

## **Austrian Economics and the Problems of Apriorism**

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#### **Summary**

Any attempt at scientific justification of the validity of the *a priori* economics or praxeology must face the danger of vicious circles coming from the fact that any science (including Hayek’s evolutionary-aprioristic theory of neuronal networks as developed in his *Sensory Order*) is based on some *a priori* presuppositions. It is Hegel’s conception of the spiral movement of the “experience of consciousness” (as applied originally in his *Phenomenology of Spirit*) which gives an efficient method of elimination of that kind of vicious circles; being aptly re-interpreted, it even enables to defend apriorism (in its evolutionary version) face to face the developments in modern physics which resulted in Einstein’s theory of relativity and quantum mechanics. Consequently, evolutionary apriorism (as utilising the inspirations from the works of Hayek, Adam Smith, Hegel, Karel Engliš, etc.) is able to present scientific arguments in favour of the categorical statement that praxeology – as an *a priori* proto-science – is an indispensable basis for empirical economics.

#### **Keywords:**

*a priori* economics, praxeology, proto-sciences, Hayek’s *Sensory Order*, evolutionary apriorism, Engliš, semantical order of language, Adam Smith, the spontaneous formation of language, vicious circles, Hegel, “experience of consciousness”, quantum mechanics, theory of relativity

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## 1. On the neo-Kantian Foundations of Mises' *a priori* Economics

The prestige of the Austrian economics – and especially of the Misesian-Rothbardian version of it – is not very good. The mainstream economists and economic methodologists treat the Austrians as a small sect of dogmatists and doctrinaires who use “cranky and idiosyncratic” arguments,<sup>1</sup> as people who believe to be the only truth-holders and are therefore unable to participate in standard scientific discussions.

As concerns an average professor of mainstream economics, he/she is very surprised when somebody tells him/her that economics is an *a priori* science dealing with human action. This common negative stand towards Austrian economics does not follow solely from the prevalence of relativism which has now become an intellectual fashion (in the form of postmodernism, relativistic hermeneutics, multiculturalism, etc.) and whose exponents are extremely irritated when they hear about self-evident truths.

It follows also from the fact that both Misesian-Rothbardian apriorism and Hayekian theory of spontaneous order (which is the second basic version of Austrian economics) necessarily require some philosophical foundations – in Mises-Rothbard's case this means responding to Kant's famous question: “How are synthetical judgements *a priori* possible?”

In contrast to this, mainstream economics, seems in the eyes of its representatives to be in harmony with the notion of proper science as inter-subjectively valid knowledge which does not depend on any particular philosophical conception or presupposition and which thereby appears immune from all confusions in philosophy in which any philosopher can criticise and refute anyone else.

From the standpoint of the mainstreamers, the Misesian-Rothbardian criticism of the use of mathematical methods in economics (as well as Hayekian criticism of statistics) undermine the only guarantee for the “truly” scientific status of economics.

Nevertheless, it is merely an illusion to believe that what appears as science in this way does not depend on any philosophical or proto-scientific presuppositions. The notion of purely empirical science is build upon the unhappy philosophical conception of John Locke who treated human mind as *tabula rasa*. Moreover, the empiricists' conviction that there exist only empirical (*a posteriori*) and analytical propositions is self-contradictory (because the proposition which expresses this conviction is neither empirical nor analytical);<sup>2</sup> similar inconsistencies can be found in Popper's falsificationism, too.

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<sup>1</sup> Mark Blaug, *The Methodology of Economics*, Second Edition, Cambridge University Press, Cambridge 1992, pp. 81-82.

<sup>2</sup> See Ludwig von Mises, *The Ultimate Foundations of Economic Science: An Essay on Method*, Second Edition, Sheed Andrews and McNeel, Inc., Subsidiary of Universal Press Syndicate, Kansas City (1<sup>st</sup> edition in 1962), p. 5, and Hans-Hermann Hoppe, *Economic*

The fact that mainstream economists and other scientists widely accept empiricist and positivist methodology in spite of its inconsistencies confirms José Ortega y Gasset's observation that the high degree of division of labour and routine in sciences makes it possible for almost any intellectually average person to become a successful scientist.

It is true that the logical inconsistency of pure empiricism (especially in the field of economics) makes the aprioristic approaches of the Austrians inevitable. But still, we should ask whether the mainstreamers' and other empirical scientists' contempt for and neglect of the Austrians really result solely from their ignorance and distaste for philosophy. We need to ask whether the justification of the aprioristic economics is really so clear and distinct that it would necessarily be accepted by any rational mind.

Further, we ought to have in mind that the reserved or even critical attitude of Misesians and especially of Rothbardians towards Hayek's theory of spontaneous order can compromise them in the eyes of theorists of evolution such as Stuart Kauffman, who successfully applied a computer model of biological co-evolution to the explanation of the evolution of British precedent-based common law.

But, before starting to deal with the Austrian aprioristic praxeology we must make clear the very concept of *a priori* knowledge; it is not sufficient to say (as, for instance Blaug did) that *a priori* means prior to experience. Here it is necessary to turn to Kant's philosophy which was the main inspiration for Mises.

According to Kant, human experience consists of contents and form. The contents come from outside. As given to our sensory perception, they have the character of phenomenal elements (sensations), completely destitute of being related to anything else. Their external source is called NOUMENON or thing in itself. The form of our experience consists of abstract and formal relations, namely of spatial and temporal relations and the relations expressed by categories, e.g., by the category of causality. These relations do not come from outside. It is our mind which actively imposes them onto the phenomenal elements. Kant's belief that our sensory experience can give us only such contents which are devoid of all kinds of relations, is a heritage of so called "nominalism of relations" which had been developed in the tradition of British empiricism (according to Hume, causal relations cannot be perceived, etc.). Kant's version of apriorism in which *a priori* knowledge is confined to the sphere of imposed formal relations can therefore be called "impositionism;" it stands in sharp contrast with realistic apriorism according to which the *a priori* knowledge of relations (and also of substances, etc.) is a reflection of some characters existing in reality independently of the activities of our mind (the

realistic position in the frame of apriorism is known under the name of “reflectionism”).<sup>3</sup>

In Kant, the spatial and temporal relations (such as “to be to the right of something else” or “to occur later than something else”), are imposed by our sensory intuition, which is one of the basic functions of mind. Analogously, our theoretical reason (at the level of the *Verstand*) imposes causal, modal and some other relations among some single phenomenal events or “things” which are already located in time and space. It means that our reason imposes relations as “to be the cause of something else”, “to be a property of something else”, “to be the possibility for something else”; thus, in Kant, the famous 12 categories of the *Verstand* express nothing but various relations.

All kinds of relations (spatial, temporal, categorial) must necessarily be imposed in order that we could have experience at all. This means that all experiencing minds must necessarily impose them in the same way. This, in turn, implies that our experience, as concerns its formal (=relational) aspect, is valid inter-subjectively.

According to Kant, the judgements which express explicitly that “phenomenal elements or events are necessarily connected by the above described imposed relations” are synthetical judgements *a priori*; the most famous example of these judgements in the field of theoretical reason is: “any thing is causally determined by another thing,” or stated another way, “everything that happens has a cause.”

On the other hand, analytical judgements express clearly the contents of concepts representing single phenomena or “things”– without relating them to anything else (Kant’s example is “all bodies are extended”). There are also judgements which express the relations which are imposed into phenomena on the basis of the contents of experience; Kant calls them synthetical judgements *a posteriori*; they have no necessary inter-subjective validity.

According to Kant, to have *a priori* knowledge does not mean that we possess it before having sensory experience (i.e., as a set of inborn ideas); we find it within experience when we cease to be interested solely in its contents and turn – in the mode of reflection – our attention to its form. Then we find out that any further inter-subjectively valid experience cannot correct the *a priori* knowledge or even falsify it; it is because the *a priori* knowledge is a necessary presupposition of any inter-subjectively valid experience.

It should be added that in Kant, there exists also practical reason; it imposes into originally non-related phenomena such relations as “to be a means for something else”; in doing so, it is usually determined by the contents of

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<sup>3</sup> We should have in mind that realistic apriorism (reflectionism) can be derived both from the modern meaning of the term „realism“ (referring to the existence of material entities outside our mind) and its original meaning as it was developed in medieval philosophy (it finds its expression in the “idealistic” statement *universalia sunt realia*).

experience. Nevertheless, when the practical reason is determined only by itself, it relates all our maxims and corresponding activities to the attaining of the supreme end as defined in the categorical imperative. The categorical imperative expresses thus the necessary (i.e., *a priori*) form of any moral action.

Now we can finally start to deal with Misesian aprioristic economic science (called also praxeology). Its starting point is the *a priori* knowledge of the essence of human action; this true knowledge, which has reflective character, finds its condensed expression in the form of the axiom *man acts*.<sup>4</sup>

Mises' main argument for the possibility of such non- or pre-empirical knowledge of the real structure of human action consists in his statement that reason and action are congeneric (have common origin) and homogeneous, or, in other words, they are two different aspects or attributes of the same thing.

Elsewhere Mises says that the ability of our reason to grasp and make clear the essential structure of our acting with the aid of pure *ratiocination* results from the fact that (purposeful) action is an offshoot of reason. Applying deductive approach to the axiom of action, we can formulate explicitly its logical consequences; in spite of their purely analytical or tautological status, they enrich our knowledge.

Mises here refers to geometry, arguing that the famous theorem of Pythagoras surely enriches our knowledge, even though it is implicitly present in the concept of rectangular triangle. We can see that Mises is close to Frege's conception of logical consequences (derived from analytical judgements); according to Frege, these consequences are contained in the definition, but like a plant in a seed, not like a beam in the house. Mises' economic example is quantitative theory of money which is virtually contained in the very concept of money which, in turn, can be deductively derived from the axiom of action.

When we apply some tautological theorems of praxeology – which is possible when another discipline of Misesian theory, called thymology (which is a kind of hermeneutics), states that there exist conditions for it –, they give us true knowledge of reality.<sup>5</sup>

## 2. On Hoppe's Attempt to Make Praxeology "Water-tight"

In some of his later works Mises asserts that the question concerning the synthetical or analytical (tautological) status of praxeological theorems is merely a verbal one.<sup>6</sup> In order to consider a concept or judgement as valid *a priori*, it is

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<sup>4</sup> Ludwig von Mises, *Human Action: A Treatise on Economics*, Contemporary Books, Inc., Chicago (Third revised edition published by Henry Regnery Company in 1966 by arrangement with Yale University Press), p. 39.

<sup>5</sup> Cf. Roderic T. Long, *Wittgenstein, Austrian Economics, and the Logic of Action*, chapter 5. (<http://www.mises.org/journals/scholar/long.pdf>.)

<sup>6</sup> Ludwig von Mises, *The Ultimate Foundations of Economic Science*, p. 44. See also B. Smith's comments on Mises' conception of analytical/synthetical judgements in Barry Smith,

necessary that the negation of its contents should be unthinkable for human mind and that it should necessarily be applied to our mental approach to the corresponding problems.

This is also the position of an outstanding adherent of Mises, Prof. Hoppe, who believes that the axiom of action cannot be refuted because such a refutation is necessarily an action, too; thus, the truth of the axiom cannot be denied without self-contradiction.

Hoppe says: The attempt to disprove the action-axiom would itself be an action aimed at a goal, requiring means, excluding other courses of actions..., etc.<sup>7</sup> In attempting to deny it, one would actually implicitly admit its truth. Consequently, the truth of the axiom of action simply cannot be undone.<sup>8</sup> According to Hoppe, Mises' axiom of action is not only a law of thought in neo-Kantian tradition, as Rothbard interpreted it;<sup>9</sup> it is also a law of reality. Hoppe argues that

1) the category of action necessarily includes the category of causality (in the sense of constantly operating causes) and

2) all praxeological categories work in the minds of acting persons whose actions do not proceed solely in phenomenal sphere but connect their thought with true reality in itself.

Such a transition from the originally neo-Kantian phenomenalist position of Mises (= the axiom of action is the law of thought) to a realistic one<sup>10</sup> may seem to be impressive for non-philosophers but in fact it is something very similar to the short circuit in electric engineering.

Kant himself had good reasons for arguing that human action proceeds only in the sphere of phenomena and that we can only believe (but not know) that our action is somehow related to the thing in itself, defined as freedom. (This relatedness should proceed when we act freely, respecting the categorical imperative; in this way, Kant wanted to reconcile strict causal determinism with the possibility of human freedom.)

We know that the abandoning of phenomenalism in German philosophy after Kant (which included a transition from impositionism to reflectionism in the theory of *a priori* knowledge) was not as simple as it is in Hoppe's attempt. It included the elaboration of an evolutionary and realistic ontology of nature, according to which human consciousness (and human action) has the character

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*Austrian Philosophy: The Legacy of Franz Brentano*, Open Court, Chicago and La Salle, Illinois, 1994, pp. 308, 315-316.

<sup>7</sup> Hans-Hermann Hoppe, *Economic Science and the Austrian Method*, p. 24.

<sup>8</sup> *Ibid.*, p. 22.

<sup>9</sup> "Professor Mises, in the neo-Kantian tradition, considers his axiom a *law of thought* and therefore a categorical truth *a priori* to all experience." (Murray Rothbard, In Defence of "Extreme Apriorism", *Southern Economic Journal* 23, no. 3, January 1957, p. 318.)

<sup>10</sup> This transition also means that the propositions of praxeology are unequivocally synthetical judgements *a priori*.

of the act of becoming self-conscious of formerly unconscious nature; this act comes from nature's inherent tendency to produce more and more complex structures via self-organisation.

This was done in Schelling and Hegel (in idealistic manner); the materialistic version of this conception can be found in Lukács, Gramsci (human consciousness is embedded in action), in the Czech neo-Marxist Karel Kosík, and also in many versions modern scientific realism, too. Unfortunately, all of these materialistic theories suffer from the absence of a corresponding epistemology, i. e., an epistemology which would be able to refute Descartes' argument of continuous dream and to overcome in a non-reductionist way the mind-body dualism resulting from it.<sup>11</sup>

Such an epistemology is missing also in Hoppe's version of Misesianism, in Rothbard's attempt at *a priori* economics and ethics in Aristotelian-Thomistic ontology, and also in Menger's realism which is, too, inspired by Aristotle.<sup>12</sup> Several notes in Mises in which he admits that the teleological structure of human action is a product of Darwinist evolution, are not satisfactory in this respect. Barry Smith's endeavour to find a basis for apriorism in the early version of Husserlian phenomenology includes an attempt to built up realistic epistemology (the conception of "truth-makers") but it cannot be considered to be completed.

Hoppe's main argument in favour of the "water-tight" truth of the axiom of action is false, too. The denying of a thesis cannot be ranked among teleological or purposeful actions – it does not proceed in the manner that we would first rationally conceive a plan to refute the thesis and that the following step would consist in looking for some adequate means to do so.

Our disagreement with a thesis may start from its being implicitly antithetic in relation to the theses we hold to be true. This implicit disagreement manifests itself first in a vague feeling which finds its expression in an inner voice telling us "for God's sake, it cannot be true!"

When we try to articulate this feeling, the refutation of the concerned thesis may come as a sudden, spontaneous discovery, in the mode of the Archimedean "HEUREKA!" Of course, we can apply deductive and analytical reasoning, too, but it is still a logical articulation of the above mentioned feeling. This means that the denial of a thesis as here described is not a purposeful action

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<sup>11</sup> Recently, the film *Matrix* made Cartesian approach very popular even among the general public, especially in connection with virtual reality.

<sup>12</sup> See Carl Menger, *Investigations into the Method of the Social Sciences with Special Reference to Economics*, New York University Press, New York and London 1985, pp. 37 (note), 60.

but a spontaneous activity of human mind – and that Hoppe’s argument is not valid.<sup>13</sup>

In addition, somebody can disagree with Hoppe without uttering his disagreement loudly; such a “silent resistance” to some theses (which means that they are not taken into account and become simply forgotten) cannot be properly characterised as action because action (according to Hoppe) connects our thoughts with external reality; nevertheless, such kind of silent behaviour can have important consequences, too.

Barry Smith (who argues against Hoppe that the denial of the axiom of action would not be self-contradictory if it were done by an extra-terrestrial entity)<sup>14</sup> once said that Hoppe’s argument should be put into an exhibition case in the museum of philosophy, a museum collecting some brilliant philosophical accomplishments which, nevertheless, have no validity.

We should appreciate Hoppe’s endeavour to justify economics as an *a priori* science in a short cut manner which does not presuppose having found previously a solution to such terrible philosophical questions as the mind-body dualism or the status of the synthetical judgements *a priori*. Unfortunately, no such shortcuts or even “short-circuits” are available in philosophy. (The same is true concerning Hoppe’s and Rothbard’s attempts at finding some analogous short-cut foundations for *a priori* ethics.)<sup>15</sup>

### 3. Barry Smith: Praxeology as a Fallibilistic proto-Science

Misesian axiomatic treatment of praxeology refers to the following important question: What are relations among categories? We know that in the frame of Kantianism, the inter-categorical relations must be relations among relations themselves. It is known that Kant himself did not offer any satisfactory solution to the problem of the basis of inter-categorical relations; he puts up with stating that all functions of our mind are unified by the transcendental Ego. As concerns categories, he showed that each of them has a projection into the corresponding structure of time; this means that categories of our reason (*Verstand*) are unified only through time as a kind of a common denominator, i.e., that they are unified only at a “lower” pre-conceptual level. This conception

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<sup>13</sup> I must confess that after the first reading of Hoppe’s argument I treated it to be very useful for the justification of economic apriorism and had no wish to refute it; the refutation of it arose, so to say, against my will.

<sup>14</sup> See Barry Smith, *Austrian Philosophy: The Legacy of Franz Brentano*, p. 317.

<sup>15</sup> Barry Smith also adds that Hoppe’s definition of synthetical judgements *a priori* according to which their negation is self-contradictory, excludes a lot of judgements which are in fact synthetical judgements *a priori*. It is true; for example, the negation of the most famous Kantian synthetical judgement *a priori* (any event is causally determined by another event) sounds „there are events not causally determined (i.e., miracles).” To believe in miracles is not self-contradictory.

(which fascinated Heidegger and which is relevant for an evolutionary approach, too) was criticised by Kant's follower Fichte. He required to disclose inter-categorical relations at the level of rationality and fulfilled this requirement in a highly speculative manner: Starting from the self-evident axiom "I think myself" which is not only a piece of knowledge but a real pure act/action performed by any human mind, he derived from it all categories; he treated them as necessary structures of one's becoming self-conscious. Further, since our Ego is only an individualisation of the absolute Ego which creates nature, the categories of our mind are the categories of reality. We can see that Mises is in some respect close to Fichte. (Later, Schelling and Hegel showed in reflectionistic way that the inter-categorical relations are necessary "evolutionary" conditions for nature's or the absolute's becoming self-conscious in man's mind.)

Nevertheless, as Barry Smith correctly argues, the theorems of Misesian praxeology cannot be deduced analytically from the axiom of action (similarly as it is, for example, in formal logic). According to Smith, the *a priori* validity (truth) of the praxeological knowledge comes from the fact that there exist some necessary relations of dependence among the concepts included in the theorems of praxeology. Smith is here inspired by the theory of parts and wholes (mereology) as it was developed in the early phenomenology of Husserl: in harmony with this theory, there exist so called "moments," i.e., elements which essentially cannot exist otherwise than in the context of a whole which includes them; they differ from so called "pieces" which can exist even when taken away from the whole.<sup>16</sup>

The status of such "moments" can be made clear in the following example: if there exist individual instances of the *species* "action", then there must exist also the individual instances of such *species* as the choice of instruments, choice of goals, etc. This implies that praxeology is based on a whole family of interrelated concepts; single concepts, having the status of dependent "moments", can acquire their meaning only within the context of the whole conceptual network; this is why they cannot be derived deductively from one of them (action).<sup>17</sup>

According to Smith, praxeology belongs to *a priori* proto-sciences which constitute necessary conceptual bases for corresponding empirical sciences. (Smith mentions also other *a priori* proto-sciences as, e.g., mereology, colourology, naive physics, Scheler's theory of values, the theory of universal grammar, *a priori* theory of law, institutions and politics, *a priori* ethics and even *a priori* history – as outlined in Husserl's *Crisis of European Sciences* and especially in his fragment "On the Origin of Geometry"). Consequently,

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<sup>16</sup> See Barry Smith, *Austrian Economics and Austrian Philosophy*, in: Wolfgang Grassl and Barry Smith, eds., *Austrian Economics: Historical and Philosophical Background*, Croom Helm, London & Sydney 1986, p. 14.

<sup>17</sup> See Barry Smith, *Austrian Philosophy: The Legacy of Franz Brentano*, p. 316.

praxeology fulfils its role of proto-science in relation to standard economics which uses mathematical and statistical tools.<sup>18</sup>

Smith's interpretation of the categorial network of praxeology in terms of "moments" and wholes is beyond any doubt a step forward to the correct understanding of economic apriorism. In addition, Smith argues in favour of so called fallibilistic apriorism; he states that the advancements of sciences can lead – retroactively – to some changes and corrections at the level of the corresponding *a priori* proto-sciences. Later it will be shown that the concept of fallibilistic *a priori* is very important for the justification of apriorism as such – but on condition that it will be used in somewhat different context than Smith does. Namely, Smith – against what one would expect – does not connect fallibilism in the field of *a priori* knowledge with the conception of evolutionary apriorism; his main argument is that the results of one empirical science – biology – cannot serve as a criterion for the validity of all *a priori* presuppositions as contained in all other sciences. As we will see later, Hayekian evolutionary apriorism as connected with his cultural evolutionism is able to resist this argument; taking into account the aforementioned deficiencies of Aristotelian, Hoppean or even "scientific" realism we may say that Hayek's evolutionary approach provides the most consistent foundation for the possibility of *a priori* knowledge (including *a priori* economics) conceived until today.

#### **4. Hayek's *Sensory Order*: Scientific Foundations of Evolutionary Apriorism**

At first, it should be stressed that the disagreement between Hayek and Mises is something disastrous for the Austrian economics and classical liberalism in general. From Hayek's point of view, Mises' emphasis on teleology as combined with his axiomatic method was nothing but a new incorporation of Cartesian constructivist rationalism. Moreover, Mises conceived praxeology as independent of psychology, as an island of pure rationality, closed in itself. This anti-psychologism (or logicism) had to irritate Hayek who worked intensively in psychology. We should add that a strict anti-psychologism leads necessarily to various kinds of logical Platonism (Frege, Bolzano, the early Husserl) or to the concept of transcendental Ego (Kant, Husserl in his transcendentalist period, and even Popper).

