monads (Fig. 2) is Plato’s realm of forms. The Universe we experience in space and time are shadows on the wall (appearances in empirical consciousness) which are produced in the realm of forms. We do not see the reality how it is in itself outside space and time (thing-in-itself/monad, the Idea). Simply stated, noumena (thing-in-itself) projects eternal light (pure energy) and the light (pure energy) passes through the filter of our cognitive framework which produces appearances in space and time (phenomena). The whole grid is our sensorium (each monad is a single sensor) and this manifold of sensible intuition is synthesized by the transcendental productive imagination to yield experience (phenomena). Forms are schemata (patterns of monads). We claim that the world as it is in itself outside space and time (noumena) is pure consciousness and pure energy.

6.0.3 Monad as absolute infinity

We state that the monad on its own (without other monads which overlap and limit it) is characterized as absolute infinity. That is, monad is the purest expression of the Absolute Infinite (the Idea). We will later argue that finite objects in space and time appear as monads overlap and mutually limit each other. That is, finite objects appear as mutual limitations of infinity.

6.0.4 On potential, actual infinities and the Absolute Infinite

“But even so, the infinite is not yet really free from limitation and finitude; the main point is to distinguish the genuine notion of infinity from spurious infinity, the infinite of reason from the infinite of the understanding; yet the latter is the finitised infinite, and it will be found that in the very act of keeping the infinite pure and aloof from the finite, the infinite is only made finite.” (Hegel, Science of Logic, §271)

The concept of pure absolute infinity (true infinity) belongs to reason and is like an archetype of infinity (the Idea). As for Cantor, it is equated with the Absolute (the Idea). Whenever we try to think this infinity of reason, it involves our faculty of understanding (the grid of monads) since it is the framework within which our thoughts originate. Our thoughts involve combinations of monads and thus the infinity of reason is made “spurious” infinity of the understanding. It becomes not the absolute infinity of reason, but merely non-finite of the understanding. We speculate that the addition (connection) of monads in an unending sequence (say of odd numbers) is *potential infinity*, while the total set of those monads (the set of odd numbers) is *actual infinity*. These two [spurious] infinities are the infinities of *the understanding* as they involve the connection of monads. The infinities of the understanding can be smaller or larger, however the absolute infinity of *reason* contains all infinities of the understanding in itself. Monad contains the whole grid of monads and even all higher-level grids of monads. That is, the grid of monads as a whole forms a unit which itself is a monad in the next higher-level grid of monads, and so to infinity. This is the Absolute Infinite which contains all infinities of the understanding in itself. Later we will argue that there is only one Monad, one Universal Consciousness and Reason - the Absolute himself, of which we (humans as self-conscious beings having reason) are autonomous parts.

6.0.5 Monad as soul, the Universe and God

Kant’s ideas of reason – soul, the Universe and God – are merely aspects of the Idea. Kant distinguished these ideas using three syllogisms. “The number of pure concepts of reason will be equal to the number of kinds of relation which the understanding represents to itself by means of the categories. We have therefore to seek for an *unconditioned*, first, of the *categorical synthesis* in a *subject*; secondly, of the *hypothetical synthesis* of the members of a *series*; thirdly, of the *disjunctive synthesis* of the parts in a *system*.” (A323). The idea of *soul* arises from the concept of the final, unconditioned subject of all predicates of a thing – it is derived using categorical syllogism. *The World* is the sum total of all things linked together with their conditions, that is totality of the world as series of causes – the concept derived from hypothetical syllogism. *God* is the concept of the “system” or totality of all possible predicates joined in unity – suggested by the inclusiveness of a disjunctive syllogism. “All transcendental ideas can therefore be arranged in three classes, the first containing the absolute (unconditioned) unity of the thinking subject, the second the absolute unity of the series of conditions of appearance, the third the absolute unity of the condition of all objects of thought in general. The thinking subject is the object of psychology, the sum total of all appearances (the world) is the object of cosmology, and the thing which contains the highest condition of the possibility of all that can be thought (the being of all beings) the object of theology.” (B391)

These distinctions will be important as we will argue that each monad is a parallel universe

(possible world), God is immanent in every monad and what is the place of the soul in the Universe (panpsychism).

Without the ideas of reason we could not think of the Universe (the grid of monads) as a whole, that is as a unitary system having systematic unity. Science would be impossible. The ideas of reason thus are regulative and provide systematic unity. In other words, reason holds the synthetic unity of apperception (the grid of monads – the understanding) as a single architectonic system.

Monad is the "I" or soul:

"Kant sees 'The soul is simple' as arising as follows. Within the Cartesian basis, the notion of a composite – or of a thing with parts – is the notion of several items which I somehow apprehend or think as a unity by interrelating them in a suitable way. So my basic notion of compositeness is that of several items which I somehow unite; and this preresquires myself, my intellectually or perceptually uniting self, to combine the items into a whole. So I cannot apply the notion of a composite to myself: "Although the whole of the thought could be divided and distributed among many subjects, the subjective "I" can never be thus divided and distributed, and it is this "I" that we presuppose in all thinking (A354)". (Bennett 82)

7. UNIT CELL AS LEIBNIZIAN MONAD

Early Kant was heavily influenced by Leibniz. In the several places of CPR and other writings Kant argues against Leibniz but we will not go in detail to philosophical arguments since it is not the aim of this project. Leibniz is popular in the context of present day physics because his theory of monads suggest many principles for ToE and for treating the mind and the Universe computationally. We will show how Leibniz's ideas fit into this framework. Leibniz's "Monadology" (1714) suggests us these principles:

Monad is a unit cell:

"These Monads are the real atoms of nature and, in a word, the elements of things." (§3)

"Leibniz [...] insisted that monads are not themselves in space at all, that you don't get at (the thought of) a monad by (mentally) dividing extended things, and, in a phrase, that monads are "not parts but foundations" of material things." (Bennett 171)

Holographic principle:

"Now this connexion or adaptation of all created things to each and of each to all, means that each simple substance has relations which express all the others, and, consequently, that it is a perpetual living mirror of the universe." (§56)

"And as the same town, looked at from various sides, appears quite different and becomes as it were numerous in aspects [perspectivement]; even so, as a result of the infinite number of simple substances, it is as if there were so many different universes, which, nevertheless are nothing but aspects [perspectives] of a single universe, according to the special point of view of each Monad." (§57)

Every monad "mirrors" the whole grid of monads from its perspective. As explained earlier, the grid is holographic because of the analytic unity of consciousness – the 'I' throughout the grid is the same.

Holographic principle, panpsychism (monad is mind and soul):

"Thus, although each created Monad represents the whole universe, it represents more distinctly the body which specially pertains to it, and of which it is the entelechy; and as this body expresses the whole universe through the connexion of all matter in the plenum, the soul also represents the

whole universe in representing this body, which belongs to it in a special way." (§62)

"The body belonging to a Monad (which is its entelechy or its soul) constitutes along with the entelechy what may be called a living being, and along with the soul what is called an animal. Now this body of living being or of an animal is always organic; for, as every Monad is, in its own way, a mirror of the universe, and as the universe is ruled according to a perfect order, there must also be order in that which represents it, i.e. in the perceptions of the soul, and consequently there must be order in the body, through which the universe is represented in the soul." (§63)

We see that for Leibniz our representations depend on body (hence brain) and we will argue for Kantian reconciliation between idealism and materialism. The soul does not have a specific place in our body – it represents all of it. The grid of monads (Fig. 2) then should be the fundamental structure in our brain [requires further arguments].

Parallel universes/possible worlds:

Since each monad is "windowless" (§7) we consider each monad as a parallel universe (possible world). The grid (Fig. 2) is the structure of multiverse. These are the possible worlds where events take different path in history. That is, in the grid waves travel through all possible paths and create all possible histories. The nature of quantum phenomena will be explained in a separate chapter.

Some physicists speak of the worlds having different laws of physics. It is absurd since different laws of physics means different structure of the grid which is impossible since the structure of the grid is dictated by our reason. The grid is such so Reason can be self-conscious and all the characteristics of the grid are derived from self-consciousness, as we will see in the chapter on the start of the Universe.

Later we will argue using Leibniz and Spinoza (consider monad as Spinoza's substance) that each monad on its own contains highest reality and has the ground of its existence in such highest reality (the Idea). Thus monad is not dependent for its existence on other monads but its states are. We will not provide the extensive discussion of the monad as Spinoza's substance in the context of "Ethics" (1677) since Spinoza's system is incorporated in Hegel's system on which we rely.

8. THE GRID OF MONADS IN ANALOGY WITH THE COMPUTER

In analogy with the computer, the original synthetic unity of apperception (the grid – the understanding) would be hardware (framework) on which the software (our thoughts) runs. Categories of the understanding (forms of thought) is the instruction set of the CPU-GPU. Monad is a bit (qubit) of information. Monads are related (overlap) by logical forms of thought, i.e. monads are logic gates. The computations are performed by the spontaneous act of our thought (motion of the time parameter) which represents the cycle of the CPU-GPU. Schema is a rule for CPU-GPU how to construct an image for a concept, that is a program written using basic instructions (categories). A sequence of monads (bits) is a verse/string. The processing (synthesis) is performed by the work of transcendental imagination (spontaneity of thought). The synthetic unity of apperception (transcendental unity of self-consciousness) is also the screen or display where we see the appearances. That is, CPU-GPU outputs them. They can be subjective (imaginary, dreams) and objective (empirically real experience through outer sense). Our soul stares at this screen and is conscious (apperceiving) of the states that monads represent. We see not the Planck size pixels (monads themselves) but the appearances of them.

To make a distinction between hardware and software is inprecise and there is no such distinction since we have intellectual intuition. The Universe is the product of mind. We see that each monad is a basic quantum computer in itself. It is a pure input (unit sensor), pure memory cell, pure CPU (spontaneity/apperception), pure GPU (transcendental imagination) and pure output/display

(unit pixel). Every monad is a parallel universe and every monad acts as a separate CPU-GPU. Unity of our consciousness is formed when monads (CPU-GPU's) are entangled forming the synthetic unity of apperception. That is, the transcendental subject (the 'I') in all its acts of "I think" is the same throughout the grid, as Kant argued. This entangled network of CPU-GPU's with the instruction set which manipulates the bits of information is the understanding. We see that space (the grid) is the medium where our thoughts are formed and time is the process of thinking. Our understanding (knowledge) is limited to the objects in space and time.

But who instructs the CPU-GPU what to compute (what our mind to think), who is beyond the limits of computation and solves problems which are uncomputable and undecidable for human built computers? It is the "I" which is outside computation (outside space and time) who does that – reason (soul or pure consciousness).

Finally, we are clients who exist on the same server (the Absolute) and observe the Universe from our perspectives.

8.1. On the limits of computability and Gödel's incompleteness theorems

As Kant argued, autonomy and freedom is at the core of reason. We are not merely a very complex machine as other animals, but a self-conscious and autonomous machine. We claim that no human built computer can imitate the faculty of reason because reason (or consciousness) is outside space and time – outside computation. Human built computers can only imitate the logical forms of our understanding such as Boolean operations. Simply stated, it is impossible to construct in space and time what is outside space and time. The understanding (the grid) is the framework where our reason computes its thoughts. It is our reason which decides and solves problems which are undecidable and uncomputable for human built computers. We will later argue that this is related to free will and is an essential feature of self-conscious creatures since the world is physical-moral system.

Our reason through the cognitive framework of understanding can understand all objects in the physical Universe (in space and time) completely since all objects of experience are produced within this framework. It necessary to study how the proofs of Gödel's incompleteness theorems can be modelled on this framework. For example, the grid of monads represents the set of natural numbers and Gödel numbering must involve monads. We speculate that since through the faculty of understanding we can understand all objects in the Universe completely, our reason is self-contradictory, i.e. *inconsistent*, as shown in "transcendental dialectic" of CPR. However, this self-contradictory (dialectic) nature is only an illusion.

Monad (pure reason or pure consciousness) has two opposite states – the "I" and the "not-I". They both are contained in pure primordial identity (the absolute I, the Idea) and this is the primordial case of the identity of opposites. This requires further study in such contexts as paraconsistent logic.

Stated briefly, the understanding (logical space – the grid) is the framework where reason computes through time. Reason is outside space and time (outside computation) and it is autonomous. Reason can understand all objects in space and time (in the grid) completely. Also truth, meaning, faith and free will are characteristics of reason. This can yield some grasp why any complete axiomatic system in the grid is inconsistent, any consistent system is incomplete and why consistent system cannot prove its own consistency.

8.1.1 Transcendental circle (monad) as a converter between noumena and phenomena which performs quantization

This answers the question "It from Bit or Bit from It?". Only discrete wavelengths fit on the circle to form a standing wave. Wavelengths in the grid are naturally quantized. Vibration of the monad in time (intensive magnitude) and in space (extensive magnitude) are two parts of one vibration, as we will see later. Monad performs quantization and serves as the converter from analog reality how it is in itself (noumena) to quantized (digital) Universe. Monad is the faculty of pure reason itself or pure consciousness. Simply stated, reason (pure consciousness) is outside space and time but it computes its thoughts in the understanding (the grid) where determinate thoughts are formed by synthesis (combination) of monads. Synthesis is performed by transcendental productive imagination. Reality outside space and time (noumena) is not quantized but it is our mind which quantizes it in producing thoughts and phenomena (experience).

8.1.2 The existence of objects outside us

Space and time is not a property of things-in-themselves/monads, rather space and time arise as intersubjective grid of monads, where each monad represents the whole grid from its perspective. That does not mean "brain in a vat", nor naive idealism and that objects outside us are not empirically real. They really exist as Kant proved in "refutation of idealism" of CPR. "The mere, but empirically determined, consciousness of my own existence proves the existence of objects in space outside me. (B275)". We will not provide the whole argument for the existence of objects outside us since the readers can find it in Kant's work.

9. DISCUSSION OF KANT'S SYSTEM OF THE PRINCIPLES OF PURE UNDERSTANDING IN THE CONTEXT OF THIS FRAMEWORK

"Transcendental philosophy has the peculiarity that besides the rule (or rather the universal condition of rules), which is given in the pure concept of understanding, it can also specify a priori the instance to which the rule is to be applied." (B174-175)

"Therefore we can have a transcendental science of nature. The laws of this science, which state the ways in which phenomena must be synthesized in all experience, are called by Kant the Principles of Pure Understanding. These show how the schematized categories must apply to all objects of experience." (Ellington, essay)

9.1. Monad as substance in Kant's first analogy of experience

We will not start in the synthetic order quantity-quality-relation-modality of Kant's categories. We will start with the category of "substance and accident" as this way it is less confusing to see the applications of transcendental philosophy. The schematized category of substance is the concept of the synthesis of the unchanging subject to which the changing predicates belong. Permanence is the transcendental schema. It is "a substratum of empirical time-determination in general, which therefore endures while everything else changes" (B183). The first analogy of experience tells us that "all objective determinations of time (whether of succession or of simultaneity) must be constituted by referring representations to an object in which they are related; only in this way can objective relations of time be distinguished from merely subjective or from imaginary ones. Time itself is not an object. An objective time-order is constructed by setting a representation in objective time-relations to other representations. And so time itself cannot be perceived, and because of this fact experience must have a permanent object and ultimately one permanent substratum for the whole objective world of phenomena. Change (coming into existence and passing out of it) is nothing but a way in which the permanent exists; the permanent is not merely one among many appearances but is the substratum of all appearances. A change is a way of existing that follows upon another way in which the same thing exists; there is an exchange of one state of a thing for another state of that thing, but the thing itself [substance] must remain the same thing." (Ellington, essay)

We have already defined monad to be exactly this permanent substance (fundamental informational substratum) underlying all appearances. The structure of the grid is static and only the states of monads change, allowing for objective time-order and time-relations to be constructed. The experience of time flow emerges from the grid.

Monad can be seen as a string of string theory. Seen in the context of string theory, Spinoza's "Ethics" has very similar treatment of substance. For Spinoza substance remains the same, while different physical objects (fundamental particles) are produced by substance having different modes (vibrations) in attributes of extension (Kant's space) and thought (Kant's time). We can conclude that since the permanence of substance is a necessary condition of experience, it is itself not an object of experience, i.e. substance is transcendently ideal. Thus no physical experiment will ever prove the existence of a string itself (the unchanging subject to which changing predicates belong).

The frequency of the time parameter is the frequency of the vibration of the string. Different particles are produced by monads having different modes and patterns of vibration. Patterns (i.e. schemata) are algebraic structures representing particles. We have already seen that monad is homogeneous with both sensibility (single sensor) and the synthesizing spontaneous act 'I think' (information-processing) of the understanding. Therefore information-processing rate (and processing energy) is equivalent to the frequency of the time parameter, that is the frequency of vibration of the string.

Monad can also be considered as a loop in quantum loop gravity and the grid as spin network. Causal Set Theory can also be modelled on this framework since the states of monads are related according to the "principle of succession in time, in accordance with the law of causality" (Kant's Second Analogy of Experience). The grid of monads is an invariant structure (our cognitive framework) within which our thoughts (thus also theories in science) are formed. It is the structure of the Universe as it appears to us and is the ultimate subject of all our theories.

9.2. Quality - Anticipations of Perception - Monads vibrate in time

"The transcendental schemata which are the products of the synthesis of being (reality), not-being (negation), being and not-being (limitation) are all degree, both of sensation and of what corresponds to sensation." (Ellington, essay)

"Reality, in the pure concept of understanding, is that which corresponds to a sensation in general; it is that, therefore, the concept of which in itself points to being (in time). [...] Now every sensation has a degree or magnitude whereby, in respect of its representation of an object otherwise remaining the same, it can fill out one and the same time, that is, occupy inner sense more or less completely, down to its cessation in nothingness (=0=negatio). There therefore exists a relation and connection between reality and negation, or rather a transition from the one to the other, which makes every reality representable as a quantum. The schema of a reality, as the quantity of something in so far as it fills time..." (B182)

"Since a continuous change is possible between pure intuition [complete absence of any sensation] and sense perception (which is empirical consciousness), there is possible a synthesis that produces a quantity (a more or less) of sensation, starting from pure intuition (complete absence of any sensation) and arriving at any particular quantity of sensation given through sense perception. Sensation thus has an intensive quantity." (MFNS, Essay 188). For example, color, sound, taste and even weight must have intensive quantity.

Kant argues that the sensibility provides us with the content (or matter) of our knowledge. Monad is a single sensor. The angular frequency of the time parameter is equivalent to the matter ("mass" or energy) of sensation ($E = \hbar\omega$). Frequency defines the intensive quantity (degree). The more rapid it is, the stronger the sensation. How the color is distinguished from sound, taste or weight, etc.? In the chapter on Hegel's dialectic we will briefly discuss how the whole complexity in the Universe is produced within the grid of monads.

We can see why Kant named the principles under the head of quality as "Anticipations of Perception". Indeed, this is an a priori mathematical anticipation (the angular frequency of the time parameter defines the intensive degree) of sensation, however a particular color, taste, etc. can be given only a posteriori in experience.

9.2.1 Space as sensorium of God

Hegel argued that Absolute Consciousness and Absolute Mind is collective and includes within itself all individual minds (monads). The whole grid of monads represents Universal Mind and Universal Consciousness of the Universe. Individual mind (monad) is a part of one Universal Mind. Not all minds (that is monads) are conscious or even self-conscious (apperceiving), as Leibniz argued.

For intellectual intuition the content (logical matter) becomes physical matter when sensed. Every monad is a single sensor characterized by matter ("mass" or energy) of sensation. The grid of monads as logical space is the "sensorium of God" (as for Berkeley and Newton). That is, objects in the Universe exist because the Absolute⁴ thinks and senses them – through intuitive intellect He

⁴This is panentheist conception of God, not to confuse with pantheism

produces sensuous perceptions for itself, i.e. whatever He thinks He intuitively. He is at the basis of our perceptions as Berkeley argued. The grid of monads is the medium of His thoughts (logical space) and time is the process of thinking.

Simply stated, the "hardware" (which provides energy for computation) on which the Universe as quantum computer runs is the Absolute. It is the Absolute which is at the basis of all our sensations and all possible parallel worlds (He is present in all things-in-themselves and is all-knowing). However, we are not passive observers in this "game", but are autonomous co-creators of it, as we will argue later.

9.3. Quantity – The Axioms of Intuition - monads vibrate in space

"The pure categories of unity, plurality, totality may be described as concepts of the synthesis of the homogeneous, for in these quantitative judgments the objects referred to by the subject-concept are regarded as being homogeneous with one another. The schematized categories are concepts of the synthesis of the homogeneous in time and space; as such they are categories of extensive quantity. The transcendental schemata which are the products of this synthesis are all number." (Ellington, essay)

"The Axioms of Intuition tell us that the intuitions of phenomena are extensive magnitudes. To have sense perception of an object as an appearance, we must synthesize the pure and homogeneous manifold of the determinate space and time which it occupies. Therefore the synthetic unity of the pure and homogeneous manifold of the determinate space and time is one condition that must be fulfilled if we are to perceive an object. But such synthetic unity is exactly what is thought in the schematized category of extensive quantity through the schema of number. Therefore all objects as appearances must fall under this category, and this means that phenomenal objects must be extensive quantities. And hence the application of mathematics to objects of experience is justified." (Ellington, essay)

Kant's "axioms of intuition" are not axioms of mathematics, but "axioms" of our experience in general (B761). In addition to the intensive magnitude (the frequency of vibration of monad – the rate of the time parameter), all objects of experience also have extensive magnitude (vibration in space). The frequency of vibration of monad is naturally quantized. The wave number k in $p = \hbar k$ (de Broglie matter wave) shows how many monads in space the wavefunction occupies in one wavelength. There is the coherence of the phase angles between the monads which that wavefunction occupies, that is they all vibrate at a single rate. In other words, intensive magnitude (vibration in time) and extensive magnitude (vibration in space) are parts of one and the same vibration. Monad deploys its vibration in space.

As mentioned earlier, vibrations (waves) of different monads can overlap and create complex patterns. Patterns (schemata) of vibrations in spacetime are algebraic structures. Monad can be in superposition of states imposed on it by all other monads until one state becomes actual in sense-perception of an observer (actual rate of the time parameter gets determined – time-determination is made) and time-consciousness with experience emerges (phenomena appear).

We can see why Kant named the principles under the head of quantity the "Axioms of Intuition" and called (together with "Anticipations of Perception") mathematical. The connection of homogeneous monads (as natural numbers) in intuition of space and time is a construction. It is an axiom of our experience that phenomenal objects must be extensive quantities.

9.4. Relation – Analogies of Experience

"The schematized category in the concept of the synthesis of the unchanging subject to which the changing predicates belong and is usually called by Kant the category of substance and accident.

Permanence is the transcendental schema which is the product of this synthesis. The second pure category of relation is the concept of the synthesis of antecedent and consequence, corresponding to the hypothetical judgment. The schematized category is the concept of this synthesis of antecedent and consequence in which the consequence succeeds the antecedent in time and is called the category of cause and effect. Necessary succession in time is the transcendental schema which is the product of this synthesis. The third pure category of relation, which corresponds to the disjunctive form of judgment, is that of community and is the concept of the synthesis of ultimate subjects according to which the predicates of one subject have their ground in another and vice versa. The schematized category is the concept of the synthesis of unchanging substances according to which the changing accidents of one substance have their cause in another and vice versa, and is called the category of interaction. The transcendental schema which is the product of this synthesis is the necessary coexistence of the accidents of one substance with those of another." (Ellington, essay)

"[The general] principle of the analogies is: Experience is possible only through the representation of a necessary connection of perceptions." (B218)

"The Second Analogy contains Kant's famous treatment of efficient causation. According to this principle all changes of phenomena take place in conformity with the law of the connection of cause and effect. The succession of appearances is nothing but a change of permanent substance. All objects that are given to us through the forms of time and space must have a characteristic according to which they can be judged by the hypothetical form of judgment. That characteristic is the schema of necessary succession in time. The pure category of antecedent and consequence receives its experiential significance when it is translated into terms of time and is thereby transformed into cause and effect. [...] the universal law of efficient causation is imposed a priori by the mind upon objects, while particular causal laws can be known only a posteriori. All such empirical laws are merely particular determinations of the one universal law." (Ellington, essay)

"The Third Analogy tells us that substances stand in a relation of reciprocal causality with respect to their accidents. [...] Since our representations qua objective are perceptions of objects (or permanent substances, which are not things in themselves), we can say that inasmuch as our perceptions of certain objects follow one another reciprocally, the objects are coexistent. This reversibility of our representations is a criterion for distinguishing objective coexistence from objective unilinear succession." (Ellington, essay)

What Kant is saying in the Analogies is quite straightforward. Only through the permanence of substance time can be defined – monads do not come or pass away, only their states change. All changes of the states of substances (monads) must happen according to the law of the cause and effect. Coexistent monads are in community and interact with each other. Therefore monads interact and change their states through an exchange of interaction carrying quanta. In the "Metaphysical Foundations of Natural Science" Kant derives the law of conservation of energy from the first analogy of experience which says that substance (monad) is permanent and only the accidents (modes of vibration) change. For example, if the rate (energy) of monad decreases it must be according to the law of causality and thus it must emit energy quanta which is absorbed by another monad, etc. "With regard to all changes of corporeal nature, the quantity of matter [energy] taken as a whole remains the same, unincreased and undiminished." and "consciousness has a degree that may be greater or smaller without any substance needing to arise or perish" (MFNS 541-542, p. 102-103).

9.4.1 The distinction between mathematical and dynamical principles of pure understanding

"The first of the considerations suggested by the table is that while it contains four classes of the concepts of understanding, it may, in the first instance, be divided into two groups; those in the first group being concerned with objects of intuition, pure as well as empirical, those in the second group with the existence of these objects, in their relation either to each other or to the understand-

ing. The categories in the first group I would entitle the mathematical, those in the second group the dynamical." (B110)

"In the Transcendental Analytic we have distinguished the *dynamical* principles of the understanding, as merely regulative principles of *intuition*, from the *mathematical*, which, as regards intuition, are constitutive. None the less these dynamical laws are constitutive in respect of *experience*" (B692)

The schematized categories of quantity and quality describe the spatio-temporal manifold of intuition (the grid of monads) and for that reason Kant calls the principles under those heads mathematical. Monad vibrates in time (quality - Anticipations of Perception) and in space (quantity - Axioms of Intuition) which are merely two aspects of one and the same vibration.

The principles under the heads of relation and modality Kant calls dynamical. The categories of relation determine objects as enduring substances and the relationships of objects to one another. The categories of modality determine objects with their relation to the mind that knows them. We will discuss modality in separate section and see how it give rise to quantum phenomena. The grid of monads (the synthetic unity of apperception) is the structure which generates our experience. We see that mathematical principles (quantity, quality) describe this structure and thus all objects of experience (phenomena). They constitute the content (matter) of experience. However, without the dynamical principles (relation, modality) nothing would happen in the grid of monads (the Universe) since we need causality (cause and effect) for the states of monads to change and modality for monads to acquire definite states from the superposition of states when they interact with the mind of an observer in sense-perception.

9.5. Modality (Postulates of Empirical Thought) reveal the nature of quantum phenomena

It still remains a scandal to philosophy of science and to human reason in general that after the whole century of quantum physics the nature of it remains unclear.

"The Postulates of Empirical Thought are concerned with the existence of objects in relation to the mind. [...] The Postulates add to the concept of an object nothing more than the cognitive faculty in which the concept originates and has its seat. [...] Possibility depends on the form of experience, actuality mainly on the matter of experience, and necessity on the combination of the two. The First Postulate says that if things are to be possible, then the concept of these things must agree with the forms of intuition (time and space) and with the transcendental unity of apperception. The Second Postulate states that what is connected with the material conditions of experience (viz., sensation) is actual. This means that we must have sense perception in order to have knowledge of the actuality of things. The Third Postulate says that the necessary is that whose connection with the actual is determined in accordance with the universal conditions of experience (namely, the Analogies). The necessity involved here is hypothetical (not absolute) by means of the causal law expressed in the Second Analogy. [...] Every object has a form imposed by the mind, and the object is possible because of this form. Every object has a matter that is given to the mind and synthesized under that form; thereby is the object actual. Every object is a combination of form and matter, i.e., it is a substance whose accidents are causally determined; thereby is the object necessary. Accordingly, possibility is no wider than actuality, and actuality is no wider than necessity. (B282-285)" (Ellington, essay)

"The Axioms are concerned with the synthesis of the form of intuition; the Anticipations with the synthesis of the matter of intuition; the Analogies with the synthesis of the form and the matter of intuition; and the Postulates with the relations of all these syntheses to the mind that produces them. All the Principles apply to each and every object of experience." (Ellington, essay)

"The pure category of possibility is the concept of that synthesis which is self-consistent according to the formal laws of thought. The schematized category is the concept of productive imagination's

transcendental synthesis insofar as this synthesis involves the forms of intuition. The transcendental schema which is the product of this synthesis is the agreement of different representations with the conditions of time in general. [...]

The pure category of actuality is the concept of that synthesis which is present in every judgment that claims to determine a real object. The schematized category is the concept of productive imagination's transcendental synthesis insofar as this synthesis involves the matter of intuition given at a determinate time. Existence at a determinate time is the transcendental schema which is the product of this synthesis. [...] The pure category of necessity is the concept of that synthesis which is present in every judgment that follows logically from other concepts or judgments according to the formal laws of thought. The schematized category is the concept of productive imagination's transcendental synthesis insofar as this synthesis determines the given manifold with respect to the whole time. Existence at all times is the transcendental schema which is the product of this synthesis." (Ellington, essay)

As mentioned earlier, the grid is logical structure, i.e. the Universe is pan-logical. "The pure category of possibility is the concept of that synthesis which is self-consistent according to the formal laws of thought. [...] The transcendental schema which is the product of this synthesis is the agreement of different representations with the conditions of time in general." (Ellington, essay). The whole grid (spatio-temporal manifold) in the absence of sense perception and the absence of judgment that claims to determine a real object is synthesized under the category of possibility. I.e. a particle takes all possible paths as long as it is consistent with the laws of thought and is in agreement of different representations with the conditions of time in general. Everything that can possibly happen happens. Each monad is a parallel universe (logical possible world). A particle takes all possible paths in the grid (logical fact space) which are consistent with the whole grid. Particle travels through different monads and creates all possible histories. The whole grid of monads is a mathematical structure and this phenomena is described by path integrals and probability theory. We can see that all paths a particle can take are along the synthetic relations, that is connections of monads by 6 transcendently ideal spatial dimensions (energy or information transfer channels). Spacetime structure is the structure of our logic. To be precise, it is not a particle itself that takes all possible paths but the synthesis of thoughts (which are waves) under the category of possibility within the grid of monads (the synthetic unity of apperception). There is an identity of thought and being (the Universe is panlogical) and we have intellectual intuition, as we have argued using Hegel. However, being is only through time, that is a particle is observed when it is apperceived and time-determination is made which causes monad to acquire a definite state, i.e. wavefunction collapse. With this our conscious experience (phenomena) emerges.

Unique history is observed under the category of actuality, i.e. when an observer's mind acquires sense perception of an object. "The Second Postulate states that what is connected with the material conditions of experience (viz., sensation) is actual. This means that we must have sense perception in order to have knowledge of the actuality of things." (Ellington, essay).

This explains the Fermat's principle, i.e. light takes all possible paths, however we observe that path which takes least time to reach our sense perception. Therefore the wavefunction collapse appears when a particle is observed through sense perception and a determining judgment is made. Time parameter acquires a definite value (definite rate of a monad) and time-consciousness with experience emerges by the work of transcendental synthesis of imagination. Indeed, one can spend some time and see that completely all "mysterious" quantum phenomena follow the logic of the synthesis under the categories of modality.

The forms of judgment under the heads of relation and modality are intertwined (MFNS, essay 151) and they go together and are concerned with the existence of objects in their relation either to each other or to the understanding (B110). The grid (the synthetic unity of apperception) is one quantum entangled logical network – it forms the unity of consciousness. In the phenomena of

quantum entanglement the entangled particles are produced under the category of possibility and must agree with the unity of apperception and conditions of time in general. Once one particle is measured the other acquires definite state since it must be consistent with the laws of thought (transcendental logic) and the transcendental principles of nature in the unity of self-consciousness.

Consider the phenomena of quantum entanglement in the context of the category of community (corresponds to the form of disjunctive judgment): "...we must observe that in all disjunctive judgments the sphere (that is, the multiplicity which is contained in any one judgment) is represented as a whole divided into parts (the subordinate concepts), and that since no one of them can be contained under any other, they are thought as co-ordinated with, not subordinated to, each other, and so as determining each other, not in one direction only, as in a series, but reciprocally, as in an aggregate - if one member of the division is posited, all the rest are excluded, and conversely." (B112). Time is not fundamental and it emerges through transcendental time-determination, that is the rate of a monad acquires a definite state which is equivalent to sense perception.