In his *Counter-Revolution of Science*, Hayek does not speak explicitly about apriorism. Nevertheless, he applies there a kind of understanding (*verstehende*) psychology which is very close to eidetic (i. e., *a priori*)

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<sup>18</sup> Barry Smith, In Defence of Extreme (Fallibilistic) Apriorism, *Journal of Libertarian Studies*, 12 (1996), <http://ontology.buffalo.edu/smith/articles/ROTHBARD.htm>, p. 5.

psychology as it was developed by Brentano and Husserl. This can be documented very simply by Hayek's quotation of the following statement by Democritus: ANTHROPOS ESTIN HO PANTES IDMEN ("Man is what is known to all").<sup>19</sup>

In addition, Hayek presents a brilliant foundation of the possibility of apriorism in his epoch-making work *Sensory Order*.

His position here is neo-Kantian not only because of his stress on the limits of our reason (in this context he formulates a valid proof of our brain's inability to explain its own functioning in detail), but also for the reason that he admits an irreducible difference between the physical order and the phenomenal one.

Hayek's approach in the *Sensory Order* consists in the following: to all functions of our mind which perform the imposition of relations he finds so called topological equivalents in the structures of neuronal network.

This concerns not only the structure of purposive and purposeful activities and our (and animals') primary relatedness to the classes of objects (Hayek calls it the "primacy of the abstract"), but also the gestalt-functions which are oriented to the identification of abstract and formal relations (or to perform the imposition of them) at the pre-conceptual level of sensory perception.<sup>20</sup>

It should be mentioned that according to Hayek, the topological equivalent of the indivisible sensory elements (qualitative sensations) are relations among neurons, too; but, he admits that at the phenomenal level, the sensations manifest itself as elements which are put into relations by some higher functions of the mind (or, by some higher levels of the neuronal network).

In his *Sensory Order*, Hayek finds foundations for an evolutionary apriorism. The sensory order, which is the primary form of the *a priori* relationalisation of immediately given qualities, allows us to classify events in accordance with the similarities or dissimilarities of their qualitative elements.

In our purposeful activity (which arises later) we may plan and perform our actions with the aid of this system of classifications. But, after long time, we discover that to classify events according to their causal relations makes our actions more successful and effective. Namely, this new system of classification (which corresponds to modern mathematical physics) reflects the physical order far more adequately than the previous sensory order.

Hayek here suggests that the animal and also human activity must, in order to be developed, apply first such a system of the classification of qualities which corresponds to the physical order only partly; after this "alienation" from

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<sup>19</sup> F. A. Hayek, *The Counter-Revolution of Science*, LibertyPress, Indianapolis 1979, p. 139.

<sup>20</sup> Hayek's conception of the gestalt, starting from the original approach by Ehrenfels, differs from the later holism and physicalism of the later "Gestalt-psychology"; the basic model of the gestalt in Ehrenfels' theory is melody – as being perceived as the same independently of the various scales into which it is transposed.

the physical order, human mind, using the category of causality, “comes back” to the physical order at the level of conscious knowledge.<sup>21</sup> (At the previous stage, the functions performed by the dynamics of sensory order were necessarily oriented outwards; in spite of the fact that its topological equivalents in neuronal network were and are parts of physical order, its own inward functioning remained hidden to it.)

Hayek also says that the *a priori* dimension of our knowledge increases in direct proportion to the development of new classification systems in which the objects as such are defined via their explicit (causal) interrelations.

Hayek’s foundation of evolutionary apriorism, as developed in his *Sensory Order*, is extremely important because, in consequence of the general acceptance of the theory of neuronal networks, it ceases to be solely a problem of philosophy; it can be studied in informatics of a second generation, which applies such conceptions as the theory of self-organising neuronal networks, universal Darwinism, etc.

Nevertheless, Hayek stressed that, due to the limits of our reason, the neuropsychological approach to human mind can never fully explain human mind; it must be supplemented by understanding psychology or phenomenology, etc. This statement is a very good antidote against reductionism of all kinds.

## **5. Karel Engliš: *A priori* Economics as Derived from the Semantical Order of Language**

Following Hayek in this respect we will turn back to the study of *a priori* economics “from inside.” In doing so, we will refer to work of the undeservedly neglected Czech economist Karel Engliš who, starting from Kant and neo-Kantians, elaborated a version of *a priori* economics as early as in 1930 (in his work *Teleology*, published also in German).<sup>22</sup>

Similarly as Barry Smith, Engliš knew that purposeful human action in all its aspects can be described only by a network of interrelated concepts.

The name given by Engliš to this network is “the teleological order of thought.” Apart from it, he speaks also about the normological order of thought” and the “ontological (causal) order of thought.”

According to Engliš, the conceptual interrelations are implicitly given in the semantic richness of pre-scientific (ordinary) language. At this level, we do not explicitly know them because of the non-systematic way of learning language in our childhood and of the attention devoted to grammar at schools.<sup>23</sup>

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<sup>21</sup> Cf. F. A. Hayek, *The Sensory Order. An Inquiry into the Foundations of Theoretical Psychology*, Routledge & Kegan Paul, London 1952, 6.47.

<sup>22</sup> See Karel Engliš, *Begründung der Teleologie als Form des empirischen Erkennens* (Brno, 1930), and *Teleologische Theorie der Wirtschaft* (Brno 1930).

<sup>23</sup> See Karel Engliš, *Malá logika (Minor Logic – in Czech)*, Melantrich, Praha 1947, pp. 18-21.

Unlike Mises, Engliš studies the origin of all kinds of the orders of thought: the single concepts (which can function in various combinations) arose in the process of an intellectual decomposition of the perceptual picture of reality into its abstract conceptual elements which can be thought separately.

The reason for introducing any new concept consists in its being different from other concepts; it satisfies the need to grasp something which cannot be grasped by the previous concepts. The principle of economy of thought works here, too: instead of having words and concepts for all things and situations, we can express almost all reality by combining a relatively small number of concepts.

The introduction of new concepts proceeds in reference to all existing concepts – Engliš stresses that together with the introduction of any new concept, its relations to all existing concepts is constituted, too, and that the concepts are inter-related as precisely as pinions in watch.

It implies that reality cannot be described or explained by using single concepts; it is necessary to use the whole of the corresponding order of thought.

But still, an explicit knowledge of a particular order of thought is possible only in the frame of reflection, the organon of which is logic. Logic in this sense is a formal normological science dealing with orders of thought, which, of course, does not construct its object, but merely finds it.

So far, so good. But, unfortunately, Engliš says that the introducing of new concepts results from our purposeful activity; it is a way in which we fulfil our cognitive aim; he only admits that we cannot produce new concepts arbitrarily. When he considers a science which would study the purposeful construction of the orders of thought in their role of cognitive instruments, he suggests that it would be a “very interesting teleological science.”

Engliš’s constructivist rationalism finds its final expression in the thesis that the teleological order of thought is the basis for both normological and ontological orders of thought. This concept is not very far from Misesian praxeology, but that is precisely what made it unacceptable for Hayek.

Nevertheless, Engliš is right when he believes that inter-categorial *a priori* relations (relations among relations) are constituted in the process of the formation of ordinary (pre-scientific) language. We can add that the ultimate “inner” foundation of the systematic character of categorial inter-relations can be found in the form of a reconstruction of all developmental steps of that process.

## **6. Back to Adam Smith: The Spontaneous Formation of Language**

In order to be in harmony with Hayek’s theory of spontaneous order (and with the universal Darwinism) we should treat the formation of language as a spontaneous evolution devoid of teleology. In doing so, we should also penetrate beyond the level of particular ethnic languages and study the necessary steps of

the constitution of universal grammar. This is a very exacting task but we can find very important help in another undeservedly neglected classic, Adam Smith. His *Dissertation on the First Formation of Languages* is the first attempt to treat the genesis of language (and of its universal grammar) as a spontaneous process.<sup>24</sup>

What is especially inspiring here is Smith's method which is called "theoretical" or – very unhappily – "conjectural history". Smith's friend and pupil Dugald Stewart characterises it in the following way: "In ... want of direct evidence (when very little information of some subjects can be expected from history) we are under a necessity of supplying the place of fact by conjecture; and when we are unable to ascertain how men actually conducted themselves upon particular occasions, in considering in what manner they are likely to have proceeded, from the principles of their nature, and the circumstances of their external situation. In such inquiries, the detached facts which travel and voyages afford us, may frequently serve as land-marks to our speculations; and sometimes our conclusions *a priori*, may tend to confirm the credibility of facts, which, on a superficial view, appeared to be doubtful or incredible."<sup>25</sup>

Stewart admits that Smith did not invent this method – he mentions so called *histoire raisonnée* as applied in Montesquieu's *Esprit de lois*, Hume "natural history," d'Alembert's *Discours préliminaire...*, etc. In fact, the first theorist of spontaneous order who applied the theoretico-historical method was Giambattista Vico in his famous work *Scienza Nuova* (1725).

It is very regretful that Hayek completely misunderstood the method of theoretical history. When speaking about Hume's conception of the origin of the rules of justice, he says that Hume endeavoured to safeguard himself against constructivist misinterpretation by explaining that he „only supposed those reflections to be formed at once, which in fact arise insensibly and by degrees“. Hayek's commentary to this is following: "Hume made use here of the device which Scottish moral philosophers called „conjectural history“ – a device later often called „rational reconstruction“ – in a manner that may mislead and which his younger contemporary learnt systematically to avoid."

Hayek further admits that the reading of Smith's *Theory of Moral Sentiments* and his *Dissertation on the First Formation of Languages* led Darwin in the crucial year 1838 to his decisive (evolutionary) breakthrough, but ignores that Smith applied his method of theoretical history in both works mentioned above (and also in *the Wealth of Nations*). Hayek incorrectly believed

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<sup>24</sup> See Adam Smith, Considerations Concerning the First Formation of Languages, and the Different Genius of Original and Compounded Languages, *The Philosophical Miscellany* (1761), pp. 440-479. Smith's Dissertation can be found also in Adam Smith, *Lectures on Rhetoric and Belles Lettres*, ed. J. C. Bryce, Liberty Fund, Indianapolis 1985, pp. 201-231.

<sup>25</sup> Dugald Stewart, *Account of the Life and Writings of Adam Smith, LL.D.*, in: Adam Smith, *Essays on Philosophical Subjects*, ed. by D. D. Raphael, A. S. Skinner, Liberty Fund, Indianapolis 1982, pp. 292-293.

that theoretical history meant to explain some spontaneous processes by a kind of retroactive imposing of rationality and teleology into what was actually marked by their complete absence.

Adam Smith – especially in his *Theory of Moral Sentiments* did something else – he imposed or projected into the previous phases of the spontaneous genesis of moral rules only such pre-conceptual *a priori* forms of imposing relations which can be called the *logique de coeur* (as Pascal put it); this means that he was something like a phenomenologist before phenomenology.<sup>26</sup>

Now, we can impose into the unknown past also such *a priori* forms of the pre-conceptual relating of sensations which work – as Hayek himself found – in various types of the gestalt. It is obvious that the spontaneous formation of language must be studied only with reference to the *a priori* syntheses performed by lower mental functions and without any imposition of rationality and teleology: Teleology necessarily presupposes language because only a relatively well differentiated language can make present goals as ideal models of not yet existing and therefore non-perceivable future.

Reconstruction of the process of formation of pre-scientific language and its universal grammar will yield versions of the systematic *a priori* interrelations among categories and concepts which will reflect their historical and therefore most natural linkages; the knowledge of these interrelations will give us correct foundation for all *a priori* proto-sciences including *a priori* economics.<sup>27</sup>

## 7. The Danger of Vicious Circles

The main conclusions presented above must nevertheless face a serious objection which seems to undermine them completely; it simply says that any endeavour at a scientific explanation of the possibility (and also reality) of true synthetic or even analytical judgements *a priori* must include a vicious circle in argumentation (or, the *petitio principii* error) because any scientific approach is built up on some *a priori* presuppositions.<sup>28</sup>

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<sup>26</sup> A more comprehensive description of Smith's theoretico-historical method can be found in Ján Pavlík, *F. A. Hayek a teorie spontánního řádu* (*F. A. Hayek and the Theory of Spontaneous Order* – in Czech), Professional Publishing, Praha 2004, pp. 576-619.

<sup>27</sup> As Adam Smith put it: "I approve of his plan for a Rational Grammar and am convinced that a work of this kind (...) may prove not only the best System of Grammar, but the best System of Logic in any Language, as well as the best History of the natural progress of the Human mind in forming the most important abstractions upon which all reasoning depends." (*The Correspondence of Adam Smith*, ed. E. T. Mossner, I. S. Ross, Oxford University Press 1987, pp. 87-88.)

<sup>28</sup> This objection was actually raised by Dr. Torsten Niechoj after the presentation of the previous parts of this paper.

To put it in more detail: If we adopt the Misesian thesis that *a priori* judgement asserting constantly operating causes (“under the same conditions the same causes produce always the same effect”) is necessarily included in the category of action (Mises) or – what is more adequate – in the teleological order of thought (Engliš),<sup>29</sup> we must also admit that this judgement is also a necessary presupposition of Hayekian scientific theory of neuronal networks; this theory gives us a causal explanation of the possibility of an *a priori* teleological order of thought as well as of an *a priori* order of norms and rules, be it on pre-conceptual or conceptual level; we could be content here since, as scientists, we explain human action and its rules without referring to trans-natural entities; but still – since the category of causality is included in the teleological order of thought, and since our ambition is to explain causally the transition from the *a priori* classification of phenomena in accordance with similarities/dissimilarities of their qualitative sensory elements to their being *a priori* classified in accordance with their causal relations, we fall into a hopeless vicious circle: we explain the possibility of uttering the judgement about constantly operating causes as an inter-subjectively valid or even true judgement on the basis of the presupposition that this judgement is inter-subjectively valid (or even true).

To accept the vicious-circle objection as valid, and, consequently, to give up any scientific explanation of the *a priori* functions of our mind, would be fatal not only for evolutionary apriorism, but also for *a priori* economics – it would imply that the *a priori* mental activities of acting persons (including economists themselves) are beyond the scope of science. However, the way out from the vicious circle does exist; it is not widely known because to tackle it requires to understand the most sophisticated problems of philosophy as well as to break away from various prejudices. What can be even more surprising is the fact that the basic inspiration here comes from Adam Smith.

Generally speaking, the spectre of vicious circle arises when the object of cognition is the structure and origin of cognition itself. For instance, when we study language (its validity, its universal grammar or even its origin) we must use language as a valid and universal medium of the expression and communication of the methods and results of our scientific inquiries. Accordingly, language is present in two modes – as the object of empirical linguistics (which studies the scope of the validity of language) and in the function of an immediately valid presupposition or condition for any empirical research (i.e., in its transcendental or *a priori* function).<sup>30</sup> Therefore, any attempt

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<sup>29</sup> What deserves to be mentioned in this context is Schopenhauer’s attempt to prove that even “pure” sensory perception necessarily presupposes the *a priori* knowledge of the principle of causality. (Arthur Schopenhauer, *Die Welt als Wille und Vorstellung* I., §4.)

<sup>30</sup> In other words, explaining language via language implies that language is both the object of cognition and a necessarily (*a priori* or transcendently) valid cognitive faculty belonging to the subject of cognition. It can be also said that to use language in its transcendental or *a priori* function means to move “within” it, whereas to treat language as an empirical object

to explain the transcendental function of language from the results of empirical linguistics (which treats it – *a posteriori* – as an object occurring among other empirical objects of the world) inevitably seems to lead into a vicious circle.

Analogously, Husserl criticises psychologists' attempts to derive (or explain) the laws of formal logic {the Law of Identity ( $a = a$ ) and the Law of Contradiction [ $N(a \ \& \ Na)$ ]} from the laws of empirical psychology; he argues that the theoretical construction of psychology presupposes the validity of formal logic. In order to refute psychologists' counter-arguments<sup>31</sup> he stressed that the causal laws of psychology are vague empirical (*a posteriori*) generalisations which can be valid only with some degree of probability, whereas the laws of logic as *a priori* laws possess necessary and unconditional validity; it is therefore impossible to derive them from contingent reality as described in empirical sciences.<sup>32</sup> Wittgenstein, in stating that logic is transcendental, represents the same position; his conviction that empirical knowledge is contingent leads him to say that to believe in a causal nexus is a superstition.<sup>33</sup>

It is worth to mention that in Kant, the vicious circle would result from any attempt of natural sciences (based on the *a priori* category of causality as well as on time and space as the *a priori* forms of our sensory perception) to explain causally their own possibility or even reality; namely, it would mean to explain the imposing of causal necessity (as performed by the *Verstand*) with the aid of causal necessity as imposed into otherwise relation-less sensations.

Now, the reader has probably surmised what conclusion is to be derived from these examples: The vicious circles which seem to result inevitably from our cognition's endeavour to recognise itself can be avoided in the just described ways, but only on condition of falling back upon the irreconcilable dualism of the *a priori* and *a posteriori* knowledge, of the transcendental and the empirical, of the necessary and the contingent. Moreover, these kinds of dualism refer (more or less explicitly) to a more deeply seated dualism of mind (or some aspects of it) and matter.

This is especially clear in Kant's transcendentalism. According to Kant, the basis for the spatial, temporal and categorical *a priori* syntheses is the transcendental Ego, the pure, universal, *a priori* form of the act of man's becoming self-conscious, which, as such, does not depend on the content of the inner and external experience of the individual human beings. It also means that

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means to look at it "from without." [See Jaroslav Peregrin, *Filosofie a jazyk (Philosophy and Language – in Czech)*, TRITON, Prague 2003, pp. 106-115.]

<sup>31</sup> They asserted that Husserl's argument would have prevented the building up of logic, too, and that such kind of argumentation confused the laws of logic in the role of premises from which one infers with their role of rules, in conformity with which one must infer.

<sup>32</sup> Cf. Jan Patočka, *Úvod do Husserlovy fenomenologie (Introduction to Husserl's Phenomenology – in Czech)*, SPN, Prague 1969, pp. 20-22.

<sup>33</sup> *Tractatus*, 6.13, 5.1361.

the transcendental Ego as the source of temporal and causal order does not depend on time and the causal nexus of nature. Kant (and later Brentano and Husserl) adopted Aristotle's metaphysical understanding of act as that which does not come from possibility to actuality in time (i.e., via a step-by-step progression, or, in other words, *per partes*), but in a purely non-temporal manner. Simply speaking, Kant's transcendental Ego (together with the *Verstand*, *Vernunft* and time and space as the *a priori* forms of sensory perception) is not a part of nature, does not arise from nature and also the character of its functioning does not depend on nature.<sup>34</sup> In addition, Kant's dualism is self-contradictory: his system necessarily requires a relation between the thing in itself and our mind (he treats this relation as "affection"); but, his system also implies that all kinds of relations, as imposed by various faculties of the transcendental Ego, can take place only within our mind. Although Kant's system – as separating both the transcendental from the empirical and the phenomenal from the thing in itself – eliminates the vicious circle coming from the attempt to derive the *a priori* from the *a posteriori* knowledge, it cannot avoid self-contradictions necessarily stemming from its dualistic character.

Another form of untenable dualism can be found in Brentano's and Husserl's theory of intentional acts and intentional objects, which – similarly as Kant's theory of transcendental Ego – was inspired by Aristotle's conception of acts.<sup>35</sup> In this theory, the necessary *a priori* validity of the formally logical Law of Identity is founded in some mental activities which, having similar character as the Aristotelian acts, do not depend on contingent psychic or even material processes: they constitute themselves via becoming self-reflected. Accordingly, the self-identity of the intentional objects of our consciousness (such as meanings or perceived objects) does not arise in time; so, in spite of the fact that intentional acts are experienced in time, the self-identity of the intentional

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<sup>34</sup> To be just, we must mention that in Kant, the transcendental Ego with all its faculties is finite: as a pure form it can function only if it is filled up with some sensory contents. In this way, Kant wants to eliminate the problem of the connection between form and contents: the form (the transcendental Ego) cannot exist separately from the content (no act can be in pure possibility), and, in turn, the phenomenal content cannot exist separately from the form. This solution (which is a slightly changed version of Aristotle's hylemorphism) is, however, only verbal: in fact, Kant asserts here only the co-existence of form and content, not their unity; except for the fact that both form and content (= sensations as contained in our mind) are ideal, they have no other common character which would enable them to be unified and serve as a basis for mutual interrelatedness.

<sup>35</sup> It must be stressed that the term "intentional" in phenomenological philosophy of Brentano and Husserl does not mean "deliberate" or "purposeful" as it is usual in English; it simply means a necessary orientedness of the mental activities toward corresponding objects. In other words, to assert intentional character of thinking and perceiving means nothing but to say that any thinking and perceiving is thinking of something, or perceiving of something. The objects toward which the intentional acts are oriented (sensations, perceptions, judgements, ideas, etc.) are called intentional objects; according to Brentano and Husserl, they are contained solely within our mind.

objects toward which the acts are oriented lasts constantly from the beginning to the end of the temporal duration of their being experienced in one's mind. It is thus an essential character of the intentional acts that they impose self-identity into all content which is represented within mind in the form of intentional objects; this also implies that the way in which the self-identity of intentional objects is established is beyond causal determination.

In other words, in the frame of an intentional act, the corresponding intentional object manifests itself necessarily as self-identical; otherwise, there would be no act and also no object which would manifest itself at all. It is therefore no surprise that Husserl later accepted a neo-Kantian version of the transcendental Ego (it plays the role of the basis for all intentional acts).

Husserl's attempt at avoiding the vicious circle (which would arise if somebody tried to derive formal logic from the causal nexus of nature) led him finally to the assertion that the world is only a product of the transcendental Ego, an intentional object which is present only within the minds of recognising subjects. Accordingly, our belief that the world exists independently of us (and that it existed before the mysterious coming of the transcendental Ego, i.e., before the origin of man) is simply an illusion. This conclusion, coming from Husserl's effort to go beyond dualism as implied in the earlier version of his transcendentalism, was not acceptable even by his pupils; it is well known that one of them, Heidegger, wanted to save phenomenology by introducing the famous *a priori* existential "being-in-the world".