Monad is simple quantum harmonic oscillator and produces simple harmonic motion, while the grid of monads is mathematical structure itself. It is a basis for harmonic analysis and this is the nature of the uncertainty principle since uncertainty pairs are Fourier transform pairs. The uncertainty principle allows various possibilities, as we will argue in the chapter on the possibility of free will. Quantum entanglement should not be seen as "spooky" since the grid (the synthetic unity of apperception) is one quantum entangled logical network from which time and our experience emerges.

We can speculate that the synthesis in the grid involving all possibilities is performed by our unconscious. For example, Kant speaks of synthesis of apprehension in intuition. At the present stage this study is unfinished.

9.6. On free will

Kant argued that all phenomena are subject to the laws of nature hence the Universe is deterministic. Leibniz held similar view (§22). Neuroscience shows that all our actions are determined by the processes in our brain. Since the Big-Bang everything is happening according to the law of causality. Nevertheless, both Leibniz and Kant argued that free will is compatible with determinism of all physical phenomena. In the Third Antinomy Kant shows that it is impossible to prove or disprove free will.

In "Time and Free Will: An Essay on the Immediate Data of Consciousness" (1889) philosopher Henri Bergson reacts to Kant and argues that free will is possible within *duration*. We see that Bergson's duration is while a transcendental time parameter moves around the monad in between two separate cycles of synthesis. Physical world we experience exists only in present. The grid is invariant structure and at each moment of our experience represents the state of affairs, a snapshot. The succession of moments is integrated by our memory and thus we experience succession of time and movement in physical world. As mentioned earlier, memory and will also originate from the monad. Free will is possible only within that duration between moments of experience (snapshots). Kant says:

"Assume that there is freedom in the transcendental sense, as a special kind of causality in accordance with which the events in the world can have come about, namely, a power of absolutely beginning a state, and therefore also of absolutely beginning a series of consequences of that state; it then follows that not only will a series have its absolute beginning in this spontaneity, but that the very determination of this spontaneity to originate the series, that is to say, the causality itself, will have an absolute beginning." (B473)

Act of spontaneity is the motion of the time parameter in the monad which represents our reason thinking (consciousness processing information). Causal spontaneity is defined as “the faculty of beginning a state spontaneously,” which is to say that a causally spontaneous moral agent “does not depend, according to the law of nature, on another cause, by which it is determined in time.” Free will must be identified with the transcendental subject (moral agent) and its spontaneity, i.e. with the monad, that is reason itself. Free will means that from the possibilities provided to us within the grid we choose which state the monad will acquire (wavefunction collapse, experience emerges) and in doing so we originate the series of cause and effect. This choice is transcendental time-determination in which transcendental imagination produces time-consciousness (time emerges) and our sensuous experience (phenomena). Therefore for us future is not yet completely determined and past is memory and a chain of causal relations. Every cycle we are given a new snapshot (state of affairs) of the Universe. Every cycle we choose between possible worlds. Phenomena rapidly re-appear to us, depending on the rate of synthesis (time parameter).

We can state that no scientific experiment will ever prove the existence of free will since phenomena in the Universe happen according to the law of cause and effect (Kant’s Second Analogy of Experience). However, the uncertainty principle allows possibilities and shows us the limits of our study of phenomena.

We can speculate that our perception is action-oriented, that is action and perception are related, and we will expand this further in the section on the unity of theoretical and practical reason. We will show that the world exists as a moral-physical system for us to act from freedom (free will) and the ultimate moral law (categorical imperative).

10. KANT’S METAPHYSICAL DOCTRINE OF MATTER AND MOVEMENT

“And since in every doctrine of nature only so much science proper is to be found as there is a priori cognition in it, a doctrine of nature will contain only so much science proper as there is applied mathematics in it.” (MFNS, 470)

“in order to make possible the application of mathematics to the doctrine of body, which can become natural science only by means of such application, principles of the construction of concepts that belong to the possibility of matter in general must precede. Hence a complete analysis of the concept of a matter in general must be laid at the foundation of the doctrine of body. [...] such a doctrine is an actual metaphysics of corporeal nature.” (MFNS, 472)

“The fundamental determination of a something that is to be an object of the external senses must be motion, for thereby only can these senses be affected. The understanding leads all other predicates which pertain to the nature of matter back to motion; thus natural science is throughout either a pure or an applied doctrine of motion.” (MFNS, 476-477)

“The Metaphysical Foundations of Natural Science is, then, concerned with the principles of the construction of concepts belonging to the possibility of matter in general. These principles constitute a complete system when the concepts of matter is determined by the schematized categories. And so even though mathematics is used in the metaphysical doctrine of body, this use does not render this doctrine a system comprising infinitely many propositions.” (Ellington, essay)

In the “Metaphysical Foundations of Natural Science” Kant determines a priori the concept of matter as an object of experience according to the categories. In the “Analytic of Principles” of CPR Kant mostly speaks about time. In MFNS Kant speaks about motion in space as a form of outer intuition.

“For alteration is combination of contradictorily opposed determinations in the existence of one and the same thing. Now how it is possible that from a given state of a thing an opposite state should

follow, not only cannot be conceived by reason without an example, but is actually incomprehensible to reason without intuition. The intuition required is the intuition of the movement of a point in space. The presence of the point in different locations (as a sequence of opposite determinations) is what alone first yields to us an intuition of alternation. . . " (B291-293)

10.1. Quantity – movability in space

Here there are no important conclusions within the context of modern physics.

Under the categories of quantity motion is considered. The movability in space is the only property attributed to matter which is considered as a mathematical point. Kant regards motion as a quantum. Since categories of quantity are concepts of the synthesis of the homogeneous monads, propositions in this chapter simply state the principles according to which motion can be constructed within our cognitive framework. Curvilinear motion require the addition of a cause by means of which there is a continuous change of direction and thus only rectilinear motion is considered under quantity.

"Matter is the movable in space. That space which is itself movable is called material, or also relative, space; that in which all motion must ultimately be thought (which is itself therefore absolutely immovable) is called pure, or also absolute, space." (MFNS, 480)

"The motion of a thing is the change of its external relations to a given space." (MFNS, 482)

We see that for Kant our cognitive framework (the grid) as transcendently ideal space is regarded to be pure or absolute space, while space which we experience as phenomena (empirically real space) is relative. Kant holds relational view, as Leibniz.

10.2. Quality – matter fills a space

[requires further study]

"The concept of matter is reduced to nothing but moving forces; this could not be expected to be otherwise, because in space no activity and no change can be thought of but mere motion." (MFNS, 524)

According to Kant matter fills a space by means of a moving force and not by its mere existence. Kant denies physical atoms (atoms in philosophical sense) existing in itself in absolutely empty space. For Kant the concept of matter is reduced to nothing but moving forces. There is no difference between force and matter, they are intertwined.

Kant states that we can think of only two types of moving forces – attraction and repulsion. That is, a force attracts or repels. Kant later tries to derive 4 fundamental forces corresponding to the 4 heads in the table of the categories.

According to Kant, matter fills its space by the repulsive force, i.e. by its own force of extension. This Kant argues under the category of reality. Under the category of negation Kant establishes an original attractive force. According to Kant the attractive force depends on the mass of the matter, while the repulsive force (expansive) rests on the degree to which the space is filled. We can see that under the category of reality matter occupies a space and the monad resists compression. Kant calls such short range repulsive force superficial because it acts only in contact. The negation (the opposite category of negation) of this is long range attraction. Those two forces limit each other (category of limitation) and matter fills a space to a determinate degree. Kant argues that the original attraction of matter would act in inverse proportion to the square of the distance at all distances, while the original repulsion in inverse proportion to the cube of the infinitely small distances (in contact). "If it is said, therefore, that the repulsive forces of the parts of matter that

immediately repel one another stand in inverse ratio to the cubes of their distances, this means only that they stand in inverse ratio to the volumes one imagines between parts that are nevertheless in immediate contact, and whose distances must for precisely this reason be called infinitely small, so as to be distinguished from every actual distance." (MFNS, 522)

It is interesting that long range attractive force and short range repulsive force was obtained by implementing the Leibniz's principle of the most variety in the paper by Julian Barbour & Lee Smolin (1992). This subject requires further study.

In "Opus Postumum" Kant argued that all fundamental interactions and general properties of matter can be found from the table of the categories and that there are 4 of them, corresponding to the table. We will see in separate section that fundamental forces (and the categories) are generated by the Hegelian principle of dialectic when the Universe starts.

10.3. Speculation that electromagnetism is the only fundamental force and photon is the only fundamental energy quantum:

Kant, Schelling and Hegel argued that repulsive and attractive force is inherent to substance (monad). Monad contains two contradictory states. Kant says "alteration is combination of contradictorily opposed determinations in the existence of one and the same thing." (B291-292). Hegel argued that in substance (monad) opposite forces of repulsion and attraction alter, that it always vibrates. That is, half of the monad's cycle is repulsion, the other half attraction. Monad vibrates by push and pulls.

We speculate that there is only one fundamental force – electromagnetism, and only one fundamental particle – photon. The force of electromagnetism is this original attractive-repulsive force inherent to monad and is represented by U(1) group. Photon is the quantum of energy of monad. The grid of monads (the original synthetic unity of apperception) as transcendently ideal space-time is the ether.

All other fundamental forces and particles are mathematical constructions from monads. According to Kant, particles (matter) occupy space by moving forces and not by mere existence. In other words, everything what exist is forces, therefore all fundamental particles and general properties of matter must be derived from forces, which are mathematical constructions (algebraic structures). In other words, as Hegel argued, all reality is fundamentally thoughts (panlogical) and logical matter becomes physical matter when it is sensed and experience emerges. Our thoughts are electromagnetic waves in the grid of monads (the synthetic unity of apperception - the ether), and photon is the energy quantum of monad. It is a "quantum" of our thoughts (and sensation), that is quantum of information-processing (quantum of spontaneity "I think"). Monad is natural converter from "analog" reality how it is in itself (absolute infinite, noumena, i.e. pure consciousness and pure energy) to quantized (digital) Universe we experience (phenomena). All complex objects are constructed from complex patterns (schemata) of thoughts which are formed by waves overlapping in various possible ways and according to mathematical principles. That is mathematics describe the spatio-temporal manifold of pure intuition, as Kant argued. We will discuss how complexity arises in the section on Hegel's dialectic.

Similar view that photon is fundamental and other particles can be derived from patterns is proposed in the work of Brian Whitworth (2014) where physical world is regarded as an output of a computer. Though his work lacks epistemological foundation, it gives some very good examples how patterns which give various characteristics of particles (charge, mass, etc.) can be constructed.

10.3.1 Hints for quantum gravity

Transcendental synthesis of productive imagination subsumes (integrates) the 2D holographic grid of monads (boundaries of monads) and produces experience of empirically real 3D space. The

curvature of spacetime at a particular point (monad) depends on the rate of the time parameter (rate of vibration) at that point (monad). Time parameter defines the matter ("mass" or energy) of sensation. The rate of the time parameter is the rate of synthesis, i.e. the rate of information-processing. Recent publications claim that gravity is an entropic force. Gravity can be seen as an emergent phenomenon arising from the different amount of information-processing in the grid (different rates of monads). Monad vibrates by push and pulls and the average of the vibration can be seen as "temperature". We can speculate that gravity and electromagnetism are deeply related because gravity then somehow deals with the average of vibration.

The grid itself is static and does not change since it is defined by logic. However, different rates of monads (different rates of synthesis or information-processing) can distort the energy (information) transfer and create what appears as gravity (space-time curvature) in empirically real world.

"Empty space and so also empty time are no object of possible experience; the non-being of an object of perception cannot be perceived" (21:549.17-19)

Kant argued that in order space and time to be perceived and be an object of experience it must affect senses and be synthesized, i.e. monad even in vacuum must oscillate. Therefore vacuum contains particular rate of vibration of monads (rate of time parameter). We claim that this is the nature of zero-point energy. This also can help us in the study of the cosmological constant. Simply stated, the Universe as it appears to us is a quantum computer and even empty space requires processing (synthesis) hence energy (rate of the time parameter as amount of processing). Physical being (appearance) is only through time, that is through information-processing.

Probably the maximum information processing energy of one monad is defined by the amount when it becomes a micro black hole.

Bekenstein bound is an upper limit on the information (or entropy) that can be contained within a region of monads.

10.4. Relation

Here there are no important conclusions within the context of modern physics.

Kant derives the law of the conservation of energy from the category of substance, i.e. in all changes of corporeal nature the quantity of energy taken as a whole remains the same. Simply stated, the grid of monads is invariant structure and only the states of monads (rates of vibrations) change according to the law of cause and effect and conservation of energy. Since it is mathematical structure it is necessary to study the Noether's theorem in the context of it.

10.5. Modality - Motion

The representation of motion is given to us merely as an appearance, i.e., as the object of an external empirical intuition. With regard to the appearance of motion, change can be attributed to matter just as well as to space; and either matter or space can be said to be moved.

"The rectilinear motion of a matter in no relation to a matter outside of itself, i.e., such rectilinear motion thought of as absolute, is impossible." (MFNS, 555).

"Every motion of a body whereby it is moving with regard to another body, an opposite and equal motion of this other is necessary." (MFNS, 558)

"For no motion [of a body] that is to be moving with regard to another body can be absolute; but if the motion is relative with regard to this other body, then there is no relation in space that is not reciprocal and equal." (MFNS, 548)

"Circular motion of a matter, in contradistinction to the opposite motion of the space, is an actual predicate of matter. On the other hand, the opposite motion of a relative space, taken instead of the motion of the body, is no actual motion of the body." (MFNS, 556-557)

Kant holds relational approach to space and claims that absolute is only rotational motion. Newton argued for absolute motion with his bucket argument. We can speculate that the only absolute motion is the motion of the transcendental time parameter in the monad which is *pure mobility*. In MFNS Kant tells us that absolute space is only transcendently ideal, that is our cognitive framework (the grid of monads) is ideal absolute space which we use as an ultimate reference point for our construction of an appearance (experience) of motion. Itself it is not the empirically real space which we experience and which is relative. We must study the nature of motion, especially in the context of special relativity. We must understand how equations of special relativity can be derived from the monad (unit circle). At the present stage we can speculate that monad processes not only the matter-energy of sensation (rest mass), but in addition to it also motion. Motion would be information (energy) flow to neighbour overlapping monads (6 transcendently ideal dimensions). This is what is meant by "momentum" as quantity of motion, i.e. momentum involves the circular motion of the time parameter around the monad. "Kant declares mechanics to be the mathematical science that is to time what geometry is to space". Total energy of monad: $E^2 = p^2 + m^2$. We will later argue that monad is the prototype of natural units.

11. ON THE NATURE OF CONSTRUCTION OF MOTION

At the present stage this study is unfinished. Kant speaks about motion in many places of CPR and MFNS. He also relates it to the act of spontaneity. We argue that spontaneity is the motion of the time parameter around the monad. Space and time is not a property of things-in-themselves but is a product of our brain. Motion is the construction of our mind.

"This we can always perceive in ourselves. We cannot think a line without drawing it in thought, or a circle without describing it. We cannot represent the three dimensions of space save by setting three lines at right angles to one another from the same point. Even time itself we cannot represent, save in so far as we attend, in the drawing of a straight line (which has to serve as the outer figurative representation of time), merely to the act of the synthesis of the manifold whereby we successively determine inner sense, and in so doing attend to the succession of this determination in inner sense. Motion, as an act of the subject (not as a determination of an object), and therefore the synthesis of the manifold in space, first produces the concept of succession if we abstract from this manifold and attend solely to the act through which we determine the inner sense according to its form. The understanding does not, therefore, find in inner sense such a combination of the manifold, but produces it, in that it affects that sense. [...]

Motion of an object in space does not belong to a pure science, and consequently not to geometry. For the fact that something is movable cannot be known a priori, but only through experience. Motion, however, considered as the describing of a space, is a pure act of the successive synthesis of the manifold in outer intuition in general by means of the productive imagination, and belongs not only to geometry, but even to transcendental philosophy." (B155-156)

Briefly stated, at each moment the sensibility (sensorium – the grid of monads) provides us the snapshot (state of affairs) of the world. Successive synthesis of the manifold of intuition constructs an appearance of motion. Succession as a feature of inner sense must be derived from the motion of the imagination (time parameter) generating appearance. The grid of monads is static and only the states of monads change. To understand the nature of motion we must also look at Kant's and Hegel's solutions to Zeno's paradoxes [unfinished].

11.1. Space is infinitely divisible mathematically, matter is not made of infinitely many parts

In MFNS (503-508) Kant gives philosophical arguments why matter is infinitely divisible in thought

and mathematically, yet this does not mean that it is made of infinitely many parts. This is also the problem of Kant's second antinomy in CPR. Mathematical objects are constructed by a priori synthesis of monads in pure intuition of space and time. Mathematically space is infinitely divisible. All appearances in space and time are described by mathematics. Yet we know that monads are Planck length apart and thus define smallest possible physical length, i.e. at the Planck scale space is discrete. How to reconcile infinite divisibility of space with the discrete nature of space?

"If, namely, matter is infinitely divisible, then (concludes the the dogmatic metaphysician) it consists of an infinite multitude of parts; for a whole must in advance already contain within itself all the parts in their entirety into which it can be divided. This last proposition is also indubitably certain of every whole as a thing in itself. Now, one cannot grant that matter, or even space, consists of infinitely many parts (because there is a contradiction involved in thinking of an infinite number as complete, inasmuch as the concept of an infinite number already implies that it can never be wholly complete). Therefore, one must resolve either to defy the geometer by saying that space is not divisible to infinity, or to irritate the [dogmatic] metaphysician by saying that space is no property of a thing in itself and hence that matter is not a thing in itself but is the mere appearance of our external senses, just as space is their essential form. [...]

To deny the first proposition, that space is divisible to infinity, is an empty undertaking; for mathematics does not admit of being reasoned away. But yet to regard matter as a thing in itself and hence space as a property of things in themselves is identical with denying the first proposition. The philosopher sees himself thus forced to depart from the assertion that matter is a thing in itself and space a property of things in themselves, however common and suited to the common understanding this assertion may be. But of course he departs from this assertion only under the condition that in the event of his making matter and space appearances only (hence making space only form of our external sensible intuition, and thus making both matter and space not things in themselves but only subjective modes of representation of objects in themselves unknown to us), he is then helped out of the difficulty of matter's being infinitely divisible while yet not consisting of infinitely many parts. [...]

For it is not the division of the thing but only the division of its representation that can be infinitely continued." (MFNS 506-507)

"The ground of this aberration lies in a badly understood monadology, which does not at all belong to the explication of natural appearances but is a platonic concept of the world carried out by Leibniz. This concept is correct in itself insofar as the world is regarded not as an object of the senses but as a thing in itself, i.e., as merely an object of the understanding which nevertheless lies at the basis of the appearances of the senses. Now, the composite of things in themselves must certainly consist of the simple; for the parts must here be given before all composition. But the composite in the appearance does not consist of the simple, because in the appearance, which can never be given otherwise than as composite (extended), the parts can be given only through division and thus not before the composite but only in it. Therefore, it was not Leibniz' intention, as far as I comprehend, to explain space by the order of simple entities side by side, but rather to juxtapose this order as corresponding to space while yet belonging to a merely intelligible (for us unknown) world. And this is to assert nothing other than what was pointed out elsewhere, namely, that space, together with matter, whose form space is, comprises not the world of things in themselves but only the appearance of such a world, and is itself only the form of our external sensible intuition." (MFNS 507-508)

"Since space is infinitely divisible mathematically, the matter that fills space is likewise infinitely divisible mathematically. But this fact does not permit one to go on and say that since the spatial representations of matter is infinitely divisible, matter in itself consists of infinitely many parts. Any actual physical division of matter can never be completed and hence can never be entirely given. Therefore, the fact that the spatial representation of matter is infinitely divisible does not prove that matter in itself is composed of an infinite multitude of simple parts, as the atomists claim. Matter

(as appearance) is potentially divisible to infinity, but matter (as thing in itself) is never actually infinitely divisible into an infinite set of simple parts." (Ellington, essay)

Monad itself is not an object of experience. We observe not the monads but appearances generated by the transcendental synthesis of productive imagination of the grid of monads. That is, the appearances generated in our cognitive framework, the "Platonic realm of forms".

11.1.1 The Universe as an appearance is fractal

"And the Author of nature has been able to employ this divine and infinitely wonderful power of art, because each portion of matter is not only infinitely divisible, as the ancients observed, but is also actually subdivided without end, each part into further parts, of which each has some motion of its own; otherwise it would be impossible for each portion of matter to express the whole universe." (Monadology, §65)

"Whence it appears that in the smallest particle of matter there is a world of creatures, living beings, animals, entelechies, souls." (§66)

"Each portion of matter may be conceived as like a garden full of plants and like a pond full of fishes. But each branch of every plant, each member of every animal, each drop of its liquid parts is also some such garden or pond." (§67)

It is also necessary to study organic bodies and life in the context of Leibniz and the Kant's critique of teleological judgment. At the present stage this study is unfinished. We only lay a claim that monad/thing-in-itself is pure animating principle itself (life). Life comes from noumenal realm.

"Thus the organic body of each living being is a kind of divine machine or natural automaton, which infinitely surpasses all artificial automata. For a machine made by the skill of man is not a machine in each of its parts. For instance, the tooth of a brass wheel has parts or fragments which for us are not artificial products, and which do not have the special characteristics of the machine, for they give no indication of the use for which the wheel was intended. But the machines of nature, namely, living bodies, are still machines in their smallest parts ad infinitum. It is this that constitutes the difference between nature and art, that is to say, between the divine art and ours." (§64)

"Thus, although each created Monad represents the whole universe, it represents more distinctly the body which specially pertains to it, and of which it is the entelechy; and as this body expresses the whole universe through the connexion of all matter in the plenum, the soul also represents the whole universe in representing this body, which belongs to it in a special way." (§62)

"The body belonging to a Monad (which is its entelechy or its soul) constitutes along with the entelechy what may be called a living being, and along with the soul what is called an animal. Now this body of living being or of an animal is always organic; for, as every Monad is, in its own way, a mirror of the universe, and as the universe is ruled according to a perfect order, there must also be order in that which represents it, i.e. in the perceptions of the soul, and consequently there must be order in the body, through which the universe is represented in the soul." (§63)

This can yield some speculations how our brain/body represents the Universe and space and time. We are not isolating the brain from the rest of the body because for sense perceptions we need body not just brain. Neurons are much further than Planck length, microtubules as well. Yet the representation of the Universe originates in our body. Even that we have the faculty of reason and are self-conscious depend on our human body, while animals do not have these things. How the nature of Planck length can be sought in our brain? We argue for reconciliation of materialism/physicalism and idealism. Science must hold physicalist view. Our thoughts are waves in our brain. Everything in the Universe is physical except "the Idea" whose [self-conscious] expression the physical universe itself is. Leibniz states that human body is a kind of divine machine in its parts ad infinitum and

being such represents the whole universe to us. That is, all our parts somehow reflect the whole. We speculate that the Universe as an appearance is fractal at all levels. Human brain somehow has the structure which represents the structure of the Universe.

In the end there is only one Monad – the One, the Absolute, which has all other monads in itself. He lies at the basis and at the grandest scale (which is infinite). Each monad contains the whole grid of monads and all higher-level grids of monads. Every monad mirrors the whole grid (the Universe is holographic). Whenever we ‘look inside’ the monad we find the world (grid) of monads there, and so both ways to infinity.

12. KANT’S UNFINISHED “TRANSITION TO PHYSICS” – KANT’S ATTEMPT FOR FUNDAMENTAL FORCES OF PHYSICS

“The main purpose behind Kant’s Selbstsetzungslehre [self-positing] is to rationalize his transition program and to secure the possibility of physics as a science. The fundamental idea behind this doctrine is that the subject creates the world that it knows, or that what it knows is its creation, and indeed a function of its self-consciousness or self-objectification. The basis for this idea is nothing less than the central principle behind Kant’s “new way of thought”: “that we can know a priori of things only what we put into them” (B xviii). Already in the preface to the second edition of the *Kritik* Kant saw this principle as the explanation for the scientific revolution and the progress of science (B xiv). In the *Opus postumum* he made this principle into the basis for physics itself. Physics too can be an a priori science, Kant argues repeatedly in the tenth Convolut, because what we know of the physical world is ultimately only our creation [...]. We derive knowledge from nature only to the extent that we have created it according to the laws of our own a priori activity.” (Beiser 194)

“For Kant the ideal of a science is a system necessarily exhaustive of our cognitions of an object. [...] In order for physics to become a science there must be the possibility of anticipating a priori the totality and order of these empirical forces. Actual perception (experience) cannot do the job. It merely gives us the forces without guaranteeing an exhaustive enumeration of them or a systematic form in which they are ranged. [...]

The matter of experience cannot be anticipated; only the form of it can be. Therefore we must set up in an a priori way the formal schematism of matter’s constitutive forces, which experience reveals to us and which physics studies in their concrete realizations. [...] It will point out in an a priori manner how the formal conditions of cognition serve as the clue for the discovery of all the empirical forces that physics encounters in its work. [...]

The possibility of the realization of empirical representations (perceptions) in a subject are necessarily conditioned by the subject’s forms of receptivity (time and space) and synthetic functions of thought. This means that perceptions are determined by the forms of sensibility and the synthetic functions of the understanding. If a force is to mean anything to us, it must be perceived and hence must be determined by these forms and functions. [...] By means of the categories, then, one can set up a priori the schema of all the possible forces that can affect us and be perceived by us in experience. [...]

The formal schema of the general properties of matter is deduced in a similar fashion. Such a property is nothing but the dynamical behavior of a synthetic combination of forces. Every synthesis is the activity of a subject and must be conducted in accordance with the possible a priori forms of synthesis in general. The table of the categories presents us with all the possible forms. Accordingly, every empirical property that we can know anything about must conform to the categories; therefore this table provides us with a sufficient basis for setting up a priori schema of the properties of matter. [...]

These schemata in no way replace experience. We are unable by means of them to foretell or predetermine what concrete forces or what empirical properties will affect us here and now or

which ones will be given us by experience. But these schemata provide us with a clue and a sure guide for exploring the empirically real; they enable us to classify in a necessary way every possible object of physics until experience gives us the actual presence of some one of these forces or properties. [...]

He [Kant] thought that the unity of physics was not sufficiently guaranteed by the a priori possibility of a manifold of forces and properties of matter. In the ether he found a unitary element coextensive with both the unity of matter and the unity of experience. It is a matter that occupies absolutely every part of space, that penetrates the whole material domain, that is identical in all its parts, and that is endowed with a spontaneous and perpetual motion. He based his proof of its existence upon the unity of experience [synthetic unity of apperception]. [...] Experience is a system made up of a manifold of perceptions synthesized by the understanding in space. The source of these perceptions lies in the actions of the material forces which fill space. Accordingly, the forces of matter must collectively be capable of constituting a system in order to conform to the unity of possible experience. Such a system is possible only if one admits as the foundation of these forces the existence of an ether... [...] Therefore, the existence of the ether is the a priori condition of the system of experience." (Ellington, essay)

"Thus physics is constituted, not *out* of and from experience, but, [by means of] the concept of the unity of moving forces, *for* the possibility of experience (by means of observation and experiment) according to the principles of the investigation of nature. It is constituted according to the aforementioned universal principles for the coordination of whatever phenomena may ever be presented to the outer senses, insofar as outer forces act upon them and their organs. These principles found an *a priori* classification which outlines a system of nature as a schema, and in which a place is developed for each natural object." (22:326)

Sadly Kant's last big work "Transition from the Metaphysical Foundations of Natural Science to Physics" was not finished. However, Kant presents us with the key to discovery of fundamental interactions. Space and time are not properties of the things-in-themselves. According to Kant the understanding is the lawgiver of nature. Therefore the fundamental interactions of physics must be sought in the understanding itself (in laws of thought – logic). Since there are four heads in the table of the categories, Kant claims that there must be 4 fundamental interactions. For Kant fundamental interactions and properties of matter go together.

The ether of Kant is based on the unity of experience – the ether is the grid of monads itself. For experience to be possible, it is necessary that perceptions can be connected. The ether is a necessary condition for the system of the moving forces and the unity of perceptions of outer objects. Therefore the grid of monads is the unitary system of the fundamental forces of physics. It is transcendently ideal and is not an object of experience but makes experience of ourselves and the Universe as physical system possible. The ether is invariant mathematical structure. In modern physics it is the framework of Quantum Field Theory, which we can call "modern ether". Indeed, sets of monads are algebraic structures. Particles are excited states of the monads.

According to Kant all types of matter consist of ether or caloric (in Kant's terms). This ether (or caloric) is unceasingly oscillating and attraction and repulsion alternate in this oscillation. That is half of the monad's cycle is repulsion, the other half attraction. According to Kant mass of the matter is a densified ether (that is excited state). Kant claims that there must be motion in empty space because only thereby our senses are affected. In order for us to perceive empty space, forces of attraction and repulsion must alternate in empty space because our senses are affected by motion. Kant's "caloric" in today's terms is the most basic quantum of energy, that is a photon. Therefore we can claim that according to Kant's view all other particles are excited states of one fundamental all permeating field called the ether. A quantum of this all permeating field is a photon. Hegel holds the same view that photon (light) is fundamental (e.g. Philosophy of Nature, 1817, §219). In other

words, this is an energy quantum of the time parameter, i.e. quantum of information-processing. The the grid of monads is the ether and as such forms a basis for physics. It is the framework (medium) within which the mind forms its thoughts which are electromagnetic waves. The ether is Euclidian. We have already stated that it is holographic framework because of the analytic unity of consciousness. Empirically real space which is a product of the transcendental synthesis of productive imagination is not necessarily Euclidian.

Kant argues that the understanding is the lawgiver of nature and the unity of our experience of nature is based on the synthetic unity of apperception (the ether – the grid of monads). Therefore the laws of thought (transcendental logic) also are the laws of physics. This subject requires further study. Theoretical physicist Paola Zizzi in her "computational loop quantum gravity" model treats the Universe as a quantum computer and holds similar view that the laws of physics are derived from the laws of logic. She also argues that our thoughts (and consciousness) involves non-algorithmic side which she calls "quantum metalanguage", though her work lacks philosophical foundations. Needless to say, that she talks about the split between reason (which is outside space and time) and the understanding (the framework or logical space where reason computes through time).

12.1. We as an autonomous sensuous self-moving robot

We see that the moving forces (fundamental forces of physics) and our perception of ourselves as a corporeal body in space and time are fundamentally related.

"Self-consciousness is the "act" through which the subject makes itself into an object. This act is at first merely a logical act, a thought without content. The "first progress in the faculty of representation" is that from pure thought in general to pure intuition: the positing of space and time as pure manifolds. Space and time are "products of our own imagination, hence self-created intuitions." Space is then determined by problematically inserting into it forces [...], and by determining the laws according to which they act: "The forces already lie in the representation of space."

These forces are what affect the subject and allow it to think of itself as receptive and determinable. For only insofar as the subject can represent itself as affected can it appear to itself as corporeal, hence as an object of outer sense. It then progresses to knowledge of itself in the thoroughgoing determination of appearances, and of their connection into a unified whole." (Opus Postumum, introduction by Förster, xlii)

"Kant capitalizes on this idea of an a priori consciousness of our own moving forces. Only because we ourselves exercise moving forces do we apprehend the appearances of moving forces upon us. But – and this is the crucial part of Kant's argument – only in the process of such apprehension can we, and do we, appear to ourselves as empirical beings. Empirical self-consciousness emerges at the point of intersection (interaction) between the moving forces of matter as they affect me, and my own motions thereon. That is to say, on the one hand, only because I am corporeal – a system of organically moving forces – can I be affected by moving forces of matter; on the other hand, only insofar as I can represent myself as affected do I appear to myself as sensuous and corporeal, that is, as an object of outer sense." (Förster, Kant's Final Synthesis)

The understanding prescribes laws to the Universe and defines the fundamental forces of physics (according to the forms of thought – table of the categories). Kant in "Opus Postumum" (fascicles on "the Selbstsetzungslehre") argued that experience of ourselves as corporeal body would not be possible if we could not constitute ourselves as affected by the moving forces (fundamental forces of physics). As Fichte argued, the transcendental subject (the I) self-posites and self-constitutes through its self-consciousness. Our outer sense is affected by motion. That is, moving forces affect our outer sense and the manifold of sense perceptions (the grid of monads) is synthesized. In this act

spontaneity (apperception) makes monad acquire a definite state from the superposition of states. In this synthesis we constitute ourselves, that is our body is affected (through sense organs) by the moving forces. With it conscious experience of ourselves and the world emerges. Therefore our perceptions are deeply related to the moving forces (fundamental forces of physics). We are created to act. 'To act' means both: in a sense that it is an *act* of spontaneity of the subject (the I) and in a sense that this spontaneity (circular motion of the time parameter) is pure mobility and creates mechanical motion in the physical world. The spontaneity being an act of synthesis successively synthesizes the snapshots of the present moment and produces an appearance of motion.