In Wittgenstein who (similarly as Husserl) wanted to hold logic in separation from the contingent world, we can find another attempt to avoid the dangers of dualism. He did not ascribe the transcendental subject the quasi-Aristotelian character of actively functioning form, as we can see it done in Kant and Husserl. Instead, he simply argues that the subject is not a part of the world because it is merely the limit of the world.<sup>36</sup> As concerns logic, his attitude is similar: logic is transcendental because it is a mirror image of the world. These witty metaphors give us, of course, no real solution – Wittgenstein eliminated the problem by forbidding to speak about him. Moreover, as it has been already mentioned, the basic thesis of his logical positivism (that there exist only analytical and factual propositions) is self-contradictory.<sup>37</sup>

As concerns the vicious circle as included in the theoretical reflection of language, there exists a way how to avoid it, too. It can be found in Bolzano's logical Platonism. According to Bolzano, meanings, propositions, truths and theories are non-temporary ideal entities which persist independently on both our psychic activities of thinking/verbal expressing and physical processes in nature. When we think, these immaterial entities (called by Bolzano

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<sup>36</sup> *Tractatus*, 5.632.

<sup>37</sup> J. Peregrin shows that Wittgenstein did not avoid the vicious circle in his semantical analyses; namely, when intending to speak about language (treated as object) he, in fact, speaks about language in its role of transcendental medium. (*Ibid.*, pp. 115-116.)

representations in themselves, propositions in themselves, etc.) only enter into our minds; they would persist even if no human mind would think them. This conception was adopted by Frege, Russell and the early Husserl in his *Logical Investigations* (Husserl believed that meanings are general ideal (=timeless) entities whose individual instances arise when they are actually thought by single human minds), and, surprisingly, by Popper in his theory of three worlds. Logical Platonism, however, lacks the status of a fully-fledged theory; its representatives did not formulate any valid argument in favour of the conditions for the possibility of persistence of timeless semantic entities – except for asserting that otherwise, there would be no foundations for the necessary validity of logic and of the transcendental use of language. In other words, they argue that without postulating those entities we would fall into vicious circles. This is why it is of no value to take seriously this form of extreme dualism.

## **8. Monism as the only Basis for Evolutionary Apriorism**

The untenability of dualistic conceptions of apriorism (which hopefully has been sufficiently shown in the preceding text) directly implies that apriorism can be substantiated only in the frame of monism. The necessity of monistic approach becomes especially clear if we take into account that the dualistic versions of apriorism were formulated at a time when sciences like genetics, neuropsychology, informatics, etc., simply did not exist. This does not concern only Kant who believed that the causal explanation of living organism was principally impossible. Even Husserl (and the neo-Kantians) worked in a period when the only form of empirical psychology was primitive associanism and when it was generally believed that the Second Law of Thermodynamics prevents nature from spontaneously originating complex structures. Today, the situation is radically different – it is almost needless to show closely the way in which the monistic approach finds its support in such advancements of science like Prigogine's non-equilibrium thermodynamics (which includes an exact proof of the possibility of self-organisation in nature), etc.<sup>38</sup>

Simplifying somewhat, we can say that monism treats human mind as a specific part of nature: it is that part of nature which enables it to interact with itself via its becoming self-conscious in the mode of conceptual self-reflection. (Nature's interaction with itself, as mediated by such functions of human mind as language and conceptual thinking, proceeds in the form of human purposeful

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<sup>38</sup> Moreover, dualism is an essentially anti-philosophical position. This assertion becomes promptly clear when we read in Adam Smith that philosophy arises from wonder, i.e., from a reaction to “seeming incoherences” which “require some chain of intermediate events, which, by connecting them with something that has gone before, may thus render the whole course of universe consistent and of a piece”. (Adam Smith, *History of Astronomy*, III. 3; in: Adam Smith, *Essays on Philosophical Subjects*, ed. by D. D. Raphael, A. S. Skinner, Liberty Fund, Indianapolis 1982, pp. 50-51.)

action.) The self-reflection of nature includes also the self-reflection of the very organ of its becoming self-reflected; this self-reflection finds its expression in our knowledge of both mankind in its socio-historical development and of individual human mind.<sup>39</sup> Stemming from nature, human mind necessarily includes some lower stages of nature's informational self-reflection, such as nature's self-apparition at the level of sensory phenomena (which is typical for animal's psyche) and the pre-conceptual relationalisation of single sensations, as performed by the gestalt-functions of psyche (this is applied both in animal psyche and in human mind).

As concerns apriorism, the monistic approach applies the following argument: If the functioning of human mind includes some kinds of necessary *a priori* relationalisations (such as the teleological order of thought, the principle of constantly operating causes, formal logic, universal grammar, etc.), and if human mind is a part of nature and stems from it, then nature, too, must contain some sorts of necessary relations and interconnections; namely, it is impossible that the necessity of mind's functioning could stem from a fully contingent nature.<sup>40</sup> Thus, the necessary relations and interconnections (laws of nature) which enabled the rise and functioning of the necessary *a priori* relationalisations which take place in human minds, have to exist really (objectively) at least in that part of nature which was the basis for the evolution of organic life (including man). Since it has been shown that the origin and evolution of life have been influenced also by some events which took place in very distant regions of the universe (such as cosmic radiation, etc.), we can make no great error believing that the necessary relations and interconnections take place in the whole universe.

The transition from dualism to monism can be illustrated by an example from the history of physics. It is known that Newton treated time and space in a manner very close to Kant's dualism: he believed that their structure does not depend on the matter they contain (he even said that space is the *sensorium Dei*). On the contrary, Einstein in his general theory of relativity proved that matter (with gravity as its necessary attribute) determines the structure of time and space. It is no accident that Einstein's theory is considered to be a decisive

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<sup>39</sup> This is why Hegel, instead of talking about a self-reflection of nature, speaks rather about the self-reflection of the Absolute. Of course, the metaphysical notion of the Absolute in Hegel refers not only to the whole, consisting of nature and human society in its historical progression, but also to the divine ability of this whole to become actual through becoming self-conscious.

<sup>40</sup> It must be stressed that Alexander's emergentism (asserting that human mind had to be originated non-causally because organic nature in itself lacks any possibility of any qualitatively higher ascend) is a version of dualism, or, even worse, of pluralism (according to Alexander, organic life had to emerge from inorganic nature in non-causal way, too). The same is true about Bergson's statements (in his *Evolution créatrice*, etc.) according to which the actuality of our consciousness does not require that the corresponding possibility should have taken place at lower levels of reality.

argument against Kantian dualism. Developing the analogy from physics to philosophy, then, we may say that in Kant, the universal validity of scientific language (as using categories and notions of time and space) does not depend on the particular empirical (sensory) contents as described or explained in it. (The same is true in the case of formal logic as treated in Husserl, Wittgenstein, Bolzano, etc.) It means that in dualism, the general or universal (the formal *a priori*) does not depend on what is particular and individual (empirical). The monistic approach states that general or universal forms must be somehow determined by the particular contents; it is possible only if the allegedly contingent contents are, in fact, governed by really existing and necessary laws of nature.

Now it becomes clear that in monistic approach, the nominalism of relations (which was characteristic for dualism) is replaced by a realistic treatment of relations. As concerns this, one must be very cautious, in order to avoid the errors of Schelling and Hegel in whom the abandoning of Kant's dualism was connected with the realistic treatment of not only the *a priori* causal order but also of what we call the *a priori* teleological and normological order of thought. The conception of really existing (objective) teleology in nature was expelled from philosophy of nature and biology only later – under the influence of Darwinist and especially neo-Darwinist evolutionary theory which proved the plausibility of purely causal explanation of the purposive arrangement of living organisms and of the interrelations among their species. Hayekian cultural evolutionism plays an analogous role in relation to the realistic treatment of the normological order of thought. Since the objective teleology is known to be impossible and since the real existence of an *a priori* moral law means only that from the standpoint of an individual, this law works independently on him/her in the minds of the masses of people,<sup>41</sup> we arrive at

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<sup>41</sup> In Hegel, the way in which the *a priori* normological exist in reality is called “objective spirit” or simply “spirit”; it simply refers to the contemporaneous presence of some set of normative imperatives in the minds of all members of a society. It is relevant for us that as concerns what is in Hegel treated as the historically first *a priori* moral order (really existing in the form of objective spirit called “moral substance”), Hegel emphasises that it has not been produced deliberately; here we can find some similarities to Hayek's theory of spontaneous genesis of rules. In his opposition to Kant's dualism Hegel asserted that the *a priori* moral law in the mind of individual is secondary in relation to the “moral substance” (i.e., that it is a reflection of moral order as it objectively exists in society); it is therefore not a product of inter-individual interactions, but, on the contrary, a necessary condition for genuinely human actions. Hegel argued metaphysically that the origin of the *a priori* moral law is directly pre-determined in the Concept (*Begriff*) of manhood, which prescribes man to ascend from nature in the form of human society. Since the Hegelian Concept of manhood corresponds in many respects to what we now call human genome, the *rationale* of this part of Hegel's metaphysics can be interpreted as follows: man comes on the scene with inborn universal grammar and some inborn moral norms because only these kinds of *a priori* relationalisations enable the existence of the original form of human society.

the conclusion that when speaking about the really existing relations we must refer solely to the causal order.

Monism and realism of relations as here presented seem to imply that in case of the causal order we must apply a reflectionistic version of apriorism instead of pure impositionism which is characteristic especially for Kant's dualism. This, of course, does not mean that we should accept the Aristotelian version of reflectionism which includes a belief that together with individual objects we directly recognise their really existing (general) essences.<sup>42</sup> Taking into account the results of modern epistemologies, the only plausible way how to treat reflectionism is as follows: The *a priori* causal relations as imposed by our reason into relationless sensory phenomena correspond to some relations as existing in the reality which is the external source of our sensations. Namely, the external (physical) reality appears via sensations only partly, in a reduced manner – as being devoid of relations at all; the *a priori* causal relationalisation, as performed by our reason, supplements, so to say, what is missing at the level of sensory phenomena, and helps us to have a full, non-reduced reflection of reality. Thus, in the *a priori* causal order, the imposition of relations is at the same time their reflection. The same seems to be true about universal grammar: it is easier to conceive it as “inborn” when we treat it as a reflection of some essential (ontological) aspects of reality. Accordingly, the process of the spontaneous genesis of language (through which the universal grammar turns from possibility into actuality), can be regarded as a progressing reflection of the really existing correlates of inter-categorical relations.

On the other hand, the *a priori* teleological and normological orders do not reflect any relations which would exist in (physical) external reality independently of us. Namely, their function is not to make present what really is, but, on the contrary, to realise a negation of what really is: they enable to change existing reality – in the frame of teleological human action the change proceeds in accordance what we want, whereas in the frame of the normological order, the change proceeds in accordance with what should be. This means that, generally speaking, we find here only pure imposition without reflection.

Monistic reflectionism, as applied to the *a priori* causal (or even to generally ontological) order, can reconstitute the conception of truth in the classical sense of the *adequatio rei et intellectus*; this restitution is very important because that Kant and the other dualists replaced truth with mere inter-subjective validity.<sup>43</sup> In considering the problem of truth it seems to be useful (for the sake

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<sup>42</sup> What would we do with Aristotle's naive-realistic noetics according to which really existing objects incessantly emit de-materialised pictures of their sensory qualities into our sensory organs?

<sup>43</sup> This heavy deficiency of (especially Kantian) dualism was clearly depicted by Hegel: “Above all, it presupposes that the Absolute stands on one side and cognition on the other, independent and separated from it, and yet is something real; or in other words, it presupposes that cognition which, since it is excluded from the Absolute, is surely outside of the truth as

of having a contrast) to recall Descartes' dualistic approach: It is God as Supreme Goodness who guarantees that nature behaves precisely in accordance with the inborn idea of causal necessity as present in the immanence of our mind. In monistic apriorism, God is replaced with evolution – especially with the cultural one as proceeding in history. Accordingly, it can be said that in the fight for survival was successful such a species which, having inborn universal grammar as well as the ability to perform *a priori* causal relationalisation, could reflect truly the characters of reality and develop its actions on the basis of this true knowledge.

The great task for the monistic approach is, of course, to build a bridge over the gap between mind and body – by finding the intermediary links connecting matter and the ideal sphere of consciousness. However, it is a genuinely philosophical or even metaphysical task; as concerns the investigation of human mind in natural sciences, monism prescribes that we apply psycho-physical parallelism (precisely in the mode used by Hayek in his *Sensory Order*). The necessity to apply psycho-physical parallelism comes from the necessary *a priori* presupposition which gives the permission to become the object of natural sciences only to such processes which are able to manifest themselves unequivocally (with the aid of some other spatial processes and movements) in the form of spatial movement (as it is, e.g., in the case of the increase of temperature which manifests itself as the spatial movement of the column of mercury in thermometer). This means that natural sciences and also empirical psychologies which try to apply the methods of natural sciences cannot principally penetrate into the inner mental entities which have no such unequivocal objectal projection into spatial movements.

Consequently, the Hayekian psycho-physical parallelism merely endeavours to show that causality as it really exists in nature outside our brain can be reflected in the causal relations within the neuronal network, i.e., within what is the external (spatial) side of mental processes; at the same time, it is also supposed in reflectionistic manner, that the causal relations within the brain which reflect the causality outside the brain are structurally isomorphic with the *a priori* causal relations as imposed within our mind. In addition, in the frame of the Hayekian parallelism it is shown that some complicated entanglements of causal processes in neuronal networks are able to produce such relational order which is structurally isomorphic with the *a priori* teleological and normological orders which are imposed on sensory phenomena within our minds; it is also shown that there exists a structural isomorphism between some other types of the entanglements of causal relations within the neuronal network and the

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well, is nevertheless true, an assumption whereby what calls itself fear of error reveals itself rather as fear of the truth.” [Georg Wilhelm Friedrich Hegel, *Phenomenology of Spirit*, translated by A. V. Miller, Oxford University Press, Oxford 1977 (further *PhS*), p. 47.] We can add that it was especially the dualists' fear from the above treated vicious circles what prevented them from the correct understanding of true knowledge.

classification of events on the basis of their sensory similarities and dissimilarities.<sup>44</sup> The supposition of the existence of structural isomorphism between various *a priori* relational orders imposed within our mind and the corresponding entanglements of causal processes as proceeding in the neuronal network has been proven to be utmost plausible when Mac Culloch and Pitts exactly proved that both biological and artificial neurons are able to perform the operations of formal logic, and, consequently, of mathematics.<sup>45</sup>

However, since the parallelistic approach directly requires us to find the causal explanation of the external (neuronal) side of the *a priori* causal relationalisation, as proceeds in our minds, it inevitably seems to fall into the vicious circle.

## 9. Hegel: The Spiral Movement of the “Experience of Consciousness”

Indeed, the vicious circle seems to follow not only from the fact that the process of nature’s becoming self-reflected (both at sensory and the conceptual level) appears to be, at first sight, a purely circular movement, but also from Hegel’s explicit formulation of the basic methodological principle of the monistic approach. It reads as follows: The results of any truly scientific or scientifically-philosophical inquiry must show that what served as an immediately and unconditionally valid starting point of the inquiry (e.g., the

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<sup>44</sup> Applying his psycho-physical parallelism, Hayek is therefore a consequential scientist, in that he tries to find the causally-relational correlates which would be isomorphic with the functions played by single sensations.

<sup>45</sup> This proof (together with the well-known capacity of the causally determined electro-mechanical logical circuits to perform logical and mathematical operations) constitutes a very strong argument against Husserl’s and Wittgenstein’s dualistic approach to formal logic: in computer engineering, formal logic (the “logic of solid bodies”, as Bergson puts it) has been actually incorporated into solid bodies which work precisely (of course, under apt conditions) without any aid from the part of the transcendental Ego and without any reference to the Platonic world of meanings in themselves. Nevertheless, it is true Husserl arrived at his dualism in reaction to primitive associantist psychology which was principally unable to find any strict regularities governing our mental processes. However, as we know, there have been developed some radically different psychological theories, such as the gestalt or eidetic psychology (both of them under the influence of Husserl himself). Especially in the gestalt psychology, the imposition of self-identity on the perceived objects as well as the imposition of various types of abstract formal relations is treated as the basic function of human mind (and also of the psyche of highly developed animals). Instead of referring to the mysterious transcendental Ego, the gestalt psychology finds its foundations in the Hayekian psycho-physical parallelism. This is why the sharply anti-psychologistic tune which find in Mises and Hoppe is useless; in fact, it is a remnant of the Kantian dualism. The fact that we are not aware of the necessary logical structure of teleology in accordance of which we act every day, can be better explained in terms of tacit knowledge. Summing up shortly this problem, we may say that the monistic approach does not reduce logic to empirical psychology (as the psychologists did), but, on the contrary, it aims at a “logisation” of psychology (in the sense of abandoning the false notion of fully contingent character of psychic processes).

*a priori* principle of constantly operating causes) is in fact necessarily mediated (conditioned) by what has been discovered during the inquiry.

Hegel's use of the term "mediation" in this connection is inspired by Kant's conception of the circular teleological arrangement of a living organism, according to which the functioning of any part of organic system (whole) is a means for the functioning of all other parts; it implies that any part of organic system is both an aim and a means and that the organic system as a whole is in relation to any of its parts both an aim and a means, too.

Nevertheless, Hegel's methodological principle would include a vicious circle only on condition that the inquiry were to consist in making explicit that which is implicitly comprehended in the premises that serve as the starting point of the inquiry; then, the results of the inquiry would not comprehend more knowledge than we would have had at its beginning; but, this is not the case.

In Hegel, the inquiry includes the whole history of the science in question. As such, it includes a kind of negative relation to its own starting point; this negative relation simply means that during the inquiry, we become aware of the limited (narrow) character of the *a priori* presuppositions which enabled us to start the inquiry. According to Hegel (inspired here by Fichte), to become aware of limits means to trespass them; in other words, the character of limitation enables us to recognise the character of what is on the other side of the limit. In this way we can discover a new, richer and/or more general version of the *a priori* schematisation. At this stage of the inquiry, we can explain the *a priori* presupposition which served as the starting point of the inquiry, as a particular instance or a partial aspect of the just discovered (more general) version of the *a priori* schematisation. We can see that when explaining the immediate starting point of the inquiry, we have more knowledge than we had at the beginning and that, therefore, we do not fall into the vicious circle.

When we ask about the possibility of this kind of evolutionary (historicised) apriorism, we should have in mind that Hegel's epistemology, ontology and methodology was inspired by Adam Smith's theory of market order. In his *Wealth of Nations*, Smith showed that the results of market processes establish conditions which enable the same kind of processes to be reproduced in extended degree; in other words, Smith discovered that the movement of free market system includes positive feed-back effect. Consequently, the self-relatedness of the movement of market system has not a circular form, but the form of spiral.<sup>46</sup> The same is true about the self-relatedness

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<sup>46</sup> This character of market system, as first described in Adam Smith, is recapitulated very appositely by Adolph Lowe: "In order to follow up the sequence of events we must break into the chain of interdependent links artificially at some point. The most opportune place to do so is the point where a prior increase in aggregate employment, stemming from the preceding 'turn of the spiral', has raised aggregate demand, thus providing new investment opportunities for further division of labour. These opportunities raise profit expectations and thus demand for savings, in this manner keeping the level of the rate of interest above the minimum and,

which takes place in living organism: the results of organic processes establish not only the conditions enabling the individual to continue his life, but also conditions for the production of new individuals via multiplying.

Taking into account the spiral form of the movements characteristic for both the spontaneous order of organic life and market economy, Hegel modelled accordingly the whole movement of nature's (in his terms, of the Absolute's) becoming self-reflected. Namely, an act of the Absolute's self-reflection, as proceeding in a historical period results in establishing the conditions which enable the following acts of self-reflection to be more complex and adequate. We can easily see that Hegel's above presented methodological principle stems from his persuasion that scientific method must follow "the life of the object".

Although we can understand intuitively that the spiral movement should eliminate vicious circle, it will be very useful to present Hegel's closer explanation of the way in which an *a priori* scheme is replaced with a more general one. Hegel was here inspired by the famous Kant's doctrine of the antinomies of pure reason; this doctrine says that when we apply the *a priori* categories of the *Verstand* beyond the appropriate field of their application (i.e., beyond the objects of our sensory experience as given in time and space), our thinking must necessarily fall into self-contradictions (antinomies). Kant, as a dualist, of course, denied any possibility of a historical evolution of the *a priori* schematisations: he did not believe that we could trespass the limits of the field of the appropriate application of categories and find some new *a priori* schemes which would be apt for the "forbidden" zone.

According to Hegel, what enables us to penetrate into that zone, is our becoming aware of the importance of reflection of cognition (as performed by single cognitive faculties of our mind) for the evolution of cognition itself.<sup>47</sup> The reflection of our cognition, as our becoming aware that it is performed by our subjective cognitive faculties, necessarily includes our becoming aware that these faculties are related to the object of cognition, i.e. to something which exists independently of their being actually performed. [Simply speaking, we know that after closing our eyes, the world as seen before, does not cease to

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considering the propensity for 'betterment', stimulating the supply of savings. Such savings offered for investment represent demand for additional labour and maintain real wages above the subsistence level. Under the influence of the propensity to procreate, labour supply responds, even if with a time lag, to the wage stimulus so that the original investment opportunities can be realised through rising employment. This raises payrolls and market demand above the level expected when the spiral under observation first began to turn, creating new investment opportunities and the opportunity for another turn. It should be emphasised that the long-term feedback mechanism, which underlies this spiral process, is 'positive', that is, self-enforcing rather than compensatory." [A. Lowe, Adam Smith's System of Equilibrium Growth, in: Andrew S. Skinner, Thomas Wilson (eds.), *Essays on Adam Smith*, Oxford University Press 1975, pp. 420-421.]

<sup>47</sup> Kant, of course, did reflect cognition in philosophy, but was not able to reflect the role which reflection plays in general.

exist; it is evident for us that its “disappearing” was caused by our bodily movement of closing the eyes (which is reflected, too), and not by the world itself.]<sup>48</sup> This means that only reflection (which necessarily accompanies the functioning of any human cognitive faculty) constitutes the difference between subject and object. If a cognitive faculty were not reflected, then what we (in reflecting it) call its object, would be reduced to the way it appears in the frame of the functioning of the faculty; this appearance would comprehend nothing which would be beyond the object’s relation to the faculty; no “in-itself”, as Hegel put it. It would be therefore no object at all.

What is just so important in Hegel’s conception is his finding that some kinds of preconceptions (very similar to *a priori* presuppositions) are not applied only in functioning of the reflected cognitive faculties (such as our reason at the level of the *Verstand*, etc.), but also in the working of reflection itself. Accordingly, when we start to reflect cognition as a whole, we have a philosophical or epistemological preconception stating that only some of our cognitive faculties can give us true knowledge (i.e., the knowledge of reality as it exists independently of our mind). (For instance, rationalists believe that our true and real knowledge comes solely from the working of our reason.) This preconception also implies that only those aspects and characters of the object exist truly (in-itself), which are able to be grasped by the considered faculty. It must be stressed that originally we do not know that it is only a preconception; on the contrary, we believe it to be fully true.