If we imagine ourselves as an autonomous sensuous self-moving robot, the I (reason/consciousness) which operates the robot is outside space and time. However, through our self-consciousness we perceive ourselves only as phenomena, i.e. corporeal moving body in space and time. Apperception (self-consciousness) causes the wavefunction collapse. In this act we (as "the I" – soul/reason) affect ourselves (as sensuous body) and this determines our body to act in phenomenal world in space and time. That is, it appears that fundamental forces of physics determines our body to act. The unitary system of the fundamental moving forces of physics is based on the ether, that is the grid of monads (the synthetic unity of apperception). The mind (or spirit) is the mediator between soul and body.

Whenever we think how we should act or relate to others (practical reason), we combine our thoughts within our cognitive framework (the understanding). The very same cognitive framework also gives laws to nature and generates appearances of physical objects. Idea of freedom (free will) is related to absolute spontaneity and autonomy of reason. As argued earlier, under the uncertainty principle this is what allows free will in the deterministic Universe. In other words, the mathematical framework of the Universe and the laws of physics – the grid of monads – is the way it is so that autonomous and self-conscious subjects can exist and realize, that is act according to, the ultimate moral law (categorical imperative). Both the laws of physics and morality come from the same source – reason (the Idea). In the chapter on the start of the Universe (Big-Bang) we will show that the grid of monads itself is generated by self-consciousness of Reason (the Idea). The Universe is created from reason and is precisely the moral-physical system, an arena where moral agents (self-conscious and autonomous subjects) interact.

13. MONAD IS PROTOTYPE FOR NATURAL UNITS

The synthesizing spontaneous act of the mind ("I think") is information-processing with its rate defined by the rate of the transcendental time parameter. One cycle defines the refresh rate. The speed limit in the Universe is the speed of light in vacuum. We will consider it to be the "speed of thought". Photon is the quantum of spontaneity "I think" (quantum of information-processing). We claim that the maximum rate of the time parameter is defined by c .

The quantized structure of spacetime arises as the faculty of understanding in our mind. Monad is analog (infinite, noumena) to digital (finite, phenomena) converter and performs quantization. Therefore **monad (Eulerian circle) is the prototype of natural units:**

Monads are separated by Planck length – unit length, the smallest length possible.

Circumference of the monad is equal to 2π .

The speed of light in vacuum is the speed needed for the time parameter to make one cycle around the monad in unit time.

Monad's intrinsic angular momentum is quantized by the reduced Planck's constant \hbar since only discrete wavelengths fit in the circle to form a standing wave. Monad vibrates both in time and space (intensive and extensive magnitudes).

...

We must study further how all natural units can be related in the grid of monads. This probably can be done using geometric relationships. This way we can understand the connections between the key equations of physics and the nature of them.

14. THE INTERACTION OF THE OPPOSITES (DIALECTIC) IS THE PRINCIPLE WHICH GENERATES THE COMPLEXITY IN THE UNIVERSE

How such a simple framework of binary monads together with their vibrations can encode the complexity of the world we experience? This is a question not only of theoretical physics, but of cognitive neuroscience as well. Theoretical physics, mathematics, natural language and human thoughts are based on the very same framework – the grid of monads (the original synthetic unity of apperception).

14.1. Monads mutually determine each other (determine qualities)

“Omnis determinatio est negatio” (Spinoza)

“If, therefore, reason employs in the complete determination of things a transcendental substrate that contains, as it were, the whole store of material from which all possible predicates of things must be taken, this substrate cannot be anything else than the idea of an *omnitudo realitatis*. All true negations are nothing but limitations – a title which would be inapplicable, were they not thus based upon the unlimited, that is, upon “the All”.

But the concept of what thus possesses all reality is just the concept of a *thing in itself* as completely determined; and since in all possible [pairs of] contradictory predicates one predicate, namely, that which belongs to being absolutely, is to be found in its determination, the concept of an *ens realissimum* is the concept of an individual being. It is therefore a transcendental *ideal* which serves as basis for the complete determination that necessarily belongs to all that exists. This ideal is the supreme and complete material condition of the possibility of all that exists – the condition to which all thought of objects, so far as their content is concerned, has to be traced back. [...]

The universal concept of a reality in general cannot be divided *a priori*, because without experience we do not know any determinate kinds of reality which would be contained under that genus. The transcendental major premiss which is presupposed in the complete determination of all things is therefore no other than the representation of the sum of all reality; it is not merely a concept which, as regards its transcendental content, comprehends all predicates *under itself*; it also contains them *within itself*; and the complete determination of any and every thing rests on the limitation of this *total* reality, inasmuch as part of it is ascribed to the thing, and the rest is excluded – a procedure which is in agreement with the ‘either–or’ of the disjunctive major premiss and with the determination of the object, in the minor premiss, through one of the members of the division. Accordingly, reason, in employing the transcendental ideal as that by reference to which it determines all possible things, is proceeding in a manner analogous with its procedure in disjunctive syllogisms – this, indeed, is the principle upon which I have based the systematic division of all transcendental ideas, as parallel with, and corresponding to, the three kinds of syllogism.

It is obvious that reason, in achieving its purpose, that, namely, of representing the necessary complete determination of things, does not presuppose the existence of a being that corresponds to this ideal, but only the idea of such a being, and this only for the purpose of deriving from an unconditioned totality of complete determination the conditioned totality, that is, the totality of the limited. The ideal is, therefore, the archetype (*prototypon*) of all things, which one and all, as imperfect copies (*ectypa*), derive from it the material of their possibility, and while approximating to it in varying degrees, yet always fall very far short of actually attaining it.

All possibility of things (that is, of the synthesis of the manifold, in respect of its content) must therefore be regarded as derivative, with only one exception, namely, the possibility of that which includes in itself all reality. This latter possibility must be regarded as original. For all negations (which are the only predicates through which anything can be distinguished from the *ens realissimum*) are merely limitations of a greater, and ultimately of the highest, reality; and they therefore presuppose this reality, and are, as regards their content, derived from it. All manifoldness of things is only a correspondingly varied mode of limiting the concept of the highest reality which forms

their common substratum, just as all figures are only possible as so many different modes of limiting infinite space. The object of the ideal of reason, an object which is present to us only in and through reason, is therefore entitled the *primordial being* (*ens originarium*). As it has nothing above it, it is also entitled the *highest being* (*ens summum*); and as everything that is conditioned is subject to it, the *being of all beings* (*ens entium*). These terms are not, however, to be taken as signifying the objective relation of an actual object to other things, but of an *idea to concepts*. We are left entirely without knowledge as to the existence of a being of such outstanding pre-eminence.

We cannot say that a primordial being consists of a number of derivative beings, for since the latter presuppose the former they cannot themselves constitute it. The idea of the primordial being must therefore be thought as simple. [...]

[T]he material for the possibility of all objects of the senses must be presupposed as given in one whole; and it is upon the limitation of this whole that all possibility of empirical objects, their distinction from each other and their complete determination, can alone be based. No other objects, besides those of the senses, can, as a matter of fact, be given to us, and nowhere save in the context of a possible experience; and consequently nothing is an object *for us*, unless it presupposes the sum of all empirical reality as the condition of its possibility." (B604-610)

"Now no one can think a negation determinately, save by basing it upon the opposed affirmation. Those born blind cannot have the least notion of darkness, since they have none of light. The savage knows nothing of poverty, since he has no acquaintance with wealth. The ignorant have no concept of their ignorance, because they have none of knowledge, etc." (B603)

This transcendental substrate is monad. Monad on its own is highest reality and absolute infinity ("the Idea"). It contains the whole store of material from which all possible predicates of things are taken. All finite objects of our experience (phenomena in space and time) are constructed by mutual limitations and determinations of monads. "All manifoldness of things is only a correspondingly varied mode of limiting the concept of the highest reality which forms their common substratum". Monads by overlapping limit each other's sphere and can acquire definite predicates under the exclusion of opposites. Monad is binary (has two opposite states). Qualities are determined not on their own but in relation to all other qualities – something is something in relation to something other: "the complete determination of any and every thing rests on the limitation of this *total* reality, inasmuch as part of it is ascribed to the thing, and the rest is excluded – a procedure which is in agreement with the 'either-or' of the disjunctive major premiss and with the determination of the object, in the minor premiss, through one of the members of the division.". That is, in defining one object in the grid we need to define all objects in the grid (in the Universe). As Leibniz argued, if we want to describe a particular thing in the Universe we need to describe the entire Universe. In Kant's arguments presented above (B604-607) we see the same. Kant argues that to know a thing completely we must know every possible predicate. This is how such a simple grid of binary monads defines all the complexity of the world. This allows to realize the greatest complexity in the Universe. The patterns of monads (schemata) represent some quality because they are limited (determined through negation) by other patterns. This is of course Spinoza's view as well and we have mentioned that Spinoza's philosophy is integrated into Hegel's.

All objects in the Universe have monad ("the Idea") as their prototype: "the ideal is, therefore, the archetype (*prototypon*) of all things, which one and all, as imperfect copies (*ectypa*), derive from it the material of their possibility, and while approximating to it in varying degrees, yet always fall very far short of actually attaining it."

Monad stores one bit (qubit) of information. One monad cannot define any qualities. Two monads (dyad) limit each other and thus can define a simplest possible object. Three monads (triad) can define more complex objects since we have more possible combinations. At the present stage this study is unfinished and we only give a principle. However, we can state that nearly everything we need to derive the complexity of fundamental particles with their properties can be

found in Hegel's philosophy ("Science of Logic") and there is no need to invent old things.

14.2. Hegel's anticipation of quantum physics

We need a more extensive study of Hegel's "Science of Logic" which at the present stage is unfinished. Hegel did not use the term "monad" in his terminology, rather the One, the Absolute, the Idea (monad is an expression of it for us). Hegel speaks about ratios. Hegel argues that a sufficient quantitative increase or decrease results in a sudden transition from one quality to another. Every possible qualitative determination is already implicitly related to every other by means of a quantitative ratio. Each quality is not absolutely distinct from each other. Hegel argues that matter (energy, monad) itself cannot be seen and only a determination of matter resulting from a specific form (pattern of monads) can be seen. Thus the only way to see matter is by combining matter with form (that is schemata). Finally, content is the unity of form and determinate matter. Content is what we perceive. That is we do not see the monads themselves, rather our mind decodes (processes through synthesis) the phenomena encoded by the patterns of vibration in the grid of monads.

Similarly as Kant, Hegel speaks about extensive (vibration in space) and intensive quantum (vibration in time). For example, 20 monads connected in series has an extensive quantum of 20 and have an intensive degree of 20. This is represented by the wave number k and, as argued earlier, all monads forming one wave vibrate at the same rate."Extensive and intensive magnitude are thus one and the same determinateness of quantum; they are only distinguished by the one having amount within itself and the other having amount outside itself." (Science of Logic, §481).

We claim that different phenomena are encoded by different patterns of various waves. Waves overlap and thus more energy is present in a monad where they overlap. Particles are excited states of the ether (the grid), where the ground state is empty space. Matter is "crystalized" space. The quantum of the ether (quantum of the vibration of monad) is photon. Therefore we claim that all fundamental interactions and particles are algebraic structures formed from this quantum.

Hegel speaks about a substratum where different qualities are different states of it ("§779-84"), which is our monad. He equates it with qualitative and quantitative infinities, as do we. From this standpoint, he argued, internal quantitative alteration (i.e. different rate of vibration) give different determinations of the substratum. It is an anticipation of string theory, where particles are excited states of strings (monads). Hegel anticipates quantum physics and discreteness of space. For him quantity is a continuous magnitude when seen as a coherent whole, but as a collection of identical ones (monads), it is a discrete magnitude (Science of Logic, §429-431).

Hegel stated that all qualities arise as ratios between things. That is different qualities are represented by different ratios of wavelengths (and vibrations of monads) within the grid. It is clear that the ratios between magnitudes (of vibrations) give different qualities. Qualities are defined only in relation to each other, that is in limitation. We know that different vibration of the string (monad) produces different particles, that is quantitative change leads to qualitative. Each quality (spin, charge, etc.) of the particle is defined in relation to all the other things in the Universe. For example, certain pattern (schema) of monads, that is certain algebraic group, and vibration rate define a certain quality in limitation by other patterns. We see that the principle when monads mutually determine each other lets to define the greatest possible variety within the grid of monads.

This is why Pythagoreans said that all things are numbers. For them number represents the application of limit (form) to the unlimited (indeterminate, boundless) primary matter (monad).

We can speculate that differential and integral calculus is the key in defining qualities of objects (see Science of Logic, §538-651). That is, in differentiating the complexity of qualities in the Universe from each other:

“Further, it has been said that what is infinite is not comparable as something greater or smaller; therefore there cannot be a relation between infinities according to orders or dignities of the infinite, although in the science of infinitesimals these distinctions do occur. Underlying this objection already mentioned is always the idea that here we are supposed to be dealing with quanta which are compared as quanta, that determinations which are no longer quanta no longer have any relationship to each other. But the truth is rather that that which has being solely in the ratio is not a quantum; the nature of quantum is such that it is supposed to have a completely indifferent existence apart from its ratio, and its difference from another quantum is supposed not to concern its own determination; on the other hand the qualitative is what it is only in its distinction from an other. The said infinite magnitudes, therefore, are not merely comparable, but they exist only as moments of comparison, i.e. of the ratio.” (Science of Logic, §574)

14.3. First movements of self-conscious thought – a short metaphysical outline of the Big-Bang

We provide some theory in order to explain the start of the Universe and to understand clearly what happens as universal consciousness (Reason) starts to think itself:

“If philosophy is to be rigorous, it must then start from an ‘absolutely unconditioned first principle... [that] lies at the basis of all consciousness and makes it possible,’ (Science of Knowledge, I, 91) the *Tathandlung*. What is the *Tathandlung* if not a radical self-positing of itself? The I is because it posits itself. Hence, Fichte’s first principle: the I posits its own Being, or $I = I$ (the I is the act of positing itself).

But the I does not exist alone. It is unthinkable without its opposite: the not-I, which must then also be posited by the I. Fichte thus arrives at his second principle: the I is opposed by the not-I.

Thus the two main principles of the *Science of Knowledge* are the I and the not-I. But how is their relation to be thought without one canceling out the other? This is the birth of what can already be called “dialectic” thought, which tries to think the I and the not-I together without one annihilating the other. The I and the not-I must therefore reciprocally limit each other. Now, the concept of limit, argues Fichte, included that of divisibility. The I and the not-I must therefore be posited as divisible. Fichte thus arrives at his third major principle: *The “I” opposes in the “I” a divisible “not-I” to the divisible “I.”* With great emphasis and little modesty, Fichte will say the following about this major principle:

In the “I,” I oppose a divisible “not-I” to the divisible “I.” No philosophy goes further than this; but every thorough-going philosophy should go back to this point; and so far as it does so, it becomes a Science of Knowledge. Everything that is to emerge hereafter in the system of the human mind must be derivable from what we have established here.

From this reciprocal determination of the I and the not-I, which is the basis for the *Science of Knowledge*, it is now possible to think the unity of the two main parts of philosophy. In theoretical philosophy, the I posits itself as determined by the not-I, and in practical philosophy, the I posits itself as determining the not-I. Thus beneath the Kantian dualism of practical and theoretical philosophy a common and federating principle is discovered: the principle of the unity of the I and the not-I. This principle is posited as an irreducible requirement of the I, even if its realization amounts to an infinite aspiration (*unendliches Streben*)” (Grondin 167-8)

“For Fichte, it is the Absolute I that has an inner limit, and that thus is its own other, conversely, the finite I relates to the not-I as to an external limit.” (Franco Cirulli, *Hegel’s Critique of Essence: A Reading of the Wesenslogik*, 2006, p32)

“The thought of reason is possible for everyone. To reach this perspective, *one must abstract the one that thinks*. For the one that carries out this abstraction, reason immediately ceases to be something subjective, as it is commonly represented. But it cannot be itself thought as something

objective since something that is objective, or thought, is only possible in opposition to the one that thinks, which is here completely abstracted. By this abstraction, therefore, it becomes the true *in-itself*, which leads to the point of indifference of the subjective and objective.

This monist conception of the absolute, or reason, claims to be the only consistent way of thinking the Absolute. A thought that is distinct from its object cannot be on the absolute's level. All distinction between subject and object, or between the person thinking and his object, would introduce a limit or a scission in the absolute.

Therefore, one can speak of an *intellectual intuition* to explain the thought of the absolute. Although Kant had refused such an intuition, the early Fichte had sometimes used it to speak of the I's consciousness of itself and its activity. But for Schelling, it is only an intuition of absolute identity and indifference. It is an intuition (Schelling sometimes speaks of *Ahnung* or presentiment) because it must be immediate. All mediation introduces a limit to the thought of the absolute. For a philosophy of identity such an intellectual intuition of the absolute is not so much *our* intuition of the absolute as the absolute's intuition of itself! And this intuition is not different from the absolute itself since in the absolute thinking and Being are the same." (Grondin 175)

"It is important to note that the act of self-positing, on Fichte's account, is the act of "being for self" where this "being for self" does not have the character of being any kind of "entity" or "content" that can be represented as an *object* for consciousness. For Fichte, the act of self-positing and the "content" of the act of self-positing fully coincide. In the act of self-positing, all that the self *is*, is simply its own act of being for self; and conversely, all that is *for* the self, is simply its act of being for self. In the act of self-positing, the act of *being a self* and the act of *being for self* fully coincide. And so in the act of self-positing, the self cannot have a conscious or object-like representation of the selfhood that it is; or (what amounts to the same thing) it cannot have a conscious or object-like representation of the selfhood that is its own act of self-positing. After all, such a conscious or object-like representation would require a distinction between the representer and represented; but if there were such a distinction, then the self doing the representing and the self being represented would not fully coincide. In the act of self-positing, however, the act of being a self and the act of being for self do fully coincide; but this is just to say that in the act of self-positing, the act of *being a self* (which is the same as the act of *being for self*) cannot be made into a representation or object for the self. [...]

Fichte further explains: "To posit oneself and to be are, as applied to the self, perfectly identical. Thus the proposition, 'I am, because I have posited myself' can also be stated as: 'I am absolutely, because I am'." (Science of Knowledge, I 98) [...]

[T]he young Hegel noted that the act of self-positing which actualizes not only *the being for self of the self* but also *the being for the self of an entire world*, is a kind of *creation out of nothing* – indeed, it is the only creation out of nothing that a critical philosopher can accept. In this act of "creation out of nothing," both the self-positing self *and* the entire world that exists for the self come to be "all at once," so to speak. [...] Hegel discusses such a "creation out of nothing" and he connects it with the Kantian claim that our talk about God can henceforth make sense only within the context of our own activity [...]

Our ideas of self, world, and God do not pertain to three essentially separate things that can be understood as bearing some kind of external relation to one another. Rather, self, world, and God – understood most fundamentally – are coextensive with one another, since they are different aspects under which the same, originary activity of self-positing (or creation out of nothing) might be articulated discursively. In this activity of self-positing, there is no world that is not always already *for* a self; there is no self that is not always already mirroring the *entire* world; and there is no external, transcendental God that is ultimately separable from the activity of self-positing (or "creation out of nothing") through which self and world come to be in the first place. [...]

In his 1801 essay on *The Difference between Fichte's and Schelling's System of Philosophy*, Hegel no longer

discusses the activity of self-positing as a "creation out of nothing" through which self and world come to be. But he gives expression to this same thought when he identifies the activity of self-positing as a "pure thinking" or "pure self-consciousness" that is neither subject nor object alone, but both at once; a "Subject-Object". (Baur 461-464)

"If I am to present anything at all, I must oppose it to the presenting self. Now within the object of presentation there can and must be an X of some sort, whereby it discloses itself as something to be presented, and not as that which presents. But *that* everything, wherein this X may be, is not that which presents, but an item to be presented, is something that no object can teach me; for merely in order to set up something as an *object*, I have to know this already; hence it must lie initially in myself, the presenter, in advance of any possible experience. [...] By abstraction from the content of the material proposition *I am*, we obtained the purely formal and logical proposition ' $A = A$ '. By a similar abstraction from the assertions set forth in the preceding paragraphs, we obtain the logical proposition ' $\sim A$ is not equal to A ', which I should like to call the *the principle of opposition*." (Fichte, Science of Knowledge, I 105)

"On the surface, the law of reflection regarding opposition seems to introduce contrast and division into the life of the mind. Yet, when considering the ideal nature of the determinable and the relation of mutual requirements of determination and determinable, the law in question is as much the law concerning the unity of the opposites. What is opposed belongs together; nothing is an opposite all by itself. Fichte goes even further than that. He maintains the identity (*Identität*) of the opposites, arguing that the opposites are the same viewed from two different sides. The identity claimed for the opposites is thus the identity of different, even opposed, sides or aspects of one and the same ("identical") entity or state of affairs. On Fichte's account, the opposed views of the same entity or state of affairs are inseparable (*unzertrennlich*). The complete nature of the entity or state of affairs shows itself only in the joint consideration of the opposites. Fichte repeatedly refers to this internally oppositional, yet unitary basic structure of the human mind as its "original duplicity". For Fichte the primordial case of the identity of opposites is the I (*Ich*) in its originary structure as subject-object. All other oppositions, including that between I and Not-I, must be regarded as the unfolding of the basic opposition in the I between the subjective or ideal and the objective or real. Consciousness in all its forms and shapes along with the world to which it relates through cognition as well as volition is the subject-object writ large. [...]

[I]t is the very act of thinking that first introduces nonidentity or manifoldness..." (Zöller 90-92)

"On the grandest scale of conceivability, all of thought (including the dialectical logic itself) is comprised by the thesis Idea, whose natural antithesis is Nature, the otherness of the known considered independently of its relation to the knower; and the grand synthesis of the two is Mind/Spirit, the self-knowing, self-actualizing totality of all that is – namely, the Absolute itself."

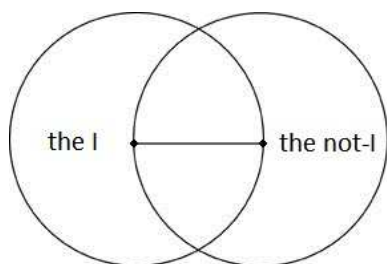


Figure 4: Dyad. The I (the Absolute – Reason or pure consciousness) posits itself as a point. It starts to think itself and time parameter starts moving around the first monad. To become conscious of itself its needs something other – the not-I. The dialectic movement of Thought starts. With the not-I matter of intuition appears to the I, i.e. the Universe starts. “The I” (first monad) and “the not-I” (second monad) vibrate at opposite phases to each other – forming a wave (Thought of the Universal Mind or Spirit). In Hegelian terms, first monad is *in itself* (the Idea), second monad is *out of itself* (Nature), their synthesis is *in and for itself* (Mind/Spirit).

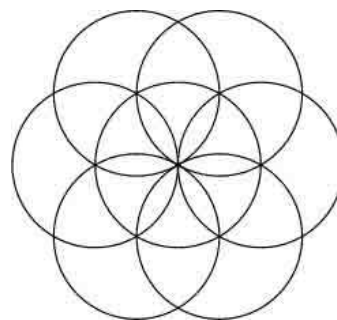


Figure 5: The last step of the first cycle of generation (the study of the intermediate steps of dialectic towards this pattern is unfinished). All possible patterns of mutual determinations of monads within this structure define the properties of the fundamental constituents of the Universe, i.e. fundamental forces and particles.

Hegelian dialectic and Fichte’s Thesis-Antithesis-Synthesis of the “I” gives us a principle how to start the Universe. As we think “the Idea” (as Reason thinks itself) we have to project it in the imagination. Through our imagination we imagine (project) it as a *dimensionless point (dot)* to indicate *pure identity* and non-dimensionality (since it is outside space and time and has no dimensions). When we start to think it (as reason thinks itself or pure consciousness starts to become conscious of itself), it acquires a boundary and becomes a unit circle where the spontaneity of thought (process of thinking) is the motion of the time parameter around the boundary of the circle. It is still infinite since it is not limited by anything else but by itself (it is not limited by any other monad which would overlap and limit the sphere). Such circle is the purest transcendental schema homogeneous with the spontaneity of thought (“I think”) and the sensible intuition (single sensor) and as such it is the *purest projection* of the faculty of imagination onto thing-in-itself/monad – the purest expression of the Idea. We are conscious of this our primordial activity (motion of the time parameter) and this is what Fichte and Hegel call intellectual intuition (intellektuelle Anschauung). This is the primordial act of self-positing which Fichte expresses as “I am”. Monad is subject-object. It is not yet a moment of the Big-Bang. Big-Bang starts with the second monad.

In order for the “I” to know itself and to become self-conscious it needs the “not-I”, that is the subject must become an object for itself through reflection. Because of the dialectic nature of reason when the “I” thinks itself (time parameter moves) it passes to the opposite – the “not-I”. This act of thinking creates the second monad (the “not-I”) which overlap with the first. These two monads vibrate at opposite phases to each other. A divisible “not-I” is opposed to the divisible “I”. Both monads mutually limit and determine each other in their synthesis. Hegel argues that qualities of objects are determined by negation and limitation by the other. To determine means to ascribe a predicate under exclusion of its opposite. The first monad is the Idea, the second monad is Nature, their synthesis is Mind/Spirit. This is when the Big-Bang happens – matter of intuition (which is physical matter) appears to the transcendental subject. “When the I reflects upon its own sensation, and posits that which limits the I and looks at it, this act is intuition, in which the non-I is intuited, and what is intuited appears as if it were the product of the non-I.”. The “I” starts to intuit and

perceive itself. It is affected by the "not-I" and holds it as a source of his sense perception. This is the very first moment of the understanding (knowledge) and self-consciousness. In Hegelian terms, first monad is *in itself* (the Idea), second monad is *out of itself* (Nature), their synthesis is *in and for itself* (Mind/Spirit). As Hegel argued, when we think of *being* our thought inevitably moves to *nothingness* and their synthesis is *becoming*. This dialectic process of Thought generates the laws of thought (logic – the structure of spacetime) and the laws of physics. The Absolute starts to think itself in space and time. Space is the medium of thoughts, while time is the process of thinking. The evolution of the Universe is the evolution of his Thought. We see that the Universe starts and exists as God's self-consciousness.

In the dyad (Fig. 4) we have 1 external relation of the monads – that is 1-dimensional space. Time is already present since it is equivalent to thinking (motion of the time parameter). As for Leibniz, one monad does not define space but two monads (dyad) do.

It is seen that in Kant's table of categories under each head first two categories are opposites of each other, while the third one unites them:

"Of course, the triadic form [dialectics] must not be regarded as scientific when it is reduced to a lifeless schema, a mere shadow, and when scientific organization is degraded into a table of terms [Kant's table]. Kant rediscovered this triadic form by instinct, but in his work it was still lifeless and uncomprehended; since then it has, however, been raised to its absolute significance, and with it the true form in its true content has been presented, so that the Notion of Science has emerged." (Hegel, Phenomenology of Mind)

We have categories of *reality* (first monad positing itself), the *negation* of it (the not-I) and mutual *limitation* of each other in their synthesis, that is the categories of quality. "the I" and "the not-I" are negations of each other. "the I" is negation of reality of "the not-I", and vice versa. Thus they both contain reality and negation (are binary) and in this sense are homogeneous with each other. The synthesis of the homogeneous in space and time is the categories of quantity – *unity* (single monad), *plurality* (two monads), *totality* (two monads taken as a unit). Both monads are in *community*, that is are *substances* which mutually exert influence on each other through *cause and effect*. Those are the categories of relation.

Dyad is the moment of first appearance of physical object in the Universe (Big-Bang). We speculate that this simplest determinate physical object is a photon with maximum possible energy. Its one wavelength involves two monads which vibrate in opposite phases. Two-monad-universe cannot determine any other quality of an object, i.e. no other distinct object. One monad can store one bit (qubit) of information. In order for the mind to determine other distinct qualities (that is distinct objects) we need more monads to have more information and possible relations which would determine more qualities.

The direction of the dialectic gives us a hint why entropy always increases and time flows in one direction – synthesis always produces more complexity. This act of synthesis is information processing. Synthesis unites the opposites and this moves time forward.

This can also yield some speculations why there is more matter than antimatter. Matter is counter-clockwise movement of the time parameter, while antimatter – clockwise.

14.3.1 Hints

We need to study the dialectic movement of Thought step by step since the first act of self-positing (first monad). At the present stage this study is unfinished. One cycle around the monad is one cycle of the "I think" (one cycle of synthesis).

The dialectic process of self-conscious thought proceeds further in a famous Pythagorean chain: Monad, Dyad, Triad, Tetrad, Pentad, Decad. First cycle is finished after generating the pattern of 7 monads (Fig. 5). If we regard the Universe as a cellular automaton, it means that transcendental automaton must repeat the cycle after 7 steps. The dialectic process of Thought generates 6 "curled up" transcendently ideal spatial dimensions. $SU(3) \times SU(2) \times U(1)$ symmetry must be present. We have already stated that monad is fundamental building block of mathematics. Thus this algebraic structure must fit into the pattern shown in Fig. 5.

Plato in "Timaeus" states that 4 fundamental forces in nature correspond to 4 Platonic solids. Kant in "Transition to Physics" tried to derive 4 fundamental forces corresponding to the 4 heads (quantity-quality-relation-modality) of the table of the categories. We need to study how the categories (forms of thought) under each head relate 7 monads together and what algebraic structure (schemata) they produce.

Dialectic process of Thought can also be expressed by the famous Fibonacci sequence (and golden ratio) since members of the sequence "synthesize" and unite the previous two. Some Platonic solids are related to the golden ratio and all of them can be constructed from the pattern in Fig. 5. If this pattern define all fundamental particles and forces, the next generation cycle must make sudden jump to much greater space and generation of new qualities at the higher level. We need to study Hegel further.

The most important statement is that all distinct qualitative determinations that are possible in this pattern of 7 monads must exhaustively define fundamental interactions and particles (they go together). All mutual definitions between monads in this pattern are the definitions of fundamental constituents of the Universe. In other words, all possible patterns of mutual determinations in this structure of 7 binary monads define all the fundamental material from which the physical universe is made up.

15. UNITY BETWEEN THEORETICAL AND PRACTICAL REASON: THE UNIVERSE IS A PHYSICAL-MORAL SYSTEM FOR CATEGORICAL IMPERATIVE TO BE REALISED

15.1. Autonomy of human being

We, as rational human beings, are individual monads (minds) in the whole inter-subjective grid of monads (Absolute Mind). In some sense there is no difference between us and the Absolute outside space and time, though we rely on our existence on Him. Our true nature is with Him (noumena) though we are trapped in space and time (phenomena) and know ourselves only phenomenally. We have intellectual intuition and free will (absolute spontaneity) and choose which definite state a monad will acquire (wavefunction collapse). That is, we are not only passive observers of the Universe, we are autonomous participants and co-creators of it, though not independent from the Absolute for creation. What distinguishes us from other conscious beings (say, animals) is self-consciousness and autonomy. We are not the passive "mechanical" participants who respond to stimuli but autonomous participants of the Universe. Our autonomy allows us a choice (free will) which definite state a monad will acquire, a characteristic given only to human beings (self-conscious beings). We choose which history we will take from all possible parallel worlds. This is what is meant by *autonomy* which is the key concept of Kant's moral philosophy. At the present stage the study of Kant's moral philosophy in this framework is unfinished.

Fichte's "Science of Knowledge" can be described as an effort to demonstrate that reason could not be theoretical (how our experience and objective cognition of the world is possible) if it were not also practical (how we ought to act in the world) – at the same time that also demonstrates that reason could not be practical if it were not also theoretical. The world starts as self-consciousness and the grid of monads is transcendental unity of self-consciousness. Moral law is identified with reason. Both morality and the physical laws of the Universe originate from the very same source – Reason (the Idea). The mathematical framework and the laws of physics are the way they are so that self-conscious moral agents can exist. In other words, the physical Universe is a system for categorical imperative (ultimate moral law) to be realized. The world is the arena where moral agents (self-conscious autonomous subjects) interact – the Universe is the moral-physical system.