Now, the progress in the reflection of our cognition leads us to investigate (willy-nilly), if our preconception is true, i.e., if our true knowledge (as supposed to be able to be expressed in some propositions) can be really based upon the considered cognitive faculty and the corresponding conception of the object. This investigation consists in comparing the object with our knowledge of the object – the object can be treated to be a standard for testing the adequacy of knowledge. The possibility to do so comes from the fact that the object is given twice: as related to our cognition (and therefore depending on it) and (in reflection) as independent of it.<sup>49</sup>

Now let us “speak Hegel” himself (the following section is one the rare ones which almost do not need an interpreter):

“Upon this distinction, which is present as a fact, the examination rests. If the comparison shows that these two moments [the object’s being related to our

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<sup>48</sup> Or, as Hegel puts it, “whatever is related to knowledge or knowing is also distinguished from it, and posited as existing outside of this relationship”. (*PhS*, pp. 52-53.)

<sup>49</sup> “The object, it is true, seems only to be for consciousness in the way that consciousness knows it; it seems that consciousness cannot, as it were, get behind the object as it exists for consciousness so as to examine what the object is *in itself*, and hence, too, cannot test its own knowledge by that standard. But the distinction between the in-itself and knowledge is already present in the very fact that consciousness knows an object at all.” (*PhS*, p. 54.)

knowledge and its being in-itself] do not correspond to the another, it would seem that consciousness must alter its knowledge to make it conform to the object. However, in fact, in the alteration of the knowledge, the object itself alters for it too, for the knowledge that was present was essentially a knowledge of the object: as the knowledge changes, so too does the object, for it essentially belonged to this knowledge. Hence it comes to pass for consciousness that what it previously took to be the *in-itself* is not an *in-itself*, or that it was only an in-itself for *consciousness*. (...) Inasmuch as the new true object issues from it, this dialectical movement which consciousness exercises on itself and which affects both its knowledge and its object, is precisely what is called experience.”<sup>50</sup>

The character of this dialectical process can be understood best when we refer to its simplest exemplification, as can be found at the very beginning of Hegel’s phenomenology of mind. The first preconception which is to be tested, is a kind of extreme (quasi-Berkeleyan) nominalism which denies the real existence of all what is universal/general and ascribes real and true existence only to what is purely individual (single);<sup>51</sup> accordingly, the true object of our knowledge is only what can be immediately given to our senses. The cognitive faculty which is able to give us true knowledge as here preconceived is our ability to feel sensations (called by Hegel “sense-certainty”). Defending this position, the mind which reflects its own cognition, can argue that sense-certainty is the richest and truest kind of knowledge – namely, sense-certainty does not omit anything from the object (because of applying no kind of abstraction) and grasps it in its perfect entirety. It implies that the object of sense-certainty must be characterised as “this” (with its two particular modes: “here” and “now”).

Testing the above mentioned preconception by considering whether the really existing treated object as something purely singular corresponds to the way it is present in sense-certainty we (together with the mind which raised the assumption) find that in order to turn our experience of sense-certainty as related to something singular into true knowledge, we must utter it; and the uttering of it is impossible without the use of the notions “this”, “here” and “now”, which are “the most abstract of generalities and in fact expresses its sameness with everything rather than its distinctiveness”.<sup>52</sup> It becomes clear that what is here and now given to sense-certainty as “this”, cannot be reached by language, which is inherently universal;<sup>53</sup> it can be merely meant, but what is merely meant without being able to be uttered and communicated, is simply untrue.

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<sup>50</sup> *PhS*, p. 54-55.

<sup>51</sup> In treating this kind of preconception, Hegel anticipated, so to say, the position of the empiriocriticists (Mach, Avenarius) who asserted that from a point of view, sensations (or, more precisely, what is usually called sensations) really exist.

<sup>52</sup> *PhS*, p. 66.

<sup>53</sup> „When I say: ‘a single thing’, I am really saying what it is from a wholly universal point of view, for everything is a single thing; and likewise ‘this thing’ is anything you like. If we

Since sense-certainty does not include our ability to understand such most general notions as “this”, “here” and “now”, it is not conforming to its object since this was preconceived. Thus, we have found that it is not able to give us true and full knowledge of really existing objects; this conclusion is in contradiction with our preconception – what it stated to be truly in-itself (the object as given to sense-certainty), has been shown to be only our own (incorrect) way of believing what is in-itself. The preconception must therefore be abandoned.

Now, having found the importance of our understanding general notions for true knowledge, we must change our treatment of what is its truly existing object: it must become conform to the cognitive ability whose role and function has been just clarified in our reflection. Since any cognitive faculty or even partial cognitive ability is known in reflection as related to what is beyond its being actually performed, in the case of our ability to understand general notions we are driven to “transfer” the character of generality to our treatment of the really and truly existing object. In doing so, we arrive at a new preconception concerning the character of true and real object. According to this preconception (which is, before becoming tested, believed to be true), the true and real object is the Thing<sup>54</sup> and the corresponding cognitive faculty is perception (i.e., the ability to feel sensation as combined with the ability to understand generality at pre-conceptual level.) The character of generality is present in the Thing in the form of unity which enables the Thing to be more than a collection of sensory qualities experienced in various sensory organs.<sup>55</sup> This kind of generality enables us to utter sentences like: “This apple has changed its colour.” In other words, it enables the Thing to remain the same even if some of its qualitative and quantitative properties are changing.<sup>56</sup> Later, the testing shows that the

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describe it more exactly as ‘this bit or paper’, then each and every bit or paper is ‘this bit or paper’, and I have only uttered the universal all the time.” (*Ibid.*) Moreover, if I wanted to help out language by pointing out this bit or paper as it is given to me here and now, my experience could not be communicated to another person. Namely, in order to do so, that person should occupy my place and look at the same direction, but it means that he/she would have to experience another (later) “now” than I have experienced. On this occasion, Hegel also shows that the allegedly immediate “this” of sense-certainty is in fact mediated by its being referred to the experiencing I.

<sup>54</sup> Our writing this notion with the capital T corresponds to the usage applied by Arnold Vincent Miller, the translator of Hegel’s *Phänomenologie des Geistes* into English.

<sup>55</sup> There is no place in this article to present closely the reasons why the results of testing sense-certainty require necessarily that precisely this kind of generality be projected into the character of the really existing object. On this occasion, it must be stressed that our above interpretation of Hegel’s conception of the “experience of consciousness” is shamefully oversimplified.

<sup>56</sup> Another example of the generality that is present in the Thing can be seen in the abstract and formal relations as described by the gestalt-psychology. They are a basis for the pre-conceptual generality of time and space (both taken in their wholeness), which necessarily constitute the Thing as given to perception.

Thing (as preconceived) has some aspects that cannot be grasped by perception; what is needed is perception's co-operation with reason, as proceeding in the form of so called apperception; this leads to the "transferring" to the really existing object of the notions of force, causality and natural law; it is typical for the mode of rationalistic realism as applied in modern science.

The process of the "experience of consciousness" must be formulated also in terms of the subject-object relationship. As we already know, at the beginning of our reflecting we believe (in line with our preconception) that the considered cognitive faculty gives us full and exhaustive knowledge of the object as it exists independently of us; it means that we are not aware of the limits of our knowledge as performed by the faculty. Its being tested shows that the faculty is able to grasp only some aspects of what we now preconceive to be really existing object (in the case of sense-certainty it is what is singular on the object), whereas the other aspects of the object, i.e., those ones which are now preconceived to be really existing and therefore independent of our cognition, are principally beyond the considered faculty's scope (as concerns sense-certainty, it is what is general within the object). In this way, reflection discovers the limits of the tested faculty; the aspects of the object, which are beyond these limits, are now preconceived as what can be grasped by the higher cognitive faculty or ability which was explicitly known during the testing. At the same time, what was in the abandoned preconception treated as really existing (the singular as grasped by sense-certainty), is now found to exist only in the object's relation to our subjective cognitive faculty. This means that together with the "transference" into object of what can be grasped by the higher faculty as having become explicitly known during the testing, another "transference" in the opposite direction proceeds, too: the aspects of the object, which (in the abandoned preconception) were treated to exist really, are "transferred" into the sphere of subject-object relations. In this sphere, their existence depends on the cognitive faculties of the subject (they do not exist when the faculties are not performed). Thus, the objectivisation of the higher (more general) is connected with the subjectivisation of the lower (less general).

When we now think about the objectal pole of what can exist only within the subject-object relations, we must describe it in terms of what we preconceive to be the character of really existing object.<sup>57</sup>

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<sup>57</sup> The above described double "transference" can be observed in modern science which, starting from Descartes, treats natural laws (recognisable solely by our reason) as really existing, and, at the same time, considers the secondary qualities (colours, tastes, smells, etc.) as existing within the subject-object interactions; the objectal pole for, e.g., our experiencing the sensation of colour is explained in physics by vibrations of electromagnetic field; this explanation includes the notions of time, space, causality, forces, etc., that are treated as existing independently of our mind. It also means that reality in itself (= matter or the *res extensa*) is devoid of the secondary qualities. Nevertheless, modern science cannot explain the

And now, what is the further progression of the “experience of consciousness” in Hegel?

After testing the preconception of modern scientific realism and proving it false, we arrive at Kant’s critical philosophy with its basic preconception stating that what is beyond the thing-in-itself’s relation to our mind is unknowable; the results of its being tested and proven false lead us to accept Schelling’s and Hegel’s monistic preconception according to which the allegedly unknowable thing in itself (treated now as the Absolute) reflects itself via our human knowledge. According to Hegel, its becoming tested showed it to be no mere preconception but truth; namely, it defined the object so that the “dialectical” reason (i. e., the *Vernunft*, as Hegel understood it)<sup>58</sup> was shown to be a cognitive faculty fully conforming to it. Consequently, the movement of the “experience of consciousness” seemed to Hegel to be accomplished and put to an end. When Hegel applied the cognitive faculty of the *Vernunft* in developing his own philosophy, he, accordingly, believed to arrive at the full, true and exhaustive knowledge of the Absolute (as expressed in his *Science of Logic*, *Philosophy of Nature* and *Philosophy of Spirit*, which, taken together, constitute his philosophical system); on the basis of this knowledge he was able to substantiate why it was necessary to start the inquiries in his *Phenomenology of Spirit* with the testing of sense-certainty. The immediate starting point was in this way

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way in which those vibrations, as related to our cognitive faculties, can become sensory phenomena. Thus, science cannot be conceived as giving us true and exhausting knowledge of all what truly exists. (The secondary sensations, as being experienced, exist truly, too). In Kant, the “transference” is far more radical: time, space, categories, as *a priori* functions of our mind dwell only within our subject; they become actualised only in subject-object relation – when filled up with the sensory contents coming from the thing in itself. On the other hand, the thing in itself, as preconceived to exist independently of our mind, is devoid of any utterable character (even of the very existence, because existence is one of the categories which can be applied solely within our mind). Kant’s preconception is therefore self-contradictory.

<sup>58</sup> The *Vernunft* is defined by Hegel as our cognitive faculty to grasp conceptually the spiral self-relatedness functioning in various kinds of spontaneous order (as exemplified in living organism and market order) as well as in the very movement of our self-reflection; accordingly, the *Vernunft* is able to know that the relation between subject and object includes both their identity and their being different in the mode of opposites. In Hegel’s *Phenomenology*, the *Vernunft* becomes explicitly reflected in the chapter which includes the testing of Kant’s preconception; after its becoming proven false, the reflection “transfers” what the *Vernunft* is able to grasp into the truly existing object. Accordingly, it is the process of the Absolute’s self-reflection what becomes now the really existing object of our knowledge. We ourselves – as the organs of the Absolute’s becoming self-reflected – are parts of the object. It means that in recognising both our mind and reality as it exist independently of it, we recognise the ways of and conditions for reality’s becoming self-reflected via our mind. (It implies that any process in nature is somehow related to its possibility to become self-reflected.)

shown to be mediated; it means that also the spiral movement, devoid of any vicious circle, had been accomplished.<sup>59</sup>

## 10. Hegel as a Predecessor of Evolutionary Apriorism

Since Hegel was mistaken in many respects in building up his system, it is not necessary to deal closely with the character of the last steps of the just mentioned mediation; in order to find the *rationale* of his system, which, of course does exist, it would have to be thoroughly reinterpreted. What is important for us is Hegel's "spiral" method, as to be applied to the problem of the evolution of the *a priori* schematisations. We add only several brief remarks in order to make it clearer in this respect.

1) Hegel's method of testing the preconceptions we apply when reflecting all types and degrees of subject-object relations can really enrich our knowledge – because of the fact that our cognitive faculties are not immediately transparent for us;<sup>60</sup> it is also evident, that their becoming truly recognised requires to devoid them of many false preconceptions. However, this is impossible to do instantaneously or by fiat. It is known that Husserl, too, wanted to set our reflective knowledge free from any preconceptions. His mistake consisted in believing that it was possible to realise it at the beginning of his inquiry of consciousness. What he regarded to be a very dubious preconception was our pre-scientific and pre-philosophical persuasion that our consciousness is a part of the causally determined world that really exists independently of us; he simply abandoned it (in the mode of putting it into parentheses) and believed to gain pure phenomena for his research. This, of course, led him to "transferring"

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<sup>59</sup> Since any step in the above described zig-zag movement of the "experience of consciousness" (proceeding from the object  $O_1$  towards finding the insufficiency of the assumedly corresponding cognitive faculty  $CF_1$  and, after becoming aware of the necessity to apply some dimensions of the higher faculty  $CF_2$ , towards the object  $O_2$ , and then, again, from the object  $O_2$  towards the testing of the faculty  $CF_2$ , etc.) enriches our reflective cognition of both the cognitive subject and the object, this movement can be treated as a spiral one, too. As it was suggested by the above example of electro-magnetic vibrations, at any step of the movement of the "experience of consciousness", the considered preconception includes almost a partial explanation (=mediation, in Hegel's terms) of how all the preceding subject-object relations are possible; the full and true explanation comes with its final step. The mediation of the very beginning of the movement by its very end therefore means that this spiral movement, too, is related to itself in spiral way. In Hegel, the accomplishing of such a spiral movement of the second order comes when the necessity of developing the *Phenomenology of Spirit* in the role of a prelude to the system is explained within the system itself.

<sup>60</sup> For instance, the II. Law of Gossen (the law of equalising marginal utilities) is a most important *a priori* formal law which is applied every day in the minds of all people in all historical periods. In spite of its being able to be easily derived from the *a priori* structure of human action (as K. Engliš has shown), it was recognised (and mathematically proved) only in 1854 by Hermann Heinrich Gossen.

the world into the consciousness. The bitter ends of his making this fatal step are already known to us. Since Husserl's approach (which can be called in this context "aprioristic") hopelessly failed, it is evident that the only way to become devoid of false preconception is undergoing a kind of Hegelian "experience of consciousness"; it means that we can arrive at true reflective knowledge only in an "*a posteriori*" manner, i.e., only at the end of the inquiry (be this end in Hegel's system or, more probably, in the infinite).

2) In Hegel's *Phenomenology*, any preconception (except for the one that stresses the role of sense-certainty) includes the negation of the preceding one; what is negated is the claim of the corresponding cognitive faculty to bring full and true knowledge of reality. However, knowledge that results from its being actually performed, is not treated as mere illusion. It is now known to be a true knowledge of that aspect of the really existing object, which exists only in relation to the subject. (Accordingly, nor sense-certainty gives us completely false cognition – even in spite of the fact that it cannot be uttered.) It means that the knowledge acquired by any cognitive faculty (again, with the exception of sense-certainty) includes in a synthetic manner all what the preceding faculties recognise truly; correspondingly, any object includes in a similarly synthetic form all what have been preconceived to be really existing object. However, it must be stressed, it is included in it in the form of those partial aspects of it, which exists only in relation to the subject. Accordingly, the transition from the Kantian non-historical impositionistic apriorism to the reflectionistic apriorism by Schelling and Hegel means that the very notion of *a priori* knowledge has not been negated, but preserved – as a partial aspect of a more comprehensive movement of the Absolute's becoming self-reflected.<sup>61</sup> We may thus say that the movement of the Hegelian "experience of consciousness" corresponds to what we now call "cumulative approach" to the relation between truth and the history of knowledge.<sup>62</sup>

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<sup>61</sup> In the frame of the Hegel's metaphysical version of the reflectionistic apriorism, causality as well as the other Kantian categories are treated to be subordinated aspects („moments“) within a more comprehensive (unconsciously) teleological determination (coming ultimately from the Hegelian Concept). Nevertheless, the validity of the *a priori* principle stating that "any event in nature is causally determined by another event" has been preserved: in Hegel, the unconscious teleology of life only necessitates that the causally determined processes in living organism should be arranged in the form of spiral.

<sup>62</sup> In other words, the Absolute (or nature) reflects itself via our minds by stages or degrees – a less adequate degree of its self-reflection is replaced by a more adequate (comprehensive, general) one; any of these degrees is partially true, but, at the same time, it contains a preconception stating it to be fully true. The Absolute's abandoning the false preconceptions is connected with the preservation of true self-knowledge it has reached. However, in testing itself in this way, it suffers, or, more precisely, its suffering is felt by us, who are incorporated organs of the Absolute's becoming self-reflected. [It is especially in the sphere of practical (moral) relations between subject and object, as they are described in those parts of his *Phenomenology* which are devoted to the Spirit.] Thus, the term "experience" as used in

3) The repeated abandoning of false preconceptions as included in the process of the “experience of consciousness” makes it to be similar to the way in which biological evolution applies the “method” of trial-and-error. And actually, Hegel himself remarks that (especially in the practical subject-object relations as mentioned in the above note) the logical structure of the transition to a preconception which defines the true object of knowledge as more comprehensive than the preceding one does not have to be fully and explicitly recognised within the consciousness of people who perform that transition; namely, these people, being fascinated by their negating of a preconception, incline to ignore that the object that corresponded to it has become preserved as a partial aspect of the newly preconceived object.<sup>63</sup> Having not fully recognised the character of the linkage between the new and the preceding object, those people seem themselves to come upon the new object “by chance and externally”. Accordingly, the origination of the new object presents itself to the people’s consciousness “without its understanding how this happens”, as it were, “behind the back of consciousness”.<sup>64</sup> It implies that in Hegel, the logical structure of the process of the “experience of consciousness” can be fully and explicitly recognised only in retrospect – and precisely this retrospective recognition of the evolution of subject-object relations in its logical necessity is what is presented in Hegel’s *Phenomenology of Spirit*.<sup>65</sup> (Hegel believed that the fullest form of the retrospective recognition can come only after the accomplishing of the whole process.) It can be said that in Hegel, the process of the “experience of consciousness” is essentially similar to the process of evolution and spiral functioning of the spontaneous order of market economy as described in Adam Smith – the people who constitute this order via the unintended results of their actions are not aware of its inner logic; they can recognise it (in reading Smith’s *Wealth of Nations*) only after its becoming sufficiently developed.<sup>66</sup>

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Hegel has some of its medieval connotations; (*experimentum crucis* or simply torturing); the single stages of the Absolute’s becoming self-reflected are explicitly said to be Stations of the Cross.

<sup>63</sup> Hegel shows, e.g., that the French revolutionaries were so fascinated by their preconception stating that they themselves were the absolutely free creators of social reality that they demolished all what had not been a product of their constructivistic rationalism.

<sup>64</sup> *PhS*, pp. 55-56.

<sup>65</sup> In fact, Hegel applies here a developed version of Adam Smith’s method of theoretical history. Hegel’s using the formulation “behind the back of consciousness” (which corresponds to Smith’s “invisible hand”) shows persuasively that Hayek’s negative stand towards the theoretico-historical method results from a misunderstanding: Hayek mistakenly believed that this method (as used also by David Hume) was an illegitimate retrospective imputation of rational design into the spontaneous process of cultural evolution. (Cf. F. A. Hayek, *The Fatal Conceit*, The University of Chicago Press, Chicago 1989, p. 145.)

<sup>66</sup> Smith’s economics is included in Hegel’s *Phenomenology* as a way in which the Absolute becomes self-reflected in some partial aspects.

This resemblance enables us to regard Hegel's *Phenomenology of Spirit* as the first outline of evolutionary apriorism – as such, it includes both apriorism (some reflected cognitive faculties, such as the *Verstand*, work in the way of *a priori* relationalisations) and the aposterioristic treatment of the respective preconceptions (any of them – except for the one concerning sense-certainty – stems from the effort at avoiding the self-contradictions resulting from the preceding one). A great advantage of this kind of evolutionary apriorism consists in its giving us a possibility to see the structure of evolutionary process from inside; therefore, it also enables anyone who intends to become educated to reproduce in his/her consciousness the whole progression of subject-object relationships.

However, there is an important difference between the biological evolution and the evolution of subject-object relations as described in Hegel. What can be called “trial” in Hegel is not a result of fully accidental mutations in the genetic code, but stems from the cognition of the contradiction between a preconception and the results of its being tested. Thus, what is here both motive force for the arising of trials (=preconceptions) and the criterion of their being tested, is consciousness' seeking for absence of self-contradictions, which is a form of its seeking for truth.<sup>67</sup> This is in contrast with biological evolution where testing the trials proceeds in the form of the struggle for survival which must be taken literally as fight for the death.<sup>68</sup> It is obvious that since evolutionary process proceeds in history as mediated by human consciousness, it must acquire some new, specific forms.<sup>69</sup>

In order to make clear the evolutionary implications of Hegel's *Phenomenology of Spirit*, it should be said the following: Hegel admits that, in transition to the new preconception of what is truly existing object, there may occur some theories and philosophies which include other preconceptions; he also admits that all newly suggested preconceptions enter into competition which results in the “survival of the fittest” one. The corresponding selection

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<sup>67</sup> In this respect, Hegel's version of evolutionary apriorism is in a good agreement with Hayek's recommendation saying us that our stand to spontaneously grown systems of law should consist in making them free from self-contradictions.

<sup>68</sup> This does not imply that true information about reality, when utilised both in animal's psyche and in human minds would be – generally – a necessary conditions for winning in the biological struggle for survival.