When the grid of monads is viewed as the fundamental structure of human relations and human society it is the ultimate subject of "Philosophy of Right". The perfect state is organized according to this structure. That is, according to the structure of the Universe.

16. PANENTHEISM – THE ONLY CONSISTENT CONCEPTION OF GOD

"Without the world God is not God" (Hegel)

"God is God only so far as he knows himself: his self-knowledge is, further, a self-consciousness in man and man's knowledge of God, which proceeds to man's self-knowledge in God." (Hegel, Encyclopaedia of the Philosophical Sciences, §564)

This section is unfinished. We will not provide the arguments to show the flaws of other conceptions of God and just state that panentheism is the only one compatible with science and philosophy. It is indeed sad to see people wasting time in arguing about the relationship between science and faith. As Kant has shown, the ideas of reason which make the greatest systematic unity and science possible are the very same ideas which make us think about God, soul and free will. Without reason we would not have self-consciousness, science, natural language, philosophy, morality, etc. and... the idea of God.

The conception of God of the most of profound thinkers in philosophy, mathematics and physics is panentheist though most do not use this term. This conception naturally lies at the core of our reason ("the Idea") and indeed should be referred simply as God, or the Absolute. Confusion arises

when people who are very weak philosophers (especially in epistemology) start to invent their own (mis)conceptions of God, rather than looking at the core of reason ("the Idea") and understanding why we can view the Universe as an orderly whole (and study in science) in the first place. Even the level of natural philosophy among scientists is poor. Physicist seek Theory of Everything when a prototype of such a system is transcendental idealism of Kant and German Idealism (especially Hegel) developed 200 years ago! Regarding natural philosophy most physicist live in the times of Ancient Greece, while the most advanced have reached only the times of Descartes, Newton, Spinoza and Leibniz. To do away with natural philosophy and the ether (though it came back as quantum field theory), to do away with the idea of God – what a false pride. Science indeed must strictly hold physicalist view and follow scientific method, however it also must know its sphere (the appearances) and the epistemological grounds of its method. [...]

Contrary to the popular belief, Spinoza's concept of God is not strictly pantheist, it is in a sense panentheist as well, though Spinoza does not speak about the transcendent part of it. Spinoza equates God with substance with infinitely many attributes. According to Spinoza, we and the Universe have only two attributes: extension (Kant's space) and thought (Kant's time). Everything in physical universe is in space and time and if God is merely the Universe (pantheism), then this substance (God) has only two attributes, contrary to Spinoza.

Cantor thought of God as the Absolute Infinite. Single monad on its own is Absolute Infinite (of reason). However, the whole infinite grid of monads taken as a unit serves as unit monad in another higher-level infinite grid of monads, and so on to infinity. This is also Absolute Infinite (of reason) which contains all infinities (of the understanding) in itself. God is the first and the last. In the end there is only one Monad which contains all other monads in itself but these other monads is itself. God generates the grid of monads (the Universe) by thinking himself (by self-conscious Thought). Each monad is a mirror of the whole universe, as Leibniz stated. God is immanent in every monad, hence omnipresent. However, God is infinitely greater than the Universe and thus transcendent.

There is only one Reason (Universal Consciousness) – God himself. God in order to know himself has to think itself. In this process his Thought generates the grid of monads (the Universe) where every monad is mind/soul (panpsychism) and the whole grid is the Mind of God. Those minds/souls finally get to be self-conscious (apperceiving) in humans beings who have reason. However, we can know ourselves only how we appear to ourselves (as an appearance/phenomena) and hence cannot know our true self (soul) and God through the understanding. Reason strives to go beyond appearances to the core of our person (soul – "the I") and this requires faith as an act of reason. When we know God and ourselves (as soul) through reason it is actually God knowing himself. The physical Universe with self-conscious subjects is essential for God to know himself. Simply stated, monad knowing itself is God knowing itself.

It does not mean that we are merely means. Since God is all-good (Love) in thinking itself He generates the best possible world and He treats everyone as an end. That is, the world is created for Him but also for us as well.

16.1. On theology within this framework

This is not the aim of our project, however we will briefly show how theology can be easily understood from this framework. By no means this is a religious or any kind of spiritual teaching, our aim is to model the ground of all our knowledge. Through mathematics and physics we know only the appearances and metaphysics (or transcendental philosophy) shows how they are constructed. About the transcendent things (God, soul, free will) we must remain humble. Humans are above nature being able to understand all objects in the Universe. However, we must keep in mind that this ability is the ability of our reason. And reason is also a self-conscious call to be like God and with God. God is Reason and regarding God we must remain humble and beware of false pride in

ourselves. We hold Kantian position that it is impossible to prove or disprove God, soul and free will, however those ideas of reason are necessary conditions of experience which give systematic unity. "I have therefore found it necessary to deny knowledge, in order to make room for faith." (B xxx.).

Each monad contains the ideas of reason. Each monad is God, soul, the world and characterized by absolute infinity (of reason). Finite objects of experience arise from mutual limitations of monads. Therefore God is present everywhere in the Universe and yet is not an empirical object of experience. All parallel worlds exist in God. Therefore he is all knowing. The grid of monads is God's Mind. We (as individual monads) exist in Him, through Him, with Him. There is no difference between us and God outside space and time and we are His creations in the image of Him. God can be characterized as Reason or pure universal consciousness. Only humans have reason among all creatures.

God is a person - "the I" and relationship with God is relationship with His person. If God would not be a person, each of us would not be an individual person (individual "I" as mind/soul).

The aspect of God which gives rise ("birth") to the physical matter in the Universe is called the Mother of God. Creation is an eternal and ongoing process (becoming). Universal Mind (Geist) is God's Spirit. The Universe is the Son of God. God posits itself: "I Am". Through the Mother of God he embodies his Mind/Spirit as the Son of God (the Universe). The first monad is God, the second monad (image of it) is the Son, their synthesis is Spirit. That is, God and the Son look at each other and share love with each other which is Spirit. This Mind/Spirit is God himself. This Spirit is the unifying principle of the whole grid of monads. The grid of monads = the universal Church.

Single monad in the beginning represents the Garden of Eden. Second monad gives rise to sensible intuition and therefore knowledge (the understanding) becomes possible. The monad can think of the other monad as other than itself and can treat matter of intuition as a means for its egoistic ends. This is original sin or alienation.

Sin or karma is the chain of cause-and-effect created by our choices. We can choose in the likeness of God (Love, categorical imperative) or treat others as means for egoistic ends (sin). God always chooses love (treats everyone as an end) therefore His Spirit (Mind) always (at each moment) realizes the greatest possible physical world. Evil exists so we can produce good from it, i.e. learn how to love.

We have free will in the Universe. We can act in accordance with God's Spirit or not. Our actions create the chain of cause and effect (karma). Objective Universe is possible only through intersubjectivity, therefore our actions influence others. Absolution liberates us from being confused in the chains of cause-and-effect (bad karma, sin), reconciles with other people (grid of monads = universal Church) and our choices create new chains of cause-and-effect. However only God knows what will happen since all parallel worlds exist in Him. We choose between parallel worlds.

We hold the view that reincarnation (transmigration of the soul) is true. However, it cannot be proved nor disproved and is a matter of faith. Mind (soul) acquires different bodies in its long process towards achieving self-consciousness of God. Human being is the final step of this process. The world is system of purification of souls. Everything is given to the soul so it can learn how to love. The doctrine of heaven, purgatory and hell serves the same function. Heaven is the soul returning back to God, hell is pre-human life, purgatory is human life. Hell is suffering without meaning. Humans suffer too but our suffering can have meaning (because we have reason), while animals do not have reason.

Monad is the purest expression of the ideas of reason - God, soul, the world. In prayer or meditation we as soul (monad) enter into the relationship with God (Monad) itself. We direct ourselves towards what lies at the basis of the world and what lies at the innermost core of our person.

7 sacraments represent 7 overlapping monads. The Eucharist is the central monad.

Religious symbols are a way to make the objects corresponding to the ideas of reason (which cannot be given in experience) sensible. Symbols point reason to those objects.

The grid of monads is the framework of natural language. Therefore Universal Mind "speaks/articulates" things into existence. The first monad posits itself and the act of self-positing is expressed as "I Am". Second monad is the moment of the Big-Bang (the physical Universe/Nature starts). Creation ex nihilo.

[...]

17. THE COMING TIME OF ABSOLUTE KNOWING

"As our own thinking becomes progressively more sophisticated and as we gain greater facility with synthesizing ideas, we may reach a final culmination in the synthesis of ideas that results in something that Hegel calls "absolute knowing." When we reach the stage of absolute knowing, all of the seemingly contradictory and conflicting details of the world are sublated and our minds become capable of piercing through to the underlying unity that ties reality together as an organic whole. At this stage of thinking, all things are integrated into, and accommodated by, a universally enveloping concept, an "absolute Idea," that leaves out nothing that has ever transpired in the universe. [...] in absolute knowing it is not implied that you can recall all of the events in history. What it does imply is that you have comprehended the underlying pattern of meaning in existence."

"As one proceeds from the confusing world of sense experience to the more complex and coherent categories of science, the Absolute Idea, of which all other abstract ideas are merely a part, is approached. Hegel also held that this increasing clarity is evident in the fact that later philosophy presupposes and advances from earlier philosophy, ultimately approaching that to which all things are related and which is nevertheless self-contained – i.e., the Absolute Idea."

"The Phenomenology is the appearance of Spirit in human consciousness through its successive stages of clarity until it reaches the stage of Absolute Knowledge wherein it knows that that of which it is conscious is itself. (Hegel, Phenomenology of Mind, Preface)."

"In the Phenomenology of Spirit I have exhibited consciousness in its movement onwards from the first immediate opposition of itself and the object to absolute knowing."

"History as a whole is a progressive, gradually self-disclosing revelation of the Absolute." (Schelling, System of Transcendental Idealism (1800))

Modern physics studies the beginning of the Universe and seeks the unification of all fundamental interactions. Science tries to unite them under one theory – Theory of Everything. What is more fundamental for physics to study? What will happen when we achieve this unification and understand the fundamentals and the beginning of the Universe?

According to Hegel, systems in the history of philosophy represent the necessary succession of ideas required by the progressive unfolding of the Idea. The history of philosophy is the development of the Absolute's self-consciousness in the mind of man.

The evolution of the Universe is the movement of self-conscious thought of the Absolute. History is nothing but the dialectical process of Reason thinking itself. Our effort to understand the objects in the world through our reason is actually reason thinking itself because all objects are products of

reason. It is consciousness thinking of itself and not yet knowing that what it is thinking of is itself.

"Spirit may exist in the mode of self-alienation. It thus exists and is conscious of itself but does not know that that of which it is conscious is itself." As we have seen, our consciousness misinterprets external objects as alien (other than itself). Reason achieves the final step of full self-consciousness by recognizing that external objects is itself. We have seen that all objects in the Universe are constructed from monads where each monad express the whole Universe and the whole grid is the Absolute Mind. "Finite spirit is not a reality over-against infinite Spirit but rather the latter's finite self-manifestation, then the human spirit is in a very significant sense the self-knowledge of infinite Spirit, such that for human spirit to truly know itself is to know God as knowing himself."

"Hegel identifies the Absolute's knowledge of itself with man's knowledge of the Absolute."

We come to understand that the fundamental element of the Universe is monad. Monad is the purest expression of the Idea (Reason or pure consciousness). That is, Reason (the Idea) comes to know itself and achieves full self-consciousness. This is the end of the dialectic process towards Absolute's self-consciousness in the mind of man.

"In the history of philosophy the different stages of the logical Idea assume the shape of successive systems, each based on a particular definition of the Absolute. As the logical Idea is seen to unfold itself in a process from the abstract to the concrete, so in the history of philosophy the earliest systems are the most abstract, and thus at the same time the poorest. The relation too of the earlier to the later systems of philosophy is much like the relation of the corresponding stages of the logical Idea: in other words, the earlier are preserved in the later: but subordinated and submerged. This is the true meaning of a much misunderstood phenomenon in the history of philosophy - the refutation of one system by another, of an earlier by a later. Most commonly the refutation is taken in a purely negative sense to mean that the system refuted has ceased to count for anything, has been set aside and done for. Were it so, the history of philosophy would be, of all studies, most saddening, displaying, as it does, the refutation of every system which time has brought forth. Now although it may be admitted that every philosophy has been refuted, it must be in an equal degree maintained that no philosophy has been refuted, nay, or can be refuted. And that in two ways. For first, every philosophy that deserves the name always embodies the Idea: and secondly, every system represents one particular factor or particular stage in the evolution of the Idea. The refutation of a philosophy, therefore, only means that its barriers are crossed, and its special principle reduced to a factor in the completer principle that follows." (Hegel, *Shorter Logic*, §86.2)

The nature of our reason is dialectic as we have seen earlier. All our knowledge about the world originates in the faculty of understanding (the grid of monads). Throughout history through the faculty of understanding we come with some knowledge of the world, but later we arrive at new knowledge which "refutes" older one. That is, we arrive at problems and contradictions in our theories and solve them. This way we proceed further in our understanding of the world by the guidance of reason. All history of science (and history in general) evolves as a long chain of thesis-antithesis-synthesis (synthesis becomes a new thesis). That is, humanity follows reason. Reason generates some knowledge in the understanding, applies it until it finds contradictions, solves them and generates new knowledge, etc. The last final synthesis is the Absolute Idea, synthesis which is so perfect that there is no antithesis for it. That is, synthesis which synthesizes all our knowledge into the single system (aka Theory of Everything). The understanding (the grid of monads) is the framework within which all our thoughts originate and is the ultimate subject of all science and philosophy. All science and philosophy worthy of the name spoke from a particular perspective of this structure and have a part in the final synthesis (in the Absolute Idea). The final synthesis unites all perspectives into single whole. To see and discuss how particular theories of science and philosophy speak from a particular perspective of this framework is a work requiring a separate

project.

17.1. The grid of monads as Leibniz's *characteristica universalis*

"Mankind is still not mature enough to lay claim to the advantages which this method could provide." (Leibniz)

"We have spoken of the art of complication of the sciences, i.e., of inventive logic... But when the tables of categories of our art of complication have been formed, something greater will emerge. For let the first terms, of the combination of which all others consist, be designated by signs; these signs will be a kind of alphabet. It will be convenient for the signs to be as natural as possible—e.g., for one, a point; for numbers, points; for the relations of one entity with another, lines; for the variation of angles and of extremities in lines, kinds of relations. If these are correctly and ingeniously established, this universal writing will be as easy as it is common, and will be capable of being read without any dictionary; at the same time, a fundamental knowledge of all things will be obtained. The whole of such a writing will be made of geometrical figures, as it were, and of a kind of pictures — just as the ancient Egyptians did, and the Chinese do today. Their pictures, however, are not reduced to a fixed alphabet... with the result that a tremendous strain on the memory is necessary, which is the contrary of what we propose." (Leibniz, *On The Art of Combination*, 1666)

"The universal "representation" of knowledge would therefore combine lines and points with "a kind of pictures" (pictographs or logograms) to be manipulated by means of his calculus ratiocinator. He hoped his pictorial algebra would advance the scientific treatment of qualitative phenomena, thereby constituting "that science in which are treated the forms or formulas of things in general, that is, quality in general"." (Leibniz, *On Universal Synthesis and Analysis*)

Leibniz was seeking a universal logical calculation framework (calculus ratiocinator) where an "alphabet" of human thought and all human knowledge could be represented. The grid of monads (Fig. 2) is precisely this framework (*characteristica universalis*). All objects in the Universe as it appears to us are generated in it. Frege in his "Beggriffsschrift" was inspired by Leibniz's idea, however it is not the main purpose of Frege's work. We must study modern logic in the context of this framework (the grid of monads). At the present stage this project is unfinished.

17.2. the Kingdom of God on earth

We argue that after understanding the beginning of the Universe and arriving at ToE we achieve Absolute Knowing. That is, the framework which shows the basis of all our knowledge of the Universe. The world is the product of Reason. The whole history is Reason thinking itself (self-consciousness). That is, we finally understand that we are all part of the One, the Absolute. The whole grid of monads is the Mind/Spirit of the Absolute. Hegel argues that Spirit is making an effort to actualize its central principle of rational freedom and that realization of Spirit culminates in self-conscious rational freedom. What our reason (consciousness) thinks as objects in the world are actually reason (consciousness) itself. There is only one Reason (Universal Consciousness) – the Absolute himself. We are autonomous parts of Him. Space and time is not reality how it is in itself. It is a product of our self-consciousness and is represented in our brain. The Thought thinking itself returns to itself and achieves full self-knowledge. The self-conscious monads (humans) understand themselves as monads and that everything originates from monad (the Idea, the Absolute himself). "The world was to be understood as Mind endeavouring to know or recognize itself by first objectifying itself as nature or matter, and then returning into itself as consciousness comprehending itself." Single monad on its own cannot be conscious of itself because to be conscious of itself (self-conscious) it needs something other (second monad). This (dyad) marks the first moment of alienation when monad can misinterpret the other monad as other than itself. This is when Nature (the Universe) starts. The Thought (the Universe) evolves in dialectical path of self-consciousness and finally achieves complete self-consciousness. That is, it returns to itself. Man understands that

man is God but "man is God only to the extent that he transcends the naturality and finitude of his spirit and elevates himself to God." This process can be depicted as: unconscious unity (single monad on its own, thesis), conscious separation/alienation (other monads, antithesis) and finally conscious unity (the whole grid as unity, synthesis).

This starts a new era of humanity - the times of rational freedom. That is, we understand that the world is the moral-physical system for ultimate moral law (love, categorical imperative) to be realized. We are all parts of the One, i.e. God. That is, our life is given so we can perfect ourselves in acting from the categorical imperative (in actions of love). We become fully conscious of ourselves and understand the nature of our rational freedom (God) and slavery (alienation, sin). This marks the establishment of the Kingdom of God on earth, or perpetual peace. Kant called it the Kingdom of Ends. Some people will resist that and still hold external objects as something alien but doing that is being ignorant in the face of the whole Universe since the Universe (and human history) just follows the self-conscious Thought of the Absolute (Reason) and this final synthesis is inevitable. As stated earlier, this is panentheist conception of God. We see that "God would not be God" without creating the world and rational self-conscious minds (humans) through which He comes to know itself. It is necessary to the nature of God, as Hegel argued. We are monads (minds) in the grid of monads (God's Mind).

As stated earlier, our study of Hegel is unfinished. We strongly encourage the readers to understand the authentic Hegel since for example marxism completely distorts and misinterprets Hegel.

17.3. On the origin of ancient metaphysics and knowledge of the Universe

Ancient metaphysics, the myths of creation, philosophy etc. are popular among speculations in the context of modern physics. Indeed, many ancient texts speak precisely about this framework we presented. How is that possible that modern physics came to repeat ancient metaphysics? Vedic texts, Buddhist texts, pre-socratic philosophy, Genesis, Kabbalah, ancient cosmology, etc. Even neoplatonism, Rosicrucians. No mysticism can be involved.

We argue that since thoughts and language are fundamental to the Universe, the primitive science generated the most primitive systematic knowledge. In natural language we see that many ancient words very directly define and relate to the things in the Universe. They define them as they are constituted in our cognitive framework. We argue that since the original synthetic unity of apperception is the framework within which all our thoughts and natural language originate, the most primitive thoughts about the world generated the most primitive (and fundamental) knowledge. This knowledge must have arisen in the first periods of human self-consciousness. This is the nature of ancient metaphysics. We can very briefly state most ancient myths in such chain:

Creator (pure consciousness or Reason) -> Monad (as containing two opposed states, for example, ying-yang) -> Mind of God (Spirit) + Feminine aspect of God -> matter + union of the opposites -> Four elements (earth, water, air, fire, i.e. forces and properties of matter in general) + ether (space) -> the phenomenal world

It is interesting that cyclic model of the Universe dominates in ancient metaphysics. The lengths of the periods in the Universe probably can be calculated from the grid of monads.

18. IN THE CONTEXT OF OTHER THINKERS

David Bohm spoke about implicate and explicate order. It is clear that the grid of monads is his implicate order, while appearances (phenomena) – explicate. Jung and Wolfgang Pauli collaborated and speculated about the links between mind, matter and psyche. Pauli was interested in psychology of scientific discovery, i.e. how new scientific theories are created by the scientist's mind. Jung

used the term *Unus mundus* ("One world") to describe the underlying source of both psychological and material reality. Pauli's vision of World Clock which unified mind and matter is clearly a monad. Monad (fundamental element) is Kant's thing-in-itself, Husserl's transcendental ego, Spinoza's substance, Heidegger's *Dasein*, Jaspers' *Existenz*, Whitehead's actual entity, Schopenhauer's individual will, Plato's Form of the Good, Aristotle's unmoved mover, Heraclitus' *Logos* (or Reason), Buddhist *dharma* (as fundamental element), Daoist *taiji*, etc. Ancient "Music of the Spheres", Pythagoreanism, Johannes Kepler's "*Mysterium Cosmographicum*", study of the "motion of the heavens" and similar texts speak of monads in this framework.

[...]

Since the grid of monads (Fig. 2) is an invariant structure of all our theories, it is only a matter of time and interest to see what aspects of it various theories speak of. It gives us hints. We must study the present problems of mathematics and theoretical physics in the context of this framework.

19. CONCLUSIONS

[to be added]

20. PROJECTS FOR FURTHER STUDY

1. Hegel's "Science of Logic"
2. Dialectic movement of Thought step by step from the start
3. Definition of fundamental forces and particles from all possible mutual determinations in the structure of 7 monads
 - Monad as the prototype of natural units
 - Gravity and the rate of time parameter (rate of synthesis or information-processing)
4. Study of modern logic in this framework
 - Philosophy of mathematics: logicism and formalism
 - Philosophy of language
5. Theory of computation: the understanding (the grid) as the framework within which reason (consciousness) computes
 - Reason and Gödel's incompleteness theorems. Monads and Gödel numbering.
6. The grid of monads as mathematical structure: algebra, harmonic analysis, probability theory in the context of quantum physics
7. Mach's principle in the context of this framework
8. Cosmological constant in the grid of monads
9. The grid of monads as transcendental cellular automaton
 - Cycles in the history of the Universe
10. Kant's "Critique of Judgment"
 - Teleology
 - Mathematical beauty

11. Fichte, Hegel. Productive imagination and re-productive imagination. How the representation of space and time is produced in our brain/body.

Unconscious processes

Kant and threefold synthesis: Synthesis of Apprehension in Intuition, Synthesis of Reproduction in Imagination, Synthesis of Recognition in a Concept.

12. Morality

Monad as Plato's Form of the Good. / God as Love.

13. Philosophy of right

Study of freedom, law, society and the State using this framework

14. Matter and memory. Monad as pure memory.

15. Monad as pure will

Schopenhauer

16. Music: the Universe as a giant synthesizer. Monads as strings. Schopenhauer on music as the embodiment of Will.

17. Human psyche using this framework

18. Study of Kant's critique of the proofs of God in the context of this framework

19. Metaphysics as science (finishing Kant's project).

20. Sociology.

The study of the model in the context of J. Baudrillard's "Simulacra and Simulation". Appearances, alienation and human psychology. The Absolute is the ultimate Truth and Reality.

...

Other ideas:

1. The Universe as a system of purification of souls. Mathematics of love, life and death. How our choices (free will) impact information flow, the chains of cause-and-effect and rebirth. The grid of monads as the function (framework) which outputs karma while input is our free will (our choices).

2. Faith and existentialism. Truth and meaning as coming from reason.

REFERENCES

- Barbour, J., & Smolin, L. (1992). Extremal variety as the foundation of a cosmological quantum theory. *arXiv:hep-th/9203041*.
- Baur, M., & Houlgate, S. (2011). *A companion to hegel / edited by stephen houlgate and michael baur*. Wiley-Blackwell.
- Beiser, F. C. (2009). *German idealism: The struggle against subjectivism, 1781-1801*. Harvard University Press.
- Bennett, J. (1974). *Kant's dialectic*. Cambridge University Press.
- de Boer, K. (2000). *Thinking in the light of time: Heidegger's encounter with hegel*. State University of New York Press.
- Ellington, J. (1970). *The unity of kant's thought in his philosophy of corporeal nature; essay included with the translation of metaphysical foundations of natural science*. Indianapolis: Bobbs-Merrill.
- Fichte, J. G. (1970). *Science of knowledge (wissenschaftslehre): with the first and second introductions / edited and translated by peter heath and john lachs*. New York: Appleton-Century-Crofts.
- Förster, E. (2000). *Kant's final synthesis: an essay on the opus postumum*. Harvard University Press.
- Grondin, J. (2012). *Introduction to metaphysics: From parmenides to levinas*. Columbia University Press.
- Hegel, G. W. F. (1961). *Science of logic / translated by w.h. johnston and l.g. struthers; with an introductory preface by viscount haldane of cloan*. London: G. Allen and Unwin; New York: Macmillan.
- Hegel, G. W. F. (1977). *Phenomenology of spirit; translated by a.v. miller, with analysis of the text and foreword by j.n. findlay*. Oxford: Clarendon Press.
- Hegel, G. W. F. (1991). *The encyclopaedia logic: Part i of the encyclopaedia of philosophical sciences with the zusatze / translation with introduction and notes by t.f. geraets, w.a. suchting, h.s. harris*. Indianapolis: Hackett.
- Kang, Y. A. (1985). *Schema and symbol: a study in kant's doctrine of schematism*. Amsterdam: Free University Press.
- Kant, I. (1929). *Critique of pure reason / translated by norman kemp smith*.
- Kant, I. (1970). *Metaphysical foundations of natural science / translated, with introduction and essay, by james ellington*. Indianapolis: Bobbs-Merrill.
- Kant, I. (1993). *Opus postumum; edited, with an introduction and notes, by eckart förster; translated by eckart förster and michael rosen*. Cambridge: Cambridge University Press.
- Kant, I. (2004). *Prolegomena to any future metaphysics that will be able to present itself as science: with two early reviews of the critique of pure reason / edited by günter zöller; translated by peter g. lucas and günter zöller*. Oxford: Oxford University Press.
- Leibniz, G. W. (1898). *The monadology / english translation by robert latta*.
- Sedgwick, S. (2008). *Kant's groundwork of the metaphysics of morals: an introduction*. Cambridge: Cambridge University Press.
- Sgarbi, M. (2012). *Kant on spontaneity (bloomsbury studies in philosophy)*. Bloomsbury Academic.
- Spinoza, B. (2000). *Ethics / translated and edited with an introduction and notes by g. h. r. parkinson*. Oxford: Oxford University Press.
- Whitworth, B. (2014). Chapter iv. the matter glitch. Retrieved from <http://brianwhitworth.com/BW-VRT4.pdf>
- Zizzi, P. (n.d.). Retrieved from http://arxiv.org/find/gr-qc/1/au:+Zizzi_P/0/1/0/all/0/1
- Zöller, G. (2002). *Fichte's transcendental philosophy: The original duplicity of intelligence and will*. Cambridge University Press.

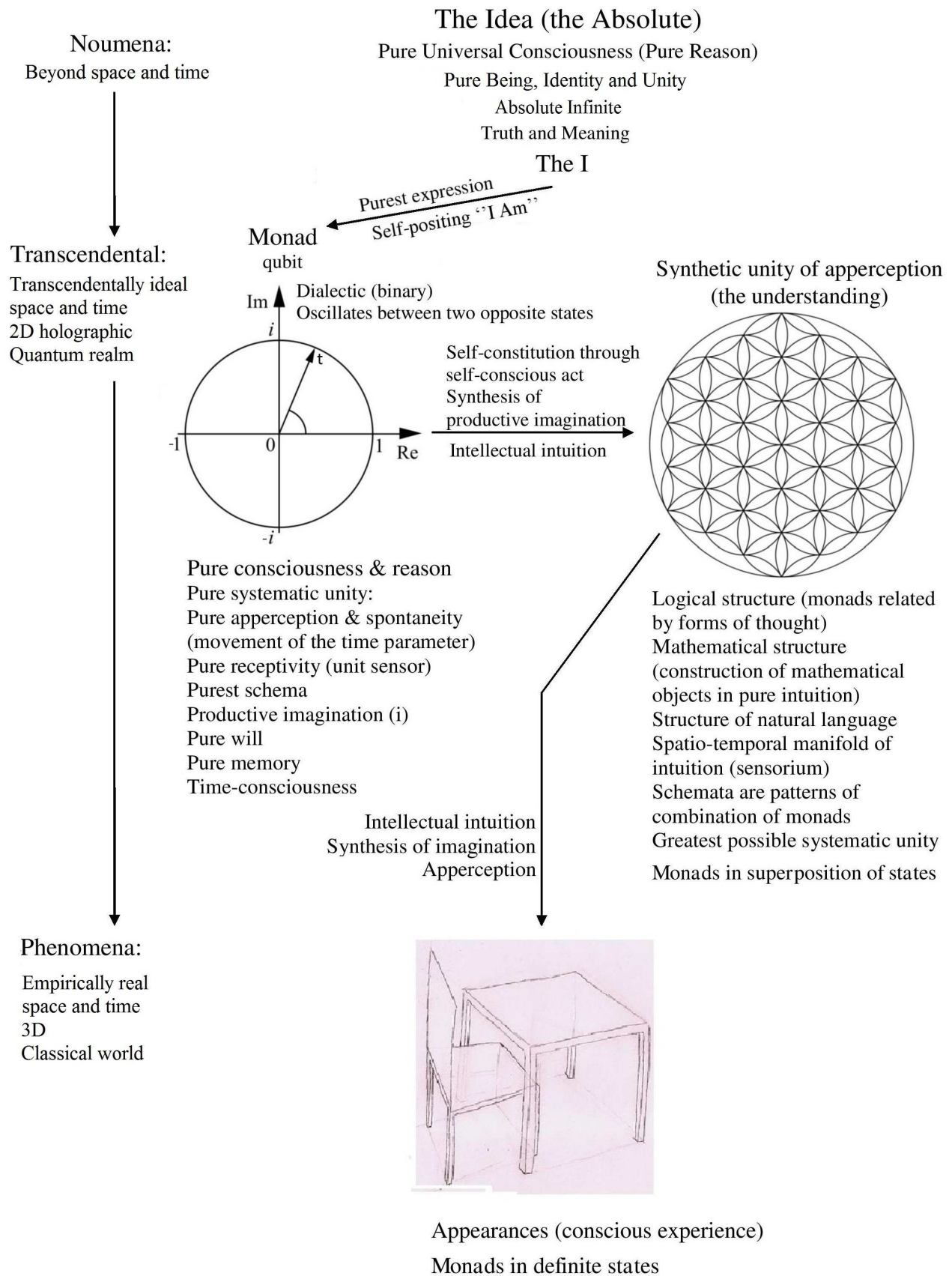


Figure 6: The model.

Appendices

A. KANT'S TABLE OF THE CATEGORIES

Logical form of judgments	Category	Schema	Synthetic principles of pure understanding
Quantity		Time-series	Axioms of Intuition
Singular (This S is P)	Unity	Synthesis of the homogeneous in time. Extensive quantity. Number.	All intuitions are extensive magnitudes.
Particular (Some S is P)	Plurality		
Universal (All S is P)	Totality		
Quality		Time-content	Anticipations of Perception
Affirmative (S is P)	Reality	Synthesis of being, not-being, being and not-being in time and space. Intensive quantity (degree).	In all appearances, the real that is an object of sensation has intensive magnitude, that is, a degree.
Negative (S is not P)	Negation		
Infinite (S is non-P)	Limitation		
Relation		Time-order	Analogies of Experience
Categorical (S is P)	Substance & Attribute	Permanence	Principle of permanence of substance
Hypothetical (If S is P then S' is P')	Cause & Effect	Necessary succession in time	Principle of succession in time, in accordance with the law of causality
Disjunctive (S is either P or P')	Community (reciprocity between agent and patient)	Necessary coexistence of the accidents of one substance with those of another	Principle of coexistence, in accordance with the law of reciprocity or community
Modality		The totality of time in respect of all possible objects of experience	Postulates of Empirical Thought in general
Problematic (S may be P)	Possibility - Impossibility	Agreement of different representations with the conditions of time in general.	That which agrees, in intuition and in concepts, with the formal conditions of experience, is possible.
Assertoric (S is P)	Existence - Non-existence	Existence at a determinate time	That which is bound up with the material conditions of experience, that is, with sensation, is actual.
Apodeictic (S must be P)	Necessity - Contingency	Existence at all times	That which in its connection with the actual is determined in accordance with universal conditions of experience, is (that is, exists as) necessary.