<sup>69</sup> However, the very fact of preserving and accumulating the past knowledge, as typical for human history, does not draw a radical distinction between biological and historical evolution. Since it is known that that the human genome is only slightly different from the genetic information that was contained in the cells of organisms which lived million years earlier, it can be said that the biological evolution, too, preserves the well-tried solutions of the problem of the adequacy of basic structures and functions of living bodies to the requirements of the struggle for survival. This feature of biological evolution finds its expression in the notion of “cumulative selection”. (See Richard Dawkins, *The Blind Watchmaker*, Penguin Books, London 1991, chapter 3.)

criteria can be clearly derived from the structure of the “experience of consciousness”: the “fittest” preconception not only eliminates contradictions implied in the previous preconception but also succeeds in including into itself the previous knowledge in the mode of the most comprehensive synthesis. In the retrospective view (of Hegel), it is precisely this character which qualifies the fittest preconception for being ranked among the necessary stages of the “experience of consciousness”; thus, the “survival” means that the considered preconception is known or recognised to have been a necessary condition for reaching today’s knowledge. On the other hand, the preconceptions which lost the “struggle for survival” – because of their being mere evolutionary “impasses” – have become simply forgotten.

Now, it becomes evident that the version of evolutionary apriorism which stems from Hegel’s adoption of Smith’s theoretico-historical method.

4) Taking into account of the original, Ancient Greek meaning of the word “dialectics” it can be said that the dialectical process of the “experience of consciousness” is a kind of consciousness’ dialogue with itself. Consequently, in the frame of this inner dialogue, our knowledge is not compared or confronted directly with the really existing objects; it is compared only with what is preconceived to be the really existing object. We have seen that in Hegel, also empirical sciences themselves are tested in this way; it results in finding that their *a priori* preconception of what really exists enable them to grasp only some partial aspects of reality. It also implies that the transition from impositionistic to reflectionistic apriorism does not proceed as an empirical refutation of the impositionistic one.

Now it is clear that any step forward to the following preconception, as described in Hegel’s *Phenomenology*, does not need to be verified/falsified by experience coming from external senses. As concerns reflection, it only makes explicit what now can be called a “tacit” functioning of our cognitive faculties; in doing so, reflection functions in precisely the same way as in Mises’ mind when he discovered the *a priori* structure of human action or in the mind of Kant when he wrote his *Critiques*. Consequently, nor the results of performing reflection cannot be verified/falsified by experience as coming from inner senses; in this context, the reflective knowledge, as described in Hegel, is *a priori*, too. On the other hand, reflective knowledge is *a posteriori*, because it can be and also necessarily is tested at any stage of its progression. Introducing into reflection this character of the *a posteriori*, Hegel’s evolutionary apriorism (as being inspired with Smith’s theoretico-historical method) reconciles apriorism with history. In developing such a dynamic kind of synthesis of apriorism and aposteriorism, Hegel avoided errors included in the extreme forms of both of them.<sup>70</sup> Here becomes clear how much is Hegel’s “experience of consciousness” different from our usual understanding of what is experience.<sup>71</sup>

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<sup>70</sup> It should be added that starting from reflection’s ability to give us *a priori* knowledge, as

Hegel's approach thereby resists all objections which would start from the thesis that it is not possible to compare the object as represented by our language and by our theories with reality as it exists independently on us.<sup>72</sup>

## 11. The "Experience of Consciousness" in the Recent History of Physics

It has been shown (hopefully in a sufficient degree) that Hegel's version of evolutionary apriorism elucidates the conditions for the possibility of a spiral return of the process of our cognition to its starting point; in the frame of monism, such a return is the only way how to avoid the danger of vicious circles. Some examples taken from his *Phenomenology of Spirit* should persuade us that the spiral explaining (=mediating) of the allegedly immediate starting points of preceding (less comprehending) degrees of explanation actually proceeded many times in the historical progression of human knowledge even though it was not known and described explicitly. Hegel's approach will be able to be regarded as definitely plausible when we prove that also the evolutionary movements in the sphere of the *a priori* relationalisations, which took place after Hegel, are fully conform to it.

What is relevant to our main problem (= to avoid vicious circle when causally explaining the possibility of the *a priori* causal relationalisation) is the radical shift in our conception of causality, as connected with the transition from classical to quantum physics. More precisely, it is necessary to understand how it is possible that physics (which in its classical period applied the principle of constantly operating causes as an *a priori* presupposition for constituting its object and method) could arrive at the conclusion that the field of the application of this principle is limited, and even trespass these limits towards statistical determinism (or even to a notion of a-causality) as applied in quantum physics. Becoming aware that a) the scientific approach of physics necessarily requires

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elucidated in Hegel, the above mentioned II. Law of Gossen is both a synthetical and analytical judgement *a priori*. Its analytical character follows from the fact that it has not only a verbal, but also a mathematical form, as given to it by Jevons. Moreover, its general form can be derived deductively, using the methods of functional analysis. (See Appendix.) This mathematical form is important – it enables that law to be accepted as inter-subjectively valid even by the economists who have not a smattering of apriorism. On the other hand, the very sentence "humans necessarily act on the II. Law of Gossen" is a synthetical judgement *a priori*, because it refers to human mind as really existing; since the law functions unconscious, it even exists independently of its being reflected. The same would be true of the theorems of Misesian praxeology if they could be deduced from the axiom of action in purely analytical way; but, as we know, it not the case.

<sup>71</sup> In Hegel, even time as such is derived from fact that the Absolute's becoming self-reflected, as proceeding in human minds, must necessarily have the form of an *a posteriori* movement; time, consequently, is a subordinate aspect of this movement.

<sup>72</sup> This old thesis which is, as it were, a philosophical commonplace, was recently "discovered" with a great rumour by Rorty in his *Philosophy and the Mirror of Nature*.

some *a priori* presuppositions, b) these *a priori* presuppositions cannot be falsified by experience,<sup>73</sup> and, c) that it is not possible to compare directly our knowledge with reality as existing independently of us, we cannot regard the problem as a trivial one.

In order to find its solution, there is needed to look closely at the character of the *a priori* presuppositions of classical physics. What necessarily belongs to them – besides the above presented principle of constantly operating causes – is a stronger form of the *a priori* causal relationalisation, which will be here called “the principle of causality”; it states that “any really existing material (= measurable) thing or event is causally determined by another really existing material (=measurable) thing or event”. This *a priori* proposition makes the object of physics destitute first of such “things” which would be caused solely by themselves (in the sense of *causa sui*);<sup>74</sup> analogously, it eliminates from the object of physics the “things”, the occurrence of which would absolutely accidental. As we can see, neither the absolutely necessary, nor the absolutely accidental “things” can be principally studied by physics. Thirdly, the principle of causality makes physics devoid of teleological determination – be it coming from God or people or a hidden teleological order of nature. It also excludes from physics all non-measurable character of things/events (i.e., the secondary qualities, values, feelings, etc.) A very important role is played by the principle of causality when the thing/event’s being caused by something else cannot be immediately recognised; then, it strongly stimulates us to search for some hidden causes.

Moreover, the principle of constantly operating causes includes an *a priori* presupposition of classical physics, which is so important that deserves to be made explicit; it states that natural laws are necessarily invariant in time and

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<sup>73</sup> We can refute in empirical way only single hypotheses (by formulating predictions and finding them to not conform to the actually measured values of the variables), but not the principle of causality which is the presupposition of both formulating and testing the hypotheses. In reaction to this kind of problem, W. V. O. Quine proposes to abandon any principal difference between the *a priori* and empirical judgements, because to maintain it is nothing but a “non-empirical dogma of empiricism”; accordingly, in finding that a scientific proposition (containing as such both the allegedly *a priori* and empirical component) does not correspond to empirical observations, we can correct it in twofold manner: either by correcting its factual component or by changing what is usually called its being an *a priori* component. (Quine’s example in this respect is making invalid the analytical *a priori* statement that  $2 \times 2 = 4$ ). He argues that we do not use the latter way of correcting for principal reasons (i.e., that it would be impossible or even self-contradictory to refute the *a priori* judgements) but solely because its being used would turn science as a whole upside down. However, as we know, precisely this was done in quantum mechanics. Thus, the following question arises: if it is admitted to make such an upheaval of science as a whole in one case, then what prevents us to do at any occasion?

<sup>74</sup> It means nothing but that physics is *a priori* forbidden to deal with God (as treated by Spinoza).

space, even those of them whose mathematical expressions include time and space as variables.<sup>75</sup>

It is surely useful to mention here that in Kant's impositionistic apriorism, the invariance of natural laws in time and space is a consequence of the famous statement, according to which human reason prescribes laws to nature. Namely, Kant believed that not only the principle of causality but also all laws of nature are imposed by the *Verstand*; in other words, he believed that our thinking of nature can be valid inter-subjectively only on condition that we impose among events or things such relations which correspond to the laws of Newtonian physics.<sup>76</sup>

As concerns the *a priori* requirement of measurability, as included in the principle of causality, it makes explicit that physics is allowed to treat as its objects only such things/events which manifest themselves in space either immediately or by means of some intermediary processes (as it is the above mentioned case of measuring temperature with thermometers). Measurement replaces the immediate subject-object relation as proceeding at the level of

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<sup>75</sup> In order to make clear the relation between natural laws and the principle of causality it must be said that many natural laws do not include any explicit description of the causal relation between two kinds of things/events. E.g., the Law of Gay-Lussac ( $pV = nRT$ ) describes necessary interrelations among various aspects of a system (such as pressure, volume and temperature) without referring explicitly to what is beyond this system. In this case, it is not correct to believe that an increase/decrease of one of the variables (as interrelated in the form of a mathematical function expressing the corresponding natural law) is the cause of the changes of other variables. In order to find the connection between this kind of natural laws and the principle of causality it is necessary to treat the system as interacting with other things/events or systems. Then, it is easy to find the following correct formulation: when an aspect of a thing/event (as being expressed by a variable) is changing in consequence of causal determinacy coming from another thing/event, its other aspects are changing in conformity with the considered natural law. (To use to above example: if we cause an increase/decrease of the pressure of the system, its volume and/or temperature increase/decrease in conformity with the Law of Gay-Lussac.) Now, it has become clear that natural law describes also the character of the necessary interrelations among the changes of several measurable aspects of an object/event. It should be noted that the Law of Gay-Lussac belongs to a group of natural laws which express necessary connections among such measurable aspects of phenomenal world which are originally given in various fields of sensory perception: it states such a connection between temperature (as felt in our thermo-receptors) and pressure (as felt in our tactile receptors).

<sup>76</sup> Kant's deduction of the *a priori* character of natural laws can be shortly given in the following way: the *a priori* categories serve him as a basis for the deduction of the general *a priori* principles of natural science; besides the principle of causality, they include also the Law of Conservation of Matter (as derived from the category of substance). The laws of Newtonian physics come from a combination of the general *a priori* principles with mathematics and geometry which are derived from time and space as *a priori* forms of sensory intuition. Since all kinds of the *a priori* relationalisations stem from the non-temporal and non-spatial transcendental Ego, their combination, as being expressed in the mathematical formulae of natural laws, is necessarily invariant in time and space.

sensory perception with the immediate relation of our subject<sup>77</sup> to the spatially given results of an interaction between the measured object/event and the object/event which serves as measuring device. The using of measurement devices means not only an objectal extension of our sensory cognitive faculties, which enables us to acquire information from what is beyond their natural limits; it also includes an effort to make our cognition of empirical data as much objective (in the sense of inter-subjective validity) as possible.<sup>78</sup>

In classical physics, the application of measurement devices was connected with a preconception stating that the character of the measured object is not influenced by the measurement device or the changes on the object coming from its being measured are so small the they can be legitimately neglected; this preconception implied that what cannot be measured in the just described manner, cannot be the object of physics.<sup>79</sup> In other words, it stated that measurement can give us true knowledge of what exists independently of us.

Nevertheless, when physics started to study the events at the micro-level of reality and had to face therewith some serious problems coming from so called wave-particle dualism, the physicists were driven to reflect closely the character of measurement; in other words, they started to test the validity of knowledge as coming from the objectal/processual extension of our cognitive faculties. The previous advancements in physics (such as Planck's discovery of the discrete character of the radiation of electro-magnetic energy,<sup>80</sup> Einstein's

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<sup>77</sup> More precisely, the subject of cognition participates in the just described relations as being incorporated to human body which is its primary and privileged object.

<sup>78</sup> In other words, to eliminate from the object of physics the non-measurable properties of things/events means to devoid it of all what can appear to be not the same when perceived by various normally developed individuals. One can hardly cast doubt upon the fact that the location of pointer in a measuring device coincides with the line that symbolises the value of measured quantity; in using a digital measurement device, no disagreement among the observing individuals can arise. (In this case, the data can be mediated even to blind persons.) These examples are in conformity with Hegel's thesis that the object of physics is constituted via de-subjectivisation of what is given to our senses as really existing; accordingly, the non-measurable characters of things are "transferred" from the object of sensory perception into the subject.

<sup>79</sup> It is known that August Comte did not rank psychology among sciences, because, regarding introspection as the only method of psychology, argued that the very fact of performing introspection brings to pass some changes in introspected psychic events. Comte's argument was refuted by Brentano who discerned between introspection (as performed intentionally) and reflection (as proceeding spontaneously).

<sup>80</sup> It is highly relevant to mention here that Planck's discovery resulted from his being faithful to an *a priori* principle of physics which has not been introduced above. This principle says that a kind of phenomena must be explained by one ("covering") law. Being led by this principle, Planck wanted to find a law which would have unified three different laws describing the radiation of so called "absolutely black body". It required finding a finite number of the ways in which the whole energy can be distributed among single oscillators. In supposing that the radiation of energy from oscillators proceeds continuously, he necessarily arrived at the infinite number of the ways. He therefore had to suppose that the energy coming

theory of photons, etc.) enabled the physicists to describe theoretically<sup>81</sup> the character of the interaction between any possible measurement device and the measured micro-objects. It was found that at the micro-level of reality where the wave character of matter plays far more important role than at the macro-level, any thinkable measurement device necessarily influences the measured object. So, when looking at the results of measurement, we have no certainty what in them is the “contribution” of our extended sensory faculties and what expresses the character of the measured object as really existing one. The exact expression of the scope of our uncertainty can be found in the famous Heisenberg’s uncertainty relations; they are formulated as a natural law which states that it is not possible to measure precisely both the momentum of a particle and its position in space; namely, trying to measure one of this parameters more and more precisely, we must influence the measured object/event in such a manner, that as concerns the value of other parameter, it can be found everywhere in the rapidly growing interval of its possible values. This results clearly from Heisenberg’s formula  $\Delta p \Delta x = h/2\pi$  (where  $p$  is the momentum of a particle,  $x$  its position in space, and  $h$  is Planck’s constant). In this way, physical theory disclosed both the limits of measuring and the limits of measurability of what really exists; it was shown that at the micro-level of reality, measurement as objectal/processual extension of our sensory cognitive faculty does not conform to the preconception formulated in classical physics.

As concerns causality we should refer to another version of Heisenberg’s uncertainty relations as expressed in the formula  $\Delta E \Delta t = h/2\pi$  (where  $E$  is energy and  $t$  is time). The physical quantity that corresponds to the product  $E.t$  is called in physics “action” or “effect”. It explicitly expresses the quantitative dimension of causal determinacy; as such it can be as well understood as cause (in reference to an old *a priori* proposition stating that from the quantitative point of view, there can be nothing more in the effect than it was in the cause). Accordingly, the constant  $h/2\pi$  can be interpreted as both the quantum of action and the quantum of effect and the quantum of cause. To ascribe cause or effect or action as transition from cause to effect of the quantum character means nothing but to say that none of them can be measured more precisely than is admitted by the constant  $h/2\pi$ . Although one component of cause, effect or

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from any oscillator can be expressed mathematically as the product of an integer and the quantity of an indivisible “atom” of energy; under this condition, he was able to find solution of the problem (by using some theorems of combinatorics). Planck himself confessed that his introduction of that supposition (which turned classical physics upside down) was made in despair, but he decided to do it because the unifying formula had to be brought “at any cost”. It seems to be a good example of the fruitfulness of the *a priori* presuppositions of science.

<sup>81</sup> Here must be taken into account also the influence which the development of measurement devices exerts on theoretical knowledge. It is known, that any higher step in this development results in physicists’ having more precise data, which, in turn, leads to the formulation of more profound theories.

action (be it the momentum or position, energy or time) can be measured precisely, it is compensated by the impossibility to measure precisely the other one.

This implies that within the limits prescribed by Heisenberg's relations of uncertainty, the effect caused by a thing/event – which is here necessarily a micro-event – can be anyone of the infinite number of different micro-events (supposing to have definite momentum, the effect can occur everywhere in the space); similarly, an event can be caused by anyone of the infinite number of other events.

This finding is not, at first sight, in contrast with the principle of causality. It does not deny the existence of a definite event which functions as cause or effect, but only makes explicit that we can have no certainty about its parameters. As concerns the principle of constantly operating causes, it is clear that the situation is worse. Namely, the same cause can necessitate very different effects; and, Heisenberg's relations of uncertainty imply that at the micro-level of reality, it is impossible to arrange the same conditions. Thus, the behaviour of events within the limits as defined in Heisenberg's formula is not conforming to the principle of constantly operating causes – it simply ceases to be valid in the micro-world.

Apart from the physicists of the older generation the generation who defended the classical preconception (as Einstein, de Broglie and Schrödinger), the first reaction of the adherent of the non-classical consisted in adopting a version of Kantianism: they argued that since we recognise only the results of the interaction between the object and the objectal/processual extension of our subject, the physical reality in itself is unknowable. In contrast with Kant, some of them added that what we recognise as being “really existing” reality depends on our decisions to measure exactly either the position of the particles or their momentum. Quantum physics thus should have been turned into a science about the subject-object relationship; nevertheless, its inability to draw distinction between itself and its object would make it devoid of the very character of science. Moreover, if its “object” would include the decisions of single, it would lack even inter-subjective validity.

However, later, even the most radical among them (as Heisenberg himself) joined another group of physicists, i.e., to them who went beyond Kant; they applied and apply until now an approach which is fully conform with Hegel's thesis saying that to become aware of the limits of our knowledge means to trespass them.

In retrospect, the inner logic of this approach can be described as follows: When the physicists tested measurement as the extension of the cognitive faculty of sensory perception and proved it to be not conform to the really existing object because its being necessarily limited, they found that in order that the object could be truly recognised they must apply another cognitive faculty, namely such one, which would be able to go beyond the limits of the

preceding faculty and give a more comprehensive and general knowledge of reality. The character of the limits of measurement oriented them to the method of statistical physics which, until then, was treated to give no true, but only approximating knowledge. Namely, it was used to describe phenomena which were treated to be non-measurable for practical reasons (e.g., the behaviour of great number of particles as contained in one litre of gas); more precisely speaking, it appeared so from the standpoint of the preconception connected with classical physics, which asserted that any physical object, as truly existing independently of us, is principally measurable, and that all phenomena whose behaviour seems to accidental to us, are covertly based on strictly causal determinacy; in consequence, statistical physics played a subordinate role in the frame of classical physics – it was believed to describe only the surface of reality. After the abandoning of that preconception and becoming aware that reality is not only practically but also principally limited in its being measurable, the method of statistical physics was found to be able to give us true knowledge. This finding was necessarily connected with the “transferring” into the really existing object of those characters which have found to be able to be truly recognised by the method of statistical physics. Since this cognitive method is able to disclose the laws of statistical determinacy, it was precisely these laws that have been transferred into reality as exists independently of us.

Having in mind the fact that in performing measurement, the cognition of the object is mediated by some object-object relations, the physicists understood that the uncertainties would exist even if the processes or objects they used in the function of measurement device would react with the measured object naturally, without being driven to do it themselves. Accordingly, the choice between the alternatives (to have either precisely determined momentum or position) does have to come solely from the decision of person who performs measurement; it may arise as well from the natural course of events. Alternatively, it can be said that nature in itself is indifferent to having causal determinacy precise; of course, only within the interval corresponding to Heisenberg’s uncertainty relations.<sup>82</sup>

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<sup>82</sup> From this point of view, Heisenberg’s formula should be called more correctly the “principle of limited causal determinacy”. Namely, the term “uncertainty” suggests that it does not apply to reality as exists independently of us, but in the frame of subject-object relationship. There can be added the Heisenberg’s uncertainty relations do not permit to find an ultra-micro-level of reality at which some assumedly causal interrelations would give rise to the micro-level with its statistical determinacy in a way similar to the one, in which causally determined movements of the molecules of ware give rise to the chaotic Brown’s movement. (This was the main argument used in de Broglie’s and D. Bohm’s efforts at preserving the classical worldview.) The assumed causal events at the hypothetical ultra-micro-level of reality would be principally non-measurable in their classical characters because its being measurable in this sense would suppose that measurement devices would be able to “penetrate” through the micro-level.

Consequently, the object of classical physics has become a subordinated aspect of the object of quantum mechanics as using the method of statistical physics. Analogously, the laws of classical physics have become subordinated to more general and comprehensive laws of statistical physics;<sup>83</sup> or to use other words, causal determinacy is a subordinated aspect of statistical determinacy. As concerns Heisenberg's formula itself, its character of natural law is not limited by the laws of statistical determinacy, in spite of the fact that it was derived in the classical way; namely, it is nothing but a limit of the world of classical physics, which means that all kinds of limitation of the other laws of classical physics must come through it; since only it gives the laws of statistical physics "an opportunity" to set some limits to classical laws, it cannot be limited by them. Here should be said explicitly that the approach of statistical physics, as used in quantum mechanics, must be based on Heisenberg's uncertainty relations; it means that it does not presuppose the principle of constantly operating causes. The researchers who apply it, necessarily take into account the limitations prescribed by Heisenberg's formula even in conceiving and setting up the experiments which are to confirm their hypotheses.

From the purely physical point of view, the "transference" proceeded in the following way: At the macro-level as described by classical physics, it is possible to treat the mechanical movement of solid bodies separately from the wave movement which is typical for the vibrations of electro-magnetic field. On the other hand, the *a priori* principle of constantly operating causes, as applied by classical physics, seems to have a character of purely formal *a priori*: it is believed to be fully independent of various contents to which it is applied in its function of being *a priori* presupposition of various branches of physics. This means that it "works successfully" in both the classical theory of wave movement and classical mechanics (as includes also Einstein's theory of relativity); in other words, remaining at the macro-level, we can causally explain

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<sup>83</sup> This statement can be derived also in the following way: since the principle of constantly operating causes implies the invariance of natural laws in time and space, its being limited by Heisenberg's relations of uncertainty implies that beyond these limits, natural laws cease to be invariant in time and space, too. It is proved that so called tunnelling-effect as described by quantum physics, includes the breaking of even the Law of Conservation of Energy (within the limits prescribed by Heisenberg's formula). This peculiar fact can be elucidated very simply: In conformity with the Law of Conservation of Energy (which is essential in classical physics) some particles has not enough energy in order to reach a position; but, since the probabilistic laws of quantum mechanics admit their being there, some of them actually reach that position sooner or later. We can also mention so-called a-causality (in the sense of *actio in distans*). Since the possibility of such a process follows from the equations of quantum mechanics and, on the other hand, it is excluded by the theory of relativity, it was regarded (by Einstein, Podolsky and Rosen) as a decisive argument against quantum mechanics. Nevertheless, the existence of a-causality was recently confirmed by experiments. This means that events at the micro-level of reality can behave in the ways that are forbidden by the laws of theory of relativity as belonging to classical physics).

both the wave movement (in formulating general wave function) and the movement of solid bodies as usual “things”.

The situation changes radically when we leave the macro-level in order to penetrate into what is, as phenomenologists say “beyond the horizon of the discernability of the small”; it is obvious that here, at the micro-level, it is necessary to extend the cognitive faculty of our sensory perception by developing very sophisticated measurement devices. What was far more serious was the fact the study of the micro-world required to unify what is separated at the macro-level: the movement of particles (as “solid bodies”) had to be described in terms of wave functions as describing originally only the vibrations of electro-magnetic field. The necessity to treat matter as having the character of both waves and particles resulted from de Broglie’s attempt to find physical foundation for Bohr’s postulates which “saved” Rutherford’s planetary model of atom. At the same time, the theory of photons showed that they, as being quanta of electromagnetic field, have also some characters of particles; this theory was verified by experiments (so called photo-effect, Compton’s phenomenon, etc.)

When de Broglie and Schrödinger formulated the wave equations which expressed the twofold character of matter, interpreted them in line with classical physics as describing the waving of matter itself. This led to two important consequences:

1) It was found that the wave equations, in spite of the fact that they are based on the principle of constantly operating causes, cannot give us any precise information about both the momentum and position of the particle described in them (namely, they include so called “dispersion” of the momenta); this found its expression in Heisenberg’s uncertainty relations which were derived from the classical wave equations as a truly natural law. Their very specific character of them consists in the fact that they set some limits to the possibility to apply the principle of constantly operating causes, though they presuppose its validity. It was thereby proved that the validity of the principle of constantly operating causes depends on the contents to which it is applied: when applied to particles treated as waves (or waves treated as particles) it comes to setting some limits to itself (in spite of its ability to be applied correctly to both waves and bodies when treated separately). This also means that the preconception of classical physics asserting it to be purely formal *a priori* principle which can be applied to any contents (to any really existing object), was proven to be false: it cannot be applied in an unlimited way to the objects which, having the character of particles have some properties of waves, too.

2) It was ascertained that if the wave functions are interpreted as describing the “waving of matter”, then not only the pioneering wave equation of de Broglie, but also the much more advanced wave equation by Schrödinger lead to absurd or untenable consequences. (Schrödinger’s model of particle as a wave-pocket was proven to be inadequate because wave-pockets, as consisting of really existing waves are necessarily unstable and decay.) Here it must be

stressed that the validity of the formalism of Schrödinger's theory did (and does) not depend on its being incorrectly interpreted.

In this situation, there were two alternatives:

1) To abandon the wave functions (in the way of an empirical refutation concerning their interpretation) and try find any other solution in the frame of classical physics as applying the principle of constantly operating causes. This alternative has not been realised.

2) To preserve the wave functions under the condition that they should have been interpreted otherwise. This has become plausible only via applying Heisenberg's uncertainty relations to the process of measurement, i.e., to the objectal/processual extension of our subjective cognitive faculty of perception.<sup>84</sup> The application had the form of testing the conformity of the cognitive faculty to what is preconceived as its object; it made Heisenberg's uncertainty relations to become the expression of principal limits of our knowledge as based on the principle of constantly operating causes. In turning the attention of the physicists the methods of statistical physics, it was precisely this step which paved the way for another interpretation of Schrödinger's wave function. It was formulated by Max Born who interpreted the wave function as describing the "waves of probability"; thus, the particles of matter at the micro-level of reality cease to be determined causally. Instead of it, their movement is subordinated to statistical determinacy as a more comprehensive character of interrelatedness. Classical physics (with its causal determinism) has been proved to be an extreme case of quantum physics. The description of reality in terms of the latter is replaced with its being described in terms of the former when the value of Planck's constant  $h$  can be put as equal to zero.<sup>85</sup>

Much more later, Roland Omnès and the other representatives of the theory of decoherence proved that there exist some processes that actually "reduce Planck's constant to zero value", or, in other words, that result in the fact that those peculiar events in which the value of Planck's constant  $h$  is not

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<sup>84</sup> This step was facilitated by the fact that Heisenberg derived his formula from his own matrix formalism of quantum mechanics, which was originally based on the principle of constantly operating causes, too; in doing so, he was not influenced by the incorrect way in which Schrödinger interpreted his wave equation. This fact has no impact on our considerations because it was proved that Heisenberg's matrix formalism of quantum mechanics is equivalent to Schrödinger's wave formalism.

<sup>85</sup> In order to compensate somehow the above simplifications, it should be added that Heisenberg's uncertainty relations can be exactly derived from both de Broglie's and Schrödinger's wave equations, too; but, it must be stressed that without the explicit reflection of the principally limited character of our cognitive faculties, the statistical interpretation of the wave functions would be hardly possible. And, what should be in this connection especially emphasised, is the fact that not only the pioneering wave equation of de Broglie, but also the much more developed wave equation by Schrödinger do not lead to absurd consequences only under the condition that the wave functions are interpreted as describing the "waves of probability".

negligible, cease to occur. More precisely, it was proved that any interaction among the micro-events is accompanied with so-called decoherence effect which leads to the disappearing of their wave characters. This disappearing proceeds with an extreme velocity (in the order of  $10^{-54}$  sec) and is especially effective within the great collections of particles which are the almost absolutely prevailing form of existence of matter. The peculiar quantum effects are thus reserved for rarely occurring single particles and photons. The decoherence effect, being a kind of self-negation of statistical determinacy, necessitates, accordingly, the establishing of what we know as the macro-level of reality, with all of its attributes, such as classical causal determinacy, the principle of constantly operating causes, the invariance of natural laws in time and space, the basis for the arising of the visual world as given to our experience, the ability to treat the movement of bodies separately from the wave movement, etc.<sup>86</sup> Omnès even shows that the decoherence effect establishes the irreversible character of the “arrow of time”, which is extremely important for the theory of self-organisation. All this confirms that what is beyond the limits of the classical world with its principle of constantly operating causes, is not any unknowable thing in itself in the sense of Kant, and that the application of the methods of statistical physics is not a mere expression of our ignorance; it is sufficient to mention that in the frame of classical physics, there is not possible to find unshakable foundation for the irreversibility of time.

We should mention briefly the limitations of our *a priori* relationalisations which come “from above”, i.e., when we attempt to apply them to the mega-level of reality. While quantum mechanics sets limits to the application of the *a priori* principle of constantly operating causes, Einstein’s theory of relativity which is another form of synthesis of the wave movement of electromagnetic field and mechanical movement of solid bodies, sets limits to the *a priori* relationalisations which are conform to the character of space and time at the macro-level of reality.<sup>87</sup> Moreover, Einstein’s general theory of relativity implies the limitation of the invariance of natural laws of time in space; but, since it respects the principle of constantly operating causes, the limitations of the invariance of natural laws must come from the changes of the character of time and space.

It is necessary to have in mind that the principle of the invariance of natural laws in time and space is closely connected with the conception of

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<sup>86</sup> In order to avoid oversimplifications, it must be referred to that part of Omnès’ theory, in which he proved that even at the macro-level, there are some types of events which are not conform to the principle of constantly operating causes; nevertheless, he adds that we can precisely describe and predict those “aliens” from the quantum world.

<sup>87</sup> The synthesis of both of these “sources” of the limitations of our *a priori* cognitive faculties can be found in relativistic quantum physics. From the standpoint of the theory of relativity, that synthesis is not very fruitful because the quantum effects play practically no role at the-mega-level of reality.

absolute time and space, as it was formulated in Newton's physics. (Newton, of course, gave only an exact formulation to our *a priori* understanding of time and space.) When taking into account that in accordance with Einstein, time and space are only subordinated aspects of matter and that matter (the Universe as a whole) is admitted to be finite in both temporal and spatial aspects, then, since it is known that natural laws describe the character of matter's movement, it is possible that the invariance of natural laws in time and space is not infinite (as seen from the standpoint of both Newtonian physics and our *a priori* understanding.)

It is so in Einstein's cylindrical model of the Universe which, having the form of a Riemannian space, is both unlimited and finite.<sup>88</sup> The finite character of time (as concerns the past) can be found in the theory of Big Bang which is inspired by the general theory of relativity. It includes also the end of the series of causal determinations (in the sense of an event being caused by some other event in the past) without referring to the *causa sui* or any other metaphysical notion. From the standpoint of these counter-intuitive theories, it is nonsensical to ask what is beyond the corresponding limits; in accordance with the Big Bang theory, it is excluded that the laws of nature could be valid "before" the explosive birth of matter itself.

What is more important is to make clear how it is possible that, having started from an *a priori* understanding of time and space, we arrive to such counter-intuitive theories as the above mentioned. It must be first said that the transition from the Newtonian to the relativistic physics is fully conform to the Hegelian scheme of the spiral return of our knowledge to its starting point: In order to avoid contradictions between the theses of the Newtonian physics and the conclusions coming from Maxwell's theory of electro-magnetic field, Einstein had to treat space and time (preconceived in the Newtonian physics as being absolutely independent of what proceeds within them) as subordinate aspects of the velocity of light, i.e., of the "true" Absolute as it was just discovered by himself.

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<sup>88</sup> Here should be added that the very existence of non-Euclidean geometries refutes Kant's belief that the Euclidean space is an *a priori* form of sensory intuition (from which, according to Kant, geometry is derived). Kant's transcendentalism implies that non-Euclidean geometries can neither be thought, nor imagined (even our imagination must respect the *a priori* forms of sensory intuition). In contrast with Kant it can be said that the Euclidean space stems from the *a priori* relationalisations performed at the level of the gestalt-functions of our mind (and probably also of animals' psyche). The relations imposed by the gestalt functions are conform to the really existing spatial and temporal character of the macro-level of reality (where the relativistic effects are missing). In addition, the gestalt relations (as abstract and formal) can be easily converted into conceptual form, which admits the construction of non-Euclidean spaces in our mind. Moreover, if it could be proved that mathematics and geometry come from the spatial and temporal relationalisations as performed by the gestalt functions, then the reflectionistic treatment of apriorism would be able to explain why nature behaves in conformity with mathematics.

In doing so, Einstein had to arrive to a radically new understanding of the character and scope of our cognitive faculties as described in terms of observation. Namely, if the observer (A) who is connected with the referential system A (which moves with the velocity  $v_a$ ) observes some events which proceed in another system B (with the velocity  $v_b$ ), the results of his observations, as concern the spatial, temporal and also some other characters of those events, are different from the results of the observer (B) who's referential system is B. In consequence of it, our cognitive faculties as oriented toward time and space have been relativised – of course, not in the sense of projecting time and space into a contingent individual subjectivity, but in the sense of their becoming dependent on the observer's becoming related to a referential system. It was precisely this kind of the reflection of the role of observing subject in his relation to the observed object, what enabled to go beyond the limits of our *a priori* understanding of time and space.

The final step of the spiral return to the starting point consists in the Newtonian physics' being proved to be an extreme case of the relativistic one;<sup>89</sup> thus, the transition from it to the Einsteinian one (as well as the transition from classical physics to quantum mechanics) proceeds in the manner of cummulativism.<sup>90</sup>

## 12. The Vicious Circles Eliminated

Now, it is clear that that the progression from classical physics to Omnès' explanation of the necessity of the establishing of causal determinacy (as including such important steps as Heisenberg's uncertainty relations and the "transferring" of statistical determinacy into reality, as starting from Born's interpretation of the wave function) is nothing but a spiral movement of physical inquiries towards their starting point.

This movement resulted in the fact that we have more and better knowledge that at the beginning, when (in the frame of classical physics) we started with the *a priori* presupposition stating that "any measurable thing/event is causally determined by another measurable thing/event". Now (since

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<sup>89</sup> It deserves to be mentioned that Einstein's theory of relativity had to struggle for its survival in conformity with the evolutionary implications of Hegel's "experience of consciousness". In the year 1908, three years after the appearing of the main theses of the special theory of relativity, Walter Ritz published another theoretical attempt to unify classical mechanics and Maxwell's theory of electro-magnetic field; very roughly speaking, it consisted of the latter becoming subordinated to the former. Ritz's theory is now completely forgotten.

<sup>90</sup> It is useless to present here the corresponding formula because it can be found in any elementary textbook devoted to the theory of relativity. But it is to be said that Kuhn, in his attempting to refuse cummulativism, had the guts to say Einstein used radically different physical concepts than Newton. This shows clearly what a nonsense is Kuhn's version of „sociology of knowledge“.

measurability did not cease an *a priori* character of physics) we have a more comprehensive *a priori* presupposition: it states that “any measurable thing/event in nature is determined by another thing/event – either causally or statistically”. The term “statistically” here expresses the limited character of both causal determinacy and the measurability of reality. Now, we also know that the principle of constantly operating causes is not valid universally. This finding enriches our knowledge – though it seems to be a paradox. Namely, in the sphere of statistical determinacy it is possible to find explanation of the establishing of sphere of causal determinacy as corresponding to the principle of constantly operating causes. Omnès’ decoherentism informs us, therewith, why the narrower version of our *a priori* principles, which was applied at the beginning, was necessary for us, the inhabitants of the macro-level of reality. This means that what is beyond the limits of the principle of constantly operating causes, is not any unknowable thing in itself or a kind of the *hic sunt leones*.

Having found its being mediated in this way, we can see that the *a priori* principle of the constantly operating causes is not something immediate in which we are imprisoned and rotate in vicious circles. If this principle were a kind of spectacles through which we necessarily look at the world, as it is in Kant’s impositionistic version of apriorism, we principally could not go beyond its limits and look at causal determinacy from outside, i.e., from the standpoint of statistical determinacy which is proved to be able to explain its origin. Thus, if the principle of constantly operating causes were only within our mind, no spiral movement returning to it would be possible.

However, having followed the transition from classical physics to quantum mechanics which, in turn, explained the necessity of classical physics, we know that such a spiral movement has been really accomplished; and, since we know, too, that the sphere causal determinacy which corresponds to the *a priori* principle of constantly operating causes was proved to arise in the frame of the statistical approach of quantum physics which does not presuppose this principle, we can infer that the causal determinacy really exists independently of our mind.

The same inference comes from the fact that the *a priori* relationalisation, as expressed in the principle of constantly operating causes, is not fully independent of the relationalised contents, as it would be in the case of a purely formal impositional *a priori*. As we have seen, this dependence, as becoming explicit on a very specific object (wave-particle), led to the delineation of the limits of the causal relationalisation from within – on the basis of the application of the principle of constantly operating causes (in deriving Heisenberg’s uncertainty relations). It should be said that the finding of the dependence of the *a priori* form on a contents is the only way in which that *a priori* form can have “contact” with reality. From within, this “contact” is given as a self-limitation of the *a priori* relationalisation. Nevertheless, to find the limits beyond which the

application of the *a priori* relationalisation is not adequate means, at the same time, that within these limits it is applied adequately. However, the adequacy implies that the *a priori* relationalisation truly reflect really existing relations. In the case of the principle of constantly operating causes, it means that it is an adequate reflection of the causal determinacy at the macro-level of reality.

In the case of the *a priori* forms of time and space, it was Einstein's discovery of their being dependent on matter, which delineated the limit between their adequate and inadequate application (i.e., the limit between the plausibility of the Euclidean space and the necessity to refer to non-Euclidean spaces).

In other words, to find the limits of an allegedly impositional (purely formal) *a priori* relationalisation means to recognise that it is in fact a reflectionistic one; this implies that within those limits, the relations which correspond to the *a priori* relationalisation, really exist.

Since there are some impenitent empiricists, it is useful to anticipate their main objections. Denying the existence of synthetical judgements *a priori*, they surely would argue that the limitation of the principle of constantly operating causes could be treated as an empirical refutation of a hypothesis.

Here it is necessary to recall Hoppe's answer to such kind of objections: since that principle is a necessary presupposition for testing hypotheses experimentally, it itself cannot be tested in this way without falling into a vicious circle. (The refutation of the main thesis of the empiricists saying that there are only empirical and analytical statements was presented above.) We should add that no hypothesis is tested in the form of reflecting our subjective cognitive faculties, as it was in the case of the transition to quantum mechanics.

In reaction, some of the empiricists could admit that the principle of constantly operating causes is an *a priori* basis for both formulating and testing hypotheses, but still, they could argue in line with Quine, that when many or even all hypotheses based on that *a priori* are falsified, we can decide to change the *a priori* at a risk of making an upheaval in physics. Our answer refers to the fact that what paves the way for the limitation of the *a priori* principle of constantly operating causes was no decision, but the discovery of a natural law as it is expressed Heisenberg's uncertainty relations. Moreover, to abandon the *a priori* in accordance with Quine would mean to deny it fully, without any possibility to reinstate its validity in a limited sphere.

However, the best way of resisting the arguments by the empiricists is to refute the main thesis of avid Hume, the founding father of empiricism. Hume, as it known, reduced the necessity of causal determination to probabilistic factual statements. This reduction becomes untenable in light of the fact, that in the frame of the probabilistic approach of statistical physics, as applied in quantum mechanics, it can be exactly proved that the sphere of probabilistic uncertainties necessarily "negates" itself via the establishing of classical causality at the macro-level of reality.

And finally it can be presented an answer from the standpoint of monistic evolutionary apriorism. This position implies that nature, in producing human mind, made human knowledge conform to the causal order as it really exists at the macro-level of reality; it was done via the inborn universal grammar and/or via the spontaneous genesis of language. As functioning in the way of the *a priori* causal relationalisations (as given explicitly as “any thing is causally determined by another thing”, etc.), human thought could avoid to apply a “hypothesis”, according to which the causal order which is present at the macro-level of reality, is valid everywhere – both at its micro- and mega-level. But this was “hypothesis” which had not been formulated by ourselves (via inductive generalisation), but by the nature itself; it was connected, to paraphrase Hegel, with nature’s becoming self-reflected. It was, from this point of view, a false “hypothesis” of nature concerning its character. On the other hand, we formulated and tested our own hypotheses on the basis of its “hypothesis”; accordingly the testing of the nature’s “hypothesis” is radically different from the testing of our ones: Since that “hypothesis” within our mind as an *a priori* relationalisation, its testing has to have at least some characters of an inner dialogue proceeding within our consciousness.

Since the objections coming from the empiricists cannot be taken seriously, we can accomplish the spiral movement to the starting point. Until now, we have followed the spiral movements which proceeded in quantum mechanics and theory of relativity and arrived at the conclusion that causal determinacy (or causal order) as corresponding to the principle of constantly operating causes, exists independently of us at the macro-level of reality.

Now it is clear that when studying our possibility to think and utter the principle of constantly operating causes, we aim to explain how the really existing causal order is reflected in human minds in the form of the *a priori* causal relationalisations. When applying here the monistic approach (because dualism have been proved to be untenable and anti-philosophical) as well as the approach of psycho-physical parallelism (which is the only way in what a strict science can study human mind) and when referring to the important results in this direction as can be found in Hayek’s *Sensory Order*), we can – without falling into the vicious circle – present a version of the causal explanation of our possibility to think and utter the sentence expressing the *a priori* principle of constantly operating causes as both inter-subjectively valid and true when referring to macro-level of reality. This enables us to develop a causal explanation of the possibility of both the teleological and normological orders of thought, and therewith the possibility of the Austrian *a priori* economics. *Q. E. D.*

It is true, however, that to explain the *a priori* orders of thought in terms of neuronal order gives us only the explanation of “from without”; moreover, it can be only the explanation of principle (in Hayekian sense). This is why the

causal explanation must be supplemented by the study of the arising and functioning of the *a priori* orders of thought “from within”.

As concerns the other vicious circles mentioned above, it can be said that in the case of formal logic, the real existence of causal determinacy (as it was inferred from the character of transition from classical to quantum physics) enables us to see that principal foundations for the necessity of logical operations in the causal necessity of the corresponding neuronal and molecular processes. (Here we can refer, e.g., to the reparasis-enzyme whose function is to preserve the self-identity of the molecular basis for genetic information.) However, the vicious circle consisting in our inability to avoid laws of formal logic in formulating such arguments does disappear. In order to eliminate it we should – analogously to the limitations of causality via Heisenberg’s formula – arrive at the limits of formal logic from within. Such a limit exists: it was first described by Zeno in his famous Paradox of Arrow. It shows that our thinking as based on the Law of Identity (and having therefore a “cinematographic” character, as Bergson put it) is not able to grasp simple mechanical movement without falling into self-contradiction. In reaction to it, Hegel argued that the only way how to trespass this limit and looking at formal logic from beyond is to apply the *Vernunft* as a higher, dialectical form of reason; the *Vernunft* is more comprehensive than formal logic because, as being able to grasp the unity of opposites, is not bound by the Law of Identity and the Law of Contradiction. Accordingly, the vicious circle can be eliminated by treating formal logic as the extreme case of dialectics. As concerns this solution, it seems that there exists an interpretation which makes it acceptable in some respects without repeating the errors of Hegel’s metaphysics and Marxist “dialectics” of nature. (Nevertheless, it is not possible to develop that interpretation in this study.) In any case, the fact that formal logic is limited “from within” remains to be the starting point for any effort to find a better solution. In looking for the limits of formal logic we can refer also to the notion of the  $(-1)^{1/2}$ , which is successfully used both in mathematics and physics in spite of the fact that it is literally unthinkable because of including self-contradiction.

An effort to eliminate the vicious circle which would necessarily come if we would be really imprisoned within our language in its transcendental function, requires us to apply an analogous approach.

The defenders of the unavoidability of vicious circle assert that there exists no reality that could be treated within our language as being independent of the language within which we treat it. In relation to our previous investigations of causality it would mean that the very fact of our uttering the conclusion that the principle of constantly operating causes truly reflects the really existing causal order at the macro-level of reality necessarily presupposes the *a priori* validity of the language in which it is uttered; consequently, any attempt to describe the way in which language stems from the really existing causal order as a form of its self-reflection includes the vicious circle. To put it

in Kantian way, they assert that we can never compare the meaning of a word with the “corresponding” thing in itself. Thus, being unable to go beyond the limits of language, we are allowed only to compare meanings of some words with the meanings of some other words (such as “language” on the one hand, and “really existing thing” on the other); since this comparison proceeds in (reflecting) language, we must willy-nilly accept its *a priori* validity.

These assertions come from a narrow manner in which the character of the limits of language is usually understood: The limits of language can be found not only in what is purely individual or singular as being here and now (in accordance with the old thesis saying that *individuum est ineffabile*),<sup>91</sup> but also in the form of some inconsistencies within the sphere of the *a priori* validity of language when treated in the broadest sense.

The character of those inconsistencies becomes clear when we take into account that today’s human language consists from two basic parts or branches: The first of them is represented by pre-scientific language which is essentially non-mathematical (in Husserl, it is defined by its lacking such mathematical idealisations as point and moment);<sup>92</sup> the second one is mathematical language as used in physics (here we can refer to Galilei’s concept of the “language of mathematics”). Both of these languages have *a priori* validity (this follows even from the premises of the defenders of the unavoidability of the vicious circle as connected with the self-reflection of language).

What is important in this context is the fact that when physical science included only non-relativistic classical physics, propositions of physics, as expressed in mathematical form, could be fully converted into pre-scientific language; whereas later, mathematical descriptions of events or objects studied in quantum mechanics and the theory of relativity cannot be fully converted into pre-scientific language. (In attempting it physicists use some inaccurate analogies as “spin”, “electron-clouds”, etc.; the fact that physicists first formulate some correct mathematical equations and only later look for their interpretations, is in this sense symptomatic, too.) The transition from the full compatibility between the two basic (*a priori* valid) branches of human language to their incompatibility is the way in which we are become aware of the limits of language from within. However, as we already know, to become aware of the limits means to trespass them.

Namely, that transition from incompatibility to incompatibility would not come if the *a priori* of pre-scientific language and the *a priori* of mathematical

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<sup>91</sup> As Hayek frequently stresses, there are various kinds of verbally non-articulated tacit knowledge of the rules of human behaviour as oriented both towards other people and things (this knowledge which often stems from imitation can be ascribed to the gestalt functions of human mind). Not mentioning the most dubious *Id* in Freud, the existence of tacit knowledge is another important way of the limitation of language.

<sup>92</sup> Since philosophy, generally speaking, reflects the structure of pre-scientific language, its language, too, can be regarded as pre-scientific one.

language as used in physics were purely impositional kinds of the *a priori* knowledge. Similarly as it was in the above described case of causality,<sup>93</sup> the very fact of the necessity of the transition showed that the *a priori* orders of both basic parts of language depend on something which is beyond them: as concerns the formal *a priori* of mathematical language, it was shown that it depends on the contents which is relationalised by means of it, whereas in the case of the *a priori* of pre-scientific language which is not purely formal one, we should speak about its being dependent on both relational and “contentual” reality which exists independently of it. The untenability of impositionistic treatment of the *a priori* (and therefore inter-subjectively valid) character of both basic parts of human language implies that this treatment must be necessarily replaced with the reflectionistic one. This, in turn, implies that pre-scientific language is able to reflect correctly the events at the macro-level of reality, but only them, and that, on the other hand, the mathematical language (with its formal and abstractly-relational *a priori*) is able to reflect correctly the events as occurring at all level of reality. Of course, the results of using mathematical language for describing the events at the micro- and mega-level of reality cannot be fully converted into pre-scientific language.<sup>94</sup>

In order to make explicit the spiral movement which enables us to avoid the vicious circle connected with the self-reflection of language we should start from the preconception which is included in Wittgenstein’s *Tractatus*. In accordance with it we have no possibility to argue in favour of the reflectionistic character of the *a priori* of both mathematics and reflecting non-mathematical (and therefore pre-scientific) language used by Wittgenstein. Consequently, Wittgenstein’s preconception had to treat both of them in the impositionistic sense (of course, without referring to any transcendental Ego, which would impose them). Nevertheless, it was fully conform to Kant in its stress on our language’s inability to grasp the things as they exist independently of language. (Later, in his *Philosophical Investigations*, Wittgenstein arrived at a kind of relativistic impositionism: instead of the transcendental Ego, which is able to guarantee the inter-subjective validity of the imposed *a priori*, he introduces various groups of empirical individuals who accidentally and arbitrarily impose various rules of their language games.) In doing so, he did not take any account

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<sup>93</sup> Since the main argument of the defenders of the concept of humans’ being imprisoned in the immanence of their language arose from their application of Kantianism to the problems of semantics, it is obvious that the refutation of that argument must be similar to the refutation of the Kantian treatment of both causality and time and space.

<sup>94</sup> Using the term “cognitive faculty” it can be said that non-relativistic classical physics was accompanied with a preconception stating that pre-scientific language (with the aid of mathematics as an instrument of making it precise) was a cognitive faculty able to grasp fully the really existing object; after its being tested in relation to the objects of quantum mechanics and the theory of relativity it has been shown to be able to grasp only a partial aspect of reality (i.e., its macro-level).

of the theory of relativity and quantum mechanics. The above performed testing of his preconception face-to-face these forms of going beyond the limits of non-relativistic classical physics (which was the basis for Wittgenstein's understanding of science) enriched our knowledge: now, we know about the reflectionistic character of the *a priori* of both pre-scientific and mathematical language. Moreover, since pre-scientific language has been recognised to be able to recognise truly the macro-level of reality, it is, at the same time, able to recognise truly itself – because it is a part of the macro-level of reality. (In its function of reflecting language, the pre-scientific language has usually the form of a philosophical language.) The *a priori* validity of the reflected language as giving us true knowledge of the causal order of the macro-level of reality is therefore principally the same as the *a priori* validity of the reflecting language – it can give us true knowledge of that parts of the causal order of the macro-level of reality which gives birth to the reflected language.<sup>95</sup> The causal (empirical) explanation of the genesis and character of the reflected language (in the sense of Hayekian psycho-physical parallelism), which starts from the causal order of the macro-level of reality, as existing independently of language, is, accordingly, principally the same as the causal explanation of reflecting language. We simply cannot find any explanation of the reflected language without having explained in the same way the reflecting language. On the other side, we cannot have any *a priori* “presupposition” concerning the reflecting language without having the same *a priori* “presupposition” as concerns the reflected language. Thus, no dualistic gap between the allegedly transcendental (*a priori*) character of the reflecting language and as well allegedly purely empirical character of the reflected language is possible; this kind of dualism necessarily results from the dualism that is included in the impositionistic treatment of the *a priori*.

Now it is clear that the reflecting language cannot be treated as an absolutely immediate starting point of all inquiries, which does not depend on anything else. It is shown to be mediated in spiral way – by the results of the inquiry which starts from it, but yet goes beyond it; namely; when the inquiry finds the limits of language, as given in the form of in the impossibility to convert fully the descriptions made in mathematical language into pre-scientific one, it, at the same time, “touches” the reality which is beyond those limits, i.e., the reality which exists independently of language. This leads necessarily to the transition to a reflectionistic treatment of the *a priori* of both reflected and reflecting language, which means that language in both of its roles is mediated

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<sup>95</sup> Of course, the reflecting language is able to make explicit also the other *a priori* orders of thought, which are implicitly present in the reflected language (i.e., both the teleological and normological one). Since their function consists in enabling us to change the *status quo*, they can be described in their pure form as being independent of the causal order. However, when we (in the frame of reflecting language) study their origin, we must show, how the reflected language which includes them, stems from the causal order of reality.

by what it reflects. It implies that self-reflection of language does not include any vicious circle. The same is true about explaining the genesis of the *a priori* order of pre-scientific language “from within”.

### **13. Towards an Evolutionary Apriorism “from within”**

As it has been shown, the reflectionistic treatment of the *a priori* causal order of thought enables us to explain scientifically (in terms of Hayekian psycho-physical parallelism) the purely impositional way of the *a priori* relationalisation as proceeding in the frame of both the teleological and normological order of thought; since reflectionism eliminates the danger of vicious circles, it enables us to find a correct scientific explanation of the fact that the impositional *a priori* of teleological order of thought necessarily presupposes an *a priori* knowledge of the principle of constantly operating causes. Taking into account that the normological order of thought is in its application related to human actions (it either prescribes or prohibits some kinds of them) we can state that the impositional *a priori* of that order necessarily presupposes an *a priori* knowledge of the principle of constantly operating causes, too; as it may be clearly seen, not even in this case the scientific explanation leads to vicious circles.

Nevertheless, in order to get scientific explanation of the complicated interrelations among the three kinds of the *a priori* orders of thought, we should re-define somewhat the tasks of the Hayekian psycho-physical approach: It should be applied to the finding of the causally determined neuronal correlates of the structure of universal grammar which includes the reflection of both causal order as existing independently of us and the orders of impositional relationalisations which (as functioning in human action and within human normative consciousness that regulates the actions) exist only in the frame of interaction between ourselves and reality. Here should not be omitted that it is only the actualisation of universal grammar in the process of spontaneous genesis of language which enables the arising of the teleological order of thought; of course, this does not mean that language would not be able to reflect the accomplished form of that order. Such kind of a “linguistic turn” is inevitable because, in accordance with the above-developed version of evolutionary apriorism that stems from Hegel’s adoption of Smith’s theoretico-historical method, the decisive evolutionary movements in the sphere of the *a priori* knowledge proceed in history, and are therefore necessarily mediated by language. The studies in the causally determined neuronal correlates of the syntactical and semantic structure of universal grammar should give us in this context a scientific explanation of the possibility of such historical evolutionary movements.

As concerns the origination of the universal grammar itself, it seems that it does not matter whether it has been originated in its complete form by means

of an abrupt mutation of genetic code, or (what is far more probable) through some development of the pre-conceptual gestalt relationalisations in which the structure of universal grammar was present in an implicit or tacit form.<sup>96</sup> Here is sufficient to say that Hayek's scientific explanation of both animal psyche's and human mind's ability to provide that some classes of stimuli lead to some classes of responses can become a good starting point for an explanation of the general character of the structures of universal grammar (if we insisted on its being "inborn" via an abrupt mutation) as well as for explaining the universal grammar as stemming from some abstract and formal gestalt relationalisations.

However, as Hayek himself stated, any using of his approach of psycho-physical parallelism can give us only the explanation of principle. It means that especially as concerns the historical stage of the evolution of the *a priori* orders of thought, a strictly scientific explanation is not sufficient, though necessary: Being purely an external one, it must be supplemented with grasping the evolution of the *a priori* orders "from within" (via the study of the process of spontaneous genesis of language, etc.) as well as with their being interpreted from the broader standpoint of monism.

Before presenting a brief outline of some important starting points of such a "hermeneutic" approach to the evolution of the *a priori* orders of thought, it is necessary to show explicitly that evolutionary apriorism in general – and especially that version of it which is based on Hegel's adoption of Adam Smith's theoretico-historical method – is able to resist the above quoted objection by Barry Smith. As we know, he argues that the results of one empirical science – biology – cannot serve as a criterion for the validity of all *a priori* presuppositions as contained in all other sciences; to exemplify his argument, one could say that results of biology cannot validate or invalidate the *a priori* economics or the *a priori* theory of values.

What is here meant under the "results of biology"? In the context of evolutionary apriorism it cannot be anything but the statement about the "survival of the fittest". Nevertheless, as it has been precisely documented by Hayek, the conception of the survival of the fittest was transferred to biology from social sciences which dealt primarily with the origin and preservation of moral and legal norms and with their relation to economic prosperity.<sup>97</sup> We can mention also the term "universal Darwinism" as introduced recently in advanced

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<sup>96</sup> This seems to be documented by finding some elementary language abilities in higher animals (chimpanzees) which – under the influence of people – are capable to apply some forms of grammatical order when working with the symbols they have been enforced to learn. Thus, instead of "producing" the universal grammar in its entirety, a sudden genetic mutation would have enabled only the origination of human's ability to utter articulated words.

<sup>97</sup> On this occasion, Hayek quotes the following passage from Hume: "No form can persist unless it possesses those powers and organs necessary for its subsistence: some new order or economy must be tried and so on, without intermission; till at last some order which can support and maintain itself, is fallen upon." (*The Fatal Conceit*, p. 145.)

informatics and cognitive sciences; it refers to a broadly used universal method of developing computer models of the spontaneous evolution of seemingly very diverse kinds of systems (both natural and societal and cognitive ones). This leads us to conclude that instead of belonging solely to biology, the conception of the survival of the fittest must necessarily be applied in all sciences dealing with complex systems (of course, any of those sciences requires to use a proper modification of it). And, since human brains with its cognitive faculties are complex systems, too, any epistemology (as reflecting the character of both pre-scientific and scientific cognitive processes) must take into account that conception; it means that the conception of the survival of the fittest must be more or less explicitly present even in the epistemological presuppositions of such sciences which do not study complex systems.<sup>98</sup>

The reason why these consequences are not accepted very widely consists in their being seemingly at variance with the effort at variance with a tendency to de-subjectivism human knowledge, which is inherent to all serious epistemologies (including B. Smith's one). In line with it, the opponents to evolutionary apriorism are afraid of an identification of truth with power (in the sense of "might is right"), which would follow from seeing the only criterion of truth in one's (or a system's) being successful in the physical struggle for survival. As we have shown, these primitive views have nothing in common with the above-developed version of evolutionary apriorism which starts from Hegel's adoption of A. Smith's theoretico-historical method; namely, it enables us to arrive at truth via using the criterion of inner coherence of knowledge. Thus, evolutionary apriorism does not endanger the idea of objective truth; on the contrary, after being proved that the basic thesis of empiricism is self-contradictory and that both impositionistic apriorism and naive (Aristotelian or neo-Aristotelian) realism lead to untenable or even absurd consequences, it is only the transition to the reflectionistic treatment of the *a priori* character of the causal order of thought, which can guarantee our ability to grasp objective truth; and, as we have seen, this transition can result solely from the above developed version of evolutionary apriorism.<sup>99</sup>

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<sup>98</sup> This implies that B. Smith's criticism would be correct only if biology, as being based on chemistry which is, in turn, based on physics, would make an attempt to trespass the limits of psycho-physical parallelism. This is, e.g., the case of Freud's primitive biologicistic psychology which attempted to reduce all human values to sexual instinct; at the same time, it declared that any hierarchy of values which is usually treated as valid *a priori* is nothing but self-deception.

<sup>99</sup> If somebody would still undervalue the concept of the survival of the fittest as a piece of merely empirical knowledge, he/she should take into account that there exists a well-justified possibility to formulate an *a priori* proto-science which develops precisely this conception; we can call this proto-science simply "competitionology". It can be established in the form of a systematisation of our pre-scientific understanding of all kinds of competition as has been preserved in the meanings of pre-scientific language. As it is generally known, competition exists within all forms and stages of human society (having the form of individuals' effort to

In spite of the necessity to defend our position against the objection by B. Smith, his introduction of the notion “fallibilism” in connection with the *a priori* knowledge seems to be apt for being utilised also in the frame of evolutionary apriorism. The principal plausibility of this notion comes from the fact that in admitting a retroactive correction of the *a priori* presuppositions of a science by their results, Smith admits implicitly the possibility of spiral return of a scientific inquiry to its starting point.

Nevertheless, it not possible to connect the notion of fallibilism or fallibility with the *a priori* relationalisations in general; since that notion cannot be separated from the classical conception of truth (as the *adequatio rei et intellectu*), it could be applied only to the reflection *a priori* of the causal order of thought, whereas the impositional *a priori* orders of teleological and normological thought (which do not reflect any existing reality) must necessarily be treated as being neither fallibilistic nor infallibilistic. Moreover, the notion of fallibility suggests that a retroactive correction can prove that a piece of the *a priori* knowledge must be definitely refuted as an error. As we know, this is not the case of the principle of constantly operating causes: When we would apply it beyond the limits defined by Heisenberg’s uncertainty relations, we would arrive to errors, no doubt; but when we apply it within those limits, which are relatively well known, its validity can be regarded as infallible.

This is why it is appropriate to ascribe the character of fallibility only to the preconceptions which are connected with all kinds of the *a priori* relationalisations. Accordingly, the transition from classical to quantum physics has shown that the preconception of classical physics (stating that causal determinacy is a universal character of nature) was fallible. What has to be treated now as fallibilistic *a priori* in the context of physics is a preconception stating categorically that at the micro-level of reality, there can exist no other

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gain social recognition); it exists also before the origin of free market economy. This kind of competition is documented by Aristides’ challenge addressed to Themistocles, his political opponent: “We will now compete in working better for public benefit.” Nevertheless, the pre-scientific understanding of what we now express with the phrase “survival of the fittest” came from people’s experience of wars among single groups, communities, ethnic units or states (wars represent the extreme form of competition). It has been preserved in the ideological legitimisation of slavery “by law”: people who were not able to defend their land or city (because of lacking personal virtues and efficiencies and because of having unjust laws and weak gods) do not deserve to survive as people; they turn into slaves (“speaking instruments”). On the other hand, the community of the winners of war deserved to survive as community (of free people) because its members were virtuous and efficient in a higher degree than the losers and had more righteous laws, etc. All this *a priori* understanding of the survival of the fittest (as preserved in the meanings of such words of pre-scientific language as “slave” and “free citizen”) was reflected philosophically by Empedocles who formulated first an outline of universal evolutionary theory (see his fragment B 61). Later (especially under the influence of Christianity) the knowledge of “competitionology” had become more implicit (or tacit); it turned into explicitly scientific knowledge only after the massive onset of capitalism in the 18<sup>th</sup> century.

kind of determinacy than the statistical one. This preconception must be maintained – in spite of the fact that we cannot exclude a discovery of another type of determinacy (differing from both causal and statistical one), from which the statistical determinacy would stem. Namely, it is a necessary presupposition of scientific inquiries concerning the micro-level of reality; it can be declared to have been fallible only after proving the existence of some limits of the sphere of statistical determinacy at the micro-level of reality.

Now, we can finally present the promised outline of the starting points for an inquiry “from within” of all three *a priori* orders of thought.

As concerns the causal order, it should be mentioned that the above treated strong version of the causality principle has been developed by Galileo, Descartes, Newton and the other founders of modern science; in Kant’s theoretical philosophy, it acquired explicit character as one of the *a priori* presuppositions of physical science. Nevertheless, it has been derived from a very archaic version of the *a priori* understanding of causality, stating that “any thing/event is caused by another thing/event”. The application of this archaic version, as proceeded before the coming of modern science, was connected, however, with a very loose understanding of the meaning of the word “cause”. The fact that in the Aristotelian and medieval thinking, there can be found such notions as “final cause” (*causa finalis*) and “efficient cause” (*causa efficiens*), shows clearly that the archaic understanding of the principle of causality admitted not only “our” causality (as corresponding to the notion of efficient cause), but also all forms of teleological determination – as coming from God (defined in Aristotle as the aim of all aims), from people, and from unconscious teleology as working in nature;<sup>100</sup> it admitted also miracles, i.e., some interventions into the causal nexus of natural events, as necessitated by God or gods. The very existence of belief in miracles as events that are not conform to the principle of constantly operating causes gives us a confirmation that this *a priori* principle works in our pre-scientific practice in the form of tacit knowledge. In other words, people act on it in the frame of their everyday (bodily) handling with objects without being fully conscious of its necessity; some of them can therefore believe in miracles.<sup>101</sup>

In order to avoid the confusions coming from the unequivocal use of the term “cause”, we should re-formulate the archaic version of the principle of causality in following way: “Any thing/event is necessarily determined by

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<sup>100</sup> In Aristotle, one can find even four kinds of causes: the formal, material, efficient and final one; but, only the latter two causes refer to the relations of things to other things. Since Aristotle argued that all four causes necessarily determine any existing thing, his theory of four causes implies that any thing is determined by another thing in the mode of efficient cause.

<sup>101</sup> On the other hand, the principle of constantly operating causes was and also is applied (as a more or less explicit assumption) in various magical practices which reckon upon an imaginary quasi-causal network (instead of real causality as we understand it).

something else.”<sup>102</sup> It can be stated that only this form of the *a priori* relationalisation of things/events functions explicitly in the minds of all people at all stages of historical development – even in the minds of such of them who, believing in miracles, apply the principle of constantly operating causes only in an implicit manner.

This way of the *a priori* relationalisation is constituted within human minds in the process of spontaneous evolution of language: when people, in reflecting their activities directed towards the world, are driven to use firstly a word referring to a particular thing which (as given to them in their sensory perception) is the object of their activity (or even its product), they implicitly put into the just evolved word also the following general meaning “something given in sensory way, whose changes of shape, colour, etc., have been determined by our bodily activity”. Thus, the meaning includes the object’s being related to something else. In other words, the people cannot understand the meaning of that word without understanding that to what it refers can be somehow influenced by their bodily activity.<sup>103</sup>

At the same time, the people start to understand themselves in such a way that they are able to influence everything what they can touch. It is just this general character of human bodily activities (i.e., that they can be applied repeatedly to the same object or to various objects without ceasing to be the same activities) what enables those people to transfer the above described general meaning to everything they can touch.<sup>104</sup> When they handle with another

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<sup>102</sup> The notion „determine“ is here used in its broadest meaning, as referring to a thing/event’s being influenced, necessitated, caused, produces, created *ex nihilo*, established, depending on, etc. on another thing/event.

<sup>103</sup> It should be added that this kind of understanding things had to be preceded by people’s becoming aware of the object’s being independent of them; this awareness comes from the functioning of spontaneously evolved norms which, in the form of an imperative, prohibit the people (or, more precisely, the predecessors of people) to satisfy their needs via immediate consumption of goods. (See Ján Pavlík, On the Origin of Language, in: R. Casati, G. White, eds., *Philosophy and the Cognitive Sciences*, Kirchberg am Wechsel 1993, pp. 403-407.)

<sup>104</sup> As we can see, such phenomena as the sky, stars, thunder, etc. are exceptions in this context. It is therefore no accident that God or gods were located onto the celestial sphere for so a long time (until Copernicus). This leads us to the problem of God who, too, being the *causa sui* or Aristotelian Prime Mover (who himself is unmoved) is an exception from the *a priori* causal relationalisation. Here we must refer to Kant who asserted that there exists an *a priori* target for human reason (in its faculty described as the *Vernunft*) to stop the progression into the infinite of one thing’s being dependent on another thing, and again, the second thing’s being dependent on a third one, etc. The *Vernunft* (which is understood in Kant otherwise than in Hegel) attains this target by thinking all what depends on something else as based upon what does not depend on anything else. The notion of what is beyond any kind of being determined (i.e., the notion of God) is called by Kant the “idea of the pure *Vernunft*”; he argued that the working with the idea of God in just described manner is an *a priori* function of our “metaphysical” reason. This reason differs from the *a priori* relationalisations at the level of the *Verstand*; namely, its *a priori* accomplishments cannot be applied to any sensory

object, they understand it primarily as an incorporation of the general meaning; they give it the same name as they have given to the previous object. Later, when they are driven to discern the second object from the first one, they must give it another name; nevertheless, the general meaning comes necessarily onto the word expressing the new name. It can be said that in this way, the general meaning as a genus have been differentiated into two species.

Reflecting their using of instruments, the people recognise that an object (in the function of instrument) can also necessitate some changes on another object. This enables them to transfer the relation of necessary dependence (or even interdependence) from the sphere of subject-object relations to the sphere of relations among objects; of course, they ascribe the objects which actively influence other objects, a kind of subjectivity, similar to their own.

In being driven to give names to the objects, the people necessarily put this knowledge into the corresponding meanings. They cannot, therefore, to think the objects as being not conform to the above presented form of the “deterministic” *a priori* relationalisation.<sup>105</sup>

The just described process can be understood as a attempt to apply theoretico-historical method to the elucidation of the way in which the causal order of nature becomes self-reflected. It can be interpreted as an actualisation of inborn universal grammar, but also in terms of some developments in the field of pre-conceptual gestalt relationalisations.

In applying what has been reached until now to making clearer the Hayekian problem of transition from the *a priori* classification of phenomena according to the similarities/dissimilarities of their qualitative sensory elements to their being *a priori* classified in accordance with their causal relations,<sup>106</sup> we may say that the universal grammar is able to reflect both the relatively hidden causally-relational aspects of reality and the fact that in the sphere of sensory phenomena, things (and, consequently, their essences) appear to be relatively disconnected.

The ontological reflection of the world as having been accomplished in the Ancient Greek language put emphasis on the latter aspect of reality – because it was immediately apparent. Thus, Aristotle’s philosophy is an ontologisation of the classification of phenomena according to the similarities/dissimilarities of their sensory elements. Nevertheless, as it is

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experience. To explain this kind of the *a priori* functioning of our reason is possible also in the frame of evolutionary apriorism, but it would lead us very far from our main theme.

<sup>105</sup> In this brief outline of the evolutionary origin of the *a priori* causal relationalisation it was not possible to show the way in which the gestalt-psychology explains („from within“) our mind’s ability to put general meanings into words. We must make ourselves content with having a good explanation of this in Hayek’s *Sensory Order*.

<sup>106</sup> It is almost needless to add that our previous arguments refuted the objection that the causal explanation of this transition in the frame of Hayek’s psycho-physical parallelism is a vicious circle.

documented in his theory of four causes, Aristotle did not completely deny the aspect of causal interrelatedness; he just treated it to be subordinated to the (allegedly) time-invariant character of the essences of things.

The testing of this Aristotelian preconception (it proceeded in Descartes' philosophy in the form of the argument of continuous dream) led to the conclusion that the corresponding cognitive faculties are not conform to the preconceived character of really existing objects. In order to avoid the self-contradictions which were shown to be included in Aristotelian ontology, Descartes and his followers put emphasis on the relatively hidden causal (and, generally, relational) order of reality. Thus, what had started to be treated as true reality was the causally determined movement of matter as described by time-invariant natural laws. The full subordination of essences to causality has been accomplished in evolutionary biology – in its basic statement according to which genomes as the generic “essences” of natural kinds arise solely from the causal nexus in nature. Nevertheless, the Hayekian transition to the classification of events according to their causal relations finds its expression not only in biology, but also in Hayek's own cultural evolutionism and evolutionary apriorism; namely, these conceptions subordinate to the causal order everything which before seemed to be independent of it.

Now it is necessary to leave the treatment of evolution of the causal order “from within” so that we can present some important points concerning the teleological order of thought. What must be stressed first is the fact that this kind of the *a priori* relationalisations was for a very long time connected with a preconception which stated that all essential constituents of human culture (such as moral and legal rules, language, economy, religion, state, etc.) arose as results of man's purposeful activities. This preconception, called “constructivistic rationalism”, has been tested and proved to be false (or fallible, to use B. Smith's term). However, the testing of it did not proceed only in the form of scientific discussions, but also in the form of political reforms, revolutions, civil wars, counter-revolutions, etc. The preconception which has replaced the false one is Smithian-Hayekian cultural evolutionism. Since Hayek's version of cultural evolutionism both stresses and respects the limits of human reason, it does not claim to bring any absolute or exhaustive truths; this is the reason why it is possible to regard Hayek's cultural evolutionism not as a mere preconception, but as a conception which can be hardly shown to be fallible.

It must be stressed that the *a priori* teleological order of thought, as taken in itself, is fully invariant in relation to various preconceptions or conceptions which necessarily arise when it becomes reflected. This statement, however, requires developing at least a short outline of the way in which the reflection of the teleological order proceeds in the minds of people who apply it.

Since the teleological structure of human action is derived from the word's ability to make present what is not given as present in sensory perception, the description of the teleological order in language (and, later, in

silent, non-uttered thinking which is derived from language) means nothing but that language reflects a specific way of its own use. Of course, when one reflects the word's function to define an aim, he also reflects the movements of his body as causing some effects oriented to the materialisation of that aim; the effects of his using various instruments are reflected, too. In addition, he reflects his wish to make present (i.e., perceived) what is now present only in his words (intentions). When we take into account that our language is, so to say, pre-determined by the universal grammar to grasp primarily causal relations, it becomes clear that at the early stages of reflecting thought, people interpreted even teleology in terms of causality (as it documented in the Aristotelian-medieval use of the term *causa finalis*); this means that in early reflections of teleology, people themselves, as materialising their aims, are understood as instances of a special kind of causation. The understanding of causality as separated from teleology comes considerably later.

Instead of continuing in this oversimplified version of theoretical history of the reflection of teleology, we turn our attention to the fact that teleology (defined as a specific use of language) cannot be reflected immediately. As it has been suggested, the inner logical structure of the *a priori* teleological order of thought can be found in the interconnections among the meanings of words or concepts which describe human action and its results. Now we should ask: Does this logic exist before the reflection (i.e., before the verbal description) of human action? Or, is it constituted only through reflection? Our recent reference to the Aristotelian *causa finalis* shows that it is the first question which must be responded positively. It implies that somebody is able to act purposefully without being able to define what purpose is in general - and instrument in general. However, on the other hand, his action still proceeds in harmony with the general logic of action. This is possible only under the following conditions: When the acting persons express in their words a particular purpose, they must implicitly put into the corresponding name also the general meaning "something which should be materialised under this kind of circumstances by my (our) bodily activity as extended by using an instrument"; when, using the same instruments (as well as the same bodies), express in their words another particular purpose, they transfer into the corresponding name also the general meaning as described above. At the same time, they ascribe to the names of their bodies and instruments the implicit general meaning "something which under this kind of circumstances enables materialisation of this or that particular purpose".<sup>107</sup>

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<sup>107</sup> Hegel puts it in a similar way: "The individual who is going to act ... has to start immediately, and, whatever the circumstances, without further scruples about beginning, means, or End, proceed to action; for his essence and *intrinsic* nature is beginning, means, and End, all in one. As *beginning*, this nature is present in the circumstances of the action; and the *interest* which the individual finds in something is the answer already given to the question, 'whether he should act, and what should be done in a given case'." (*PhS*, p. 240.)

It is clear that the general and abstract relation “circumstances-body-instrument-purpose” which is present in the just mentioned general meanings can be grasped or actively imposed only on the basis of pre-conceptual (pre-verbal) gestalt functions of our mind. This is documented by the fact that chimpanzees are capable to set up spontaneously some instruments which enable them to reach some aims located within the field of their actual sensory perception.<sup>108</sup> Simplifying somewhat, we may thus say that purposeful action arises when animal instrumental activities (as based on pre-conceptual gestalt relationalisations and confined to what is within the horizon of actual perception) becomes subordinated to language which, as being able to make present what is not present in sensory perception, orients them to the materialisation of something which is originally beyond that horizon.

Now, we can say that they are precisely those implicit general meanings whose reflection requires a great effort on the part of reflecting mind. Even after finding the general meanings “purpose”, “instrument”, “circumstance”, “body”, “value”, etc., the reflecting mind is not always able to grasp the necessary relations among them; namely, the poles or results of a relation are far more conspicuous than the relation itself.<sup>109</sup>

We can refer here to Hegel, who clearly showed that even the evolution of human thought proceeds “behind the back” of involved individuals. Moreover, as K. Engliš stressed, new generations of people accept the treasury of language in the childhood and are therefore unable to grasp clearly the logical interconnections among meanings. Thus, H.-H. Hoppe is true when saying that psychologically, the logic of human action is neither clear, nor evident.<sup>110</sup> It means that in our reflection, we cannot instantaneously grasp the teleological order of our thought; we can only discover it.

However, since we discover only what is already contained within our language, no further sensory experience (be it external or inner) can refute our knowledge. This is why our reflection of the impositional order teleology gives us an *a priori* knowledge (in the sense of synthetical judgements *a priori*). Nevertheless, the character of the teleological order of thought can be fully

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<sup>108</sup> An attempt to explain the imposing of the relation “circumstances-body-instrument-purpose” solely on the basis of inborn universal grammar would have to lead to the assumption that universal grammar includes also the structure of the (self-)reflection of language (in its role of the “seat” of aims), which is hardly acceptable.

<sup>109</sup> In addition, people often apply the inner logic of the teleological order of thought in a fully unconscious manner – as it is in the case of Gossen’s Laws; the fact that even a person who knows them well is not aware of complicated mathematical operations which are connected with the everyday application of II. Law of Gossen, indicates that this application proceeds at the pre-conceptual level of the gestalt relationalisations. In order to support this assertion we can also mention that the verbal formulation of the II. Law of Gossen (especially in the version describing the equalising the marginal units of labour) is unusually difficult.

<sup>110</sup> This, of course, does not mean that logic should be separated from psychology in dualistic manner.

elucidated only via making a full theoretico-historical reconstruction of the forgotten process of the evolution of language.

As concerns the normological order of thought, it has a feature which can be called “quasi-reflectional”. Namely, an *a priori* norm, as being applied by the members of a society during a long period of historical development, can become to be inadequate to the character of some newly developed types of other relations among the individuals living in the considered society.

Such an inadequacy can be exemplified best on the relation between the *a priori* norm of distributive justice on the one hand and the rise and development of market order on the other. The definition of distributive justice was formulated precisely in Aristotle’s *Nicomachean Ethics*: Distributive justice is here defined as (an utmost desirable) state of affairs when the proportion between the unequal merits of various persons is in correspondence with the proportion between unequal quantities of things (goods, money, honours, military distinctions or even social status) which those persons gain as rewards for their meritorious activities in favour of the society as a whole; similarly the proportion between punishments of various persons must correspond to the proportion between their crimes, as concerns the degree of their detrimental influence on the society as a whole.<sup>111</sup>

The Law of Distributive Justice is a formal *a priori* law that is applied by all people at all stages of historical development.<sup>112</sup> Being a formal one, it admits that people living in various societies and cultures would fill it with various contents. This means that people living in a society, fill the formal scheme of the Law of Distributive Justice with what they understand to be a merit or a reward, a crime or a punishment; it is obvious that this understanding differs from society to society.

The Law of Distributive Justice is originally (and frequently until now) connected with a (false or fallible) preconception, according to which it ought to be applied to all types of relations among the members of a society. The testing of this preconception, which – similarly as it was in the case of constructivistic rationalism – proceeded (and also proceeds) in the form of social and religious reforms, civil wars, revolutions and counter-revolutions,<sup>113</sup> resulted in the conclusion that the Law of Distributive Justice is inadequate to the interrelations which constitute market order, and led to another preconception, the classically liberal one, according to which that law can be appropriately applied only within

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<sup>111</sup> *Aristotelis Ethica Nicomachea*, ed. O. Apelt, Leipzig 1912, 1131a.

<sup>112</sup> Since some elementary forms of respecting the Law of Distributive Justice can be observed in the behaviour of various species of collectively living animals, it is certain that this law is based on the pre-conceptual gestalt relationalisations as functioning in both human mind and animal psyche.

<sup>113</sup> See Ján Pavlík, On the Spontaneous Emergence of the Norms of Distributive Justice and the Catallactic Rules, in: *E-LOGOS - Electronic Journal for Philosophy/99*, <http://nb.vse.cz/kfil/elogos/ethics/pavlik-5.htm>.

such groups as family, single firm, farm, army,<sup>114</sup> but not in the sphere of interactions among market agents. Similarly as in the case of the teleological order of thought, the liberal preconception which sets very firm limits to the application of the Law of Distributive Justice, can be regarded as a fully-fledged conception that can hardly become shown to be fallible.

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<sup>114</sup> The very fact that the truly archaic Law of Distributive Justice is universally valid until now (though not as regulating all types of human interrelations) eliminates the inevitability of so-called hermeneutical circle. In other words, it is the cummulativistic character of the spontaneous evolution of the *a priori* relationalisations, which enables us to understand correctly the thought of people who lived in previous historical periods and developed some cultures which differed considerably from our one. (The same is true about the possibility to understand other cultures in synchronic sense.) Similarly, the existence of universal grammar enables one to trespass the limits of his/her own culture (as based on the corresponding ethnic language) and ascend towards universal manhood, freedom and objective truth. (Cf. Paul Johnson, *Enemies of Society*, chapter 12.)

## APPENDIX: A Proof of the II. Law of Gossen

The presentation of a proof of the II. Law of Gossen<sup>115</sup> (which states that a consumer maximises utility by spending a limited income in such a way that the last unit of money spent for any particular good yields the same marginal utility as the last unit spent for any other good) should compensate its unjustifiable absence in Mises' *Human Action*. In contrast with Jevons, this proof does not start from the notion of total utility function; in using the apparatus of functional analysis, it also avoids any expression of utilities in cardinal numbers. At the same time, it is admitted that any description of man's maximising behaviour in terms of continuous functions is merely an approximation to reality.

According to the theory of measurement, the mathematical structure of ordinal scales is characterised by isotonic group  $x' = f(x)$ , where  $f(x)$  is any monotonically decreasing or increasing function; in the case of marginal utility it is, of course, any monotonically decreasing function. It should be added that the form of ordinal scales is invariant in relation to any monotonic transformation.

Instead of Jevonsian total utility function, any monotonically decreasing function  $f(x) = u_m(x)$  will be used which expresses diminishing marginal utility; it expresses the degree of marginal utility coming from the spending of the  $x^{\text{th}}$  unit of money. The corresponding "total utility function" (understood strictly in Čuhel's sense)<sup>116</sup> will be equal to the integral of the function  $f(x)$  within the limits  $(x,0)$ .

The maximisation of consumer's utility according to the II. Law of Gossen will thus require to find the maximum of the following function  $g(x_1)$ :

$$g(x_1) = \int_0^{x_1} f_1(x) dx + \int_0^{c-x_1} f_2(x) dx$$

(The constant  $c$  expresses consumer's limited income.)

It can be relatively easily proved that this function attains its maximum in the point  $x_m$  if and only if

$$f_1(x_m) = f_2(c - x_m).$$

This means that the maximum of consumer's "total" utility is attained when the marginal utility  $f_1(x_m)$ , coming from the spending of the  $x_m^{\text{th}}$  unit of money for the good (1) is equal to the marginal utility  $f_2(c - x_m)$ , coming from the spending of the  $(c - x_m)^{\text{th}}$  unit of money for the good (2).

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<sup>115</sup> The author expresses his thanks to Dr. Pavel Vejchodsky for his help in mathematical formulating the proof.

<sup>116</sup> See Franz (František) Čuhel, On the Theory of Needs, in: *Classics in Austrian Economics: Volume I*, pp. 321-322 (section 270); translated by William Kirby from the German original *Zur Lehre von den Bedürfnissen, Theoretische Untersuchung über das Grenzgebiet der Ökonomik und der Psychologie*, Wagnerschen Universitäts Buchhandlung, Innsbruck 1907 (chapter 6, pp. 173-216); on the importance of Čuhel's contribution to Austrian Economics see Ludwig von Mises, *Notes and Recollections*, Libertarian Press, South Holland, Illinois 1978, p. 57.

Analogously, for  $n$  marginal utility functions it is necessary to find the maximum of the following function:

$$g(x_1, x_2, \dots, x_{n-1}) = \int_0^{x_1} f_1(x) dx + \int_0^{x_2} f_2(x) dx + \dots + \int_0^{c - \sum_{k=1}^{n-1} x_k} f_n(x) dx$$

It attains its maximum when

$$f_1(x_1) = f_2(x_2) = \dots = f_n\left(c - \sum_{k=1}^{n-1} x_k\right).$$

### The proofs

**THEOREM.** Let  $f_1$  and  $f_2$  be two monotonically decreasing functions of one real variable which are defined on the whole  $\mathbf{R}$ ; suppose that they are twice continuously differentiable. Let  $c \in \mathbf{R}$  be an arbitrary, but firmly chosen constant. Then the function

$$g(x_1) = \int_0^{x_1} f_1(x) dx + \int_0^{c-x_1} f_2(x) dx$$

attains its maximum in the point  $x_m \in \mathbf{R}$  if and only if

$$f_1(x_m) = f_2(c - x_m).$$

**NOTE.** The maximum of the function  $g$  need not to exist.

**PROOF.** Let us differentiate the function  $g$ :

$$g'(x_1) = f_1(x_1) - f_2(c - x_1).$$

According to one of the propositions of the classical analysis, a smooth function attains its local extremes in the points at which its derivative is equal to zero. Thus, if there exist such a point  $x_m \in \mathbf{R}$  such that

$$f_1(x_m) = f_2(c - x_m),$$

then the derivative  $g'$  is in this point equal to zero and the function  $g$  attains here, either its local maximum or local minimum. In order to ascertain that there is indeed a local maximum at point  $x_m$ , we differentiate  $g$  for the second time:

$$g''(x_1) = f_1'(x_1) + f_2'(c - x_1).$$

Since  $f_1$  and  $f_2$  are decreasing functions, their derivatives  $f_1'$  and  $f_2'$  are negative (at all points); thus,  $g''(x_m) < 0$ . Therefore (according to a proposition of classical analysis), the function  $g$  attains at  $x_m$  its local maximum.

Since  $f_1$  and  $f_2$  are decreasing functions,

$$f_1(x) - f_2(c - x)$$

is decreasing, too; thus, the equation

$$f_1(x) - f_2(c - x) = 0$$

can have at most one solution. This implies that there exists at most one *local* maximum of the function  $g$  which is also the *global* maximum.

**Q.E.D.**

**THEOREM.** Let  $f_1, f_2, \dots, f_n$  be  $n$  monotonically decreasing functions of one real variable which are defined on the whole  $\mathbf{R}$ ; suppose that all of them are at least once differentiable. Let  $c \in \mathbf{R}$  be an arbitrary, but firmly chosen constant. Then the function

$$g(x_1, x_2, \dots, x_{n-1}) = \int_0^{x_1} f_1(x) dx + \int_0^{x_2} f_2(x) dx + \dots + \int_0^{c - \sum_{k=1}^{n-1} x_k} f_n(x) dx$$

attains its maximum at the point  $[m_1, m_2, \dots, m_{n-1}] \in \mathbf{R}$  if and only if

$$f_1(x_1) = f_2(x_2) = \dots = f_n\left(c - \sum_{k=1}^{n-1} x_k\right).$$

**PROOF.** According to a proposition of the classical analysis (V. Jarník, *Diferenciální počet II*, Academia, Praha 1976, proposition 215), the function  $g$  cannot attain its extreme in the point in which even a single partial derivative existed and differed from zero. The partial derivatives of the function  $g$  can be derived easily:

$$\frac{\partial g}{\partial x_i}(x_1, x_2, \dots, x_{n-1}) = f_i(x_i) - f_n\left(c - \sum_{k=1}^{n-1} x_k\right),$$

where  $i = 1, 2, \dots, n - 1$ . We can see that these partial derivatives exist at all points. All partial derivatives of the function  $g$  are equal to zero just then when there exists point  $[m_1, m_2, \dots, m_{n-1}] \in \mathbf{R}^{n-1}$  such that

$$f_1(m_1) = f_2(m_2) = \dots = f_{n-1}(m_{n-1}) = f_n\left(c - \sum_{k=1}^{n-1} m_k\right).$$

In order to check that it is local *maximum* that is attained at such point, we use another proposition of classical analysis (*ibid.*, prop. 216) which says that it is sufficient to show that the second derivative of the function  $g$  is negative definite; or, that the bilinear form

$$\Phi(h_1, h_2, \dots, h_{n-1}) = \sum_{i=1}^{n-1} \sum_{j=1}^{n-1} \frac{\partial^2 g}{\partial x_i \partial x_j}(m_1, m_2, \dots, m_{n-1}) h_i h_j$$

is always negative for any of the values  $h_1, h_2, \dots, h_{n-1}$  such that at least one  $h_k, k = 1, 2, \dots, n-1$ , is different from zero. In order to prove it we must first have the second partial derivatives of the function  $g$ :

$$\frac{\partial^2 g}{\partial x_i \partial x_j}(m_1, m_2, \dots, m_{n-1}) = \begin{cases} f'_i(m_i) + f'_n(c - \sum_{k=1}^{n-1} m_k) & \text{pro } i = j \\ f'_n(c - \sum_{k=1}^{n-1} m_k) & \text{pro } i \neq j \end{cases},$$

where  $i, j = 1, 2, \dots, n-1$ . We insert these second partial derivatives into the formula for the second derivative  $\Phi$  and simplify and collect terms:

$$\begin{aligned} \Phi(h_1, h_2, \dots, h_{n-1}) &= \sum_{i=1}^{n-1} \left( f'_i(m_i) h_i^2 + f'_n(c - \sum_{k=1}^{n-1} m_k) h_i^2 \right) + \sum_{i=1}^{n-1} \sum_{j=1, j \neq i}^{n-1} f'_n(c - \sum_{k=1}^{n-1} m_k) h_i h_j \\ &= \sum_{i=1}^{n-1} f'_i(m_i) h_i^2 + \sum_{i=1}^{n-1} \sum_{j=1}^{n-1} f'_n(c - \sum_{k=1}^{n-1} m_k) h_i h_j \\ &= \sum_{i=1}^{n-1} \underbrace{f'_i(m_i)}_{<0} \underbrace{h_i^2}_{\geq 0} + \underbrace{f'_n(c - \sum_{k=1}^{n-1} m_k)}_{<0} \underbrace{(h_1 + h_2 + \dots + h_{n-1})^2}_{\geq 0}. \end{aligned}$$

Now we can see that the values  $\Phi(h_1, h_2, \dots, h_{n-1})$  are always negative because the functions  $f_1, f_2, \dots, f_n$  are always decreasing and their derivatives are thus negative. The function  $\Phi(h_1, h_2, \dots, h_{n-1})$  is equal to zero only when  $h_1 = h_2 = \dots = h_n = 0$ .

**Q.E.D.**