

THE CONSTRUCTION OF THE SCIENTIFIC OBJECT AND ITS CONFRONTATION

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ABSTRACT

This paper, written in honour of Academician Mircea Malița, aims to showing that confronting the construction of scientific objects one must not exclude the practice “exterior to science”. Indeed, practice is a condition of knowledge and thus it is integrated in knowledge.

The world, the objects exist independently from us, and of course no one has ever denied this fact. But the form/appearance they present themselves in front of us is depending on our *knowledge* of this form/appearance: on our senses and reason, indestructibly intertwining.

Therefore, our description of the world is according to *how we know it*. Knowledge is advancing, certainly, step by step, it is historical and depends on cultural conditions. Knowledge occurs through analogies and hypotheses, as a result of which man has developed a scientific image about the world, more and more reliable and resistant. The world appears today as *at the same time* simple and complex, unitary and multi-strata, continuous and discontinuous, with autonomies of subsystems and as systems of their integration, and sciences have constituted themselves by *learning from nature* but at the same time considering nature and the world as functioning *as an artificial object*, created by man.

The human being is both “earth” and “heaven”. Concerning our problem of the understanding of the world and the *criteria* of this process, this means that man depends on both its *senses and reason* directed on the world and reflecting, conceiving of/transmitting the world in their manners, and on the *ideas* constructed on the basis of the processes developed by senses and reason: if these processes form the “world 2” of Popper, the ideas form the “world 3”².

If so, how do we know that the world is as in our cognisance? How do we assume that our (scientific) competence is reliable, resilient, resistant? More ardently: how do we assume that the knowledge we assert is valuable?

The present paper addresses just this last question, passing from well-known epistemological arguments (*how* do we know and *what* do we know, especially in the field of sciences) to the *practical* result of knowledge: and this position is not a vulgar one, but follows Aristotle’s concept of *telos*; indeed, *for the sake of what* is realised the colossal corpus of knowledge, *for the sake of what* is made nowadays the huge scientific research? However, the address of the paper concerns only in a brief conclusion that the above questions related to the *telos* of science involve the discussion of social (political) conditions of science. The aim here was rather to substantiating the characteristics of the scientific objects: in order to allude the contradiction between science as “purely intellectual” endeavour – as some ones like to treat it – and science as it is in reality, a social process and thus, an instrument in the frame of power relations.

KEYWORDS: object, thing, epistemology, science, constructivism, truth, correspondence, logical consistence, praxis.

Instead of introduction: what is a thing?

There is a difference, and people may grasp it, between what is asserted about *things* and what is our (or people’s) *representation* about things: namely, people “focus on” the things they are interested of, letting aside the subjective mediation between them and things, *or* things “are” *as they are presented* by those who discusses them. However, though sometimes people are sensitive to this difference, the aspects are so intertwined that in fact is very difficult to separate the *image*,

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² Karl Popper, (1978). *Three Worlds*. The Tanner Lecture on Human Values, <http://tannerlectures.utah.edu/lectures/documents/popper80.pdf>

concepts, deductions and suppositions about things – which, all, have a history and reflect and at the same time shed light on different *Zeitgeists* – from the “real” essence, appearance, constitution, functionality and *telos* of these things.

By making the above difference, there is also another one: that between the *things* named with words and the *words* as such³, the more so the objective things are not only material, but also facts, conditions, states – see “state of things” –, aspects and relations, “occurrences and events”⁴, “plans, decisions, reflections, loyalties, actions”⁵, but (opposite to Heidegger) not only what is immediate.

Briefly – though Heidegger spoke about this as the third “widest possible sense” of the thing – this one (the thing) embodies, as showed above, what previously Kant called: both the *thing-in-itself* (the concept of thing-in-itself as object of thinking, not of knowledge because we cannot know without a scheme of sensibility as basis of our sensible intuition, denotes a thing *exterior* to us, objective⁶ and somehow unknown because we never arrive to understand its rich and deep infinity; but it denotes only this, it is a “*boundary concept* in order to limit the pretension of sensibility”⁷) and the *thing-for-us*, the phenomenon, the only known⁸. Actually and letting aside God referred to by Kant and Heidegger – and certainly letting aside the fact that words are realities too, even entities, if we understand this last word/quality according to the Greek meaning of *to on*/τὸ ὄν, the *true*, in fact *that which is, as both existence and a specific existence of something* (since this

³ Martin Heidegger, *What is a Thing?* (1962 (1935)), Translated by W. B. Barton Jr. and Vera Deutsch, with an analysis by Eugene T. Gendlin, Chicago, Henry Regnery Company, A Gateway Edition, 1967, p. 4: “We distinguish precisely the thing ‘house’ and the word which names this thing”.

In this work, Heidegger was interested about the thing and not about its images within the words. This was not the case in other works, but anyway and though ontology was first for him, language was for Heidegger the house of Being, the bearer of the manifestations of Being.

Having the same leaning to empiricism as Heidegger and, before, Kant, Wittgenstein has made a methodological shift in philosophy with his linguistic turn where “words haven’t for their meaning entities, sentences do not describe a reality (logically) prior to linguistic practice, and mental activity is not a sufficient condition for meaningful speaking”, Alexander Kanev, “On The Nature Of Wittgenstein’s Revolutions Of Philosophy”, in *Wittgenstein und die Zukunft der Philosophie. Eine Neubewertung nach 50 Jahren/ Wittgenstein and the Future of Philosophy. A Reassessment after 50 Years*, Beiträge der Österreichischen Ludwig Wittgenstein Gesellschaft/Contributions of the Austrian Ludwig Wittgenstein Society, Volume IX (1), Band IX (1), Herausgeber Rudolf Haller, Klaus Puhl, Kirchberg am Wechsel, 2001, pp. 372-377 (374).

⁴ Martin Heidegger, *What is a Thing?*, p. 5.

⁵ *Idem*, p. 6.

⁶ “I am conscious of my existence as determined in time. All time-determination presupposes something persistent in perception. This persistent thing, however, cannot be something in me, since my own existence in time can first be determined only through this persistent thing. Thus the perception of this persistent thing is possible only through a thing outside me and not through the mere representation of a thing outside me. Consequently, the determination of my existence in time is possible only by means of the existence of actual things that I perceive outside myself. Now consciousness in time is necessarily combined with the consciousness of the possibility of this time-determination: Therefore it is also necessarily combined with the existence of the things outside me, as the condition of time-determination; i.e., the consciousness of my own existence is at the same time an immediate consciousness of the existence of other things outside me”, Immanuel Kant, *Critique of Pure Reason* (1781), Translated and edited by Paul Guyer and Allen W. Wood, The Cambridge Edition of the Works of Immanuel Kant, Cambridge University Press, 1998, Doctrine of Elements. Pt. II. Div. I. Bk. II. Ch. II, p. 327.

⁷ *Idem*, Doctrine of Elements. Pt. II. Div. I. Bk. II. <A>, pp. 350.

⁸ The revolution made by Kant regarding the object of knowledge was the rejection of the naïve epistemology (of ancients) according to which one may know reality through the means of senses and reason, and the object within knowledge would be tantamount to the real one, thus ontology being anterior to epistemology. On the contrary, Kant has continued the Descartes’ shift towards the subject, by demonstrating that one knows only through experience and that the real object as we arrive to know it is as we have approached to through our experience and knowledge, and thus that it (the object of knowledge) illuminates only the phenomenon.

substantive form of the verb *einai*/to be is the present participle of this verb)⁹, and words avouch only what is true, they representing a special entity, that which confirms the existence (as the first guarantee of truth) of things – here it is not about two types of things, but only about one (the external world to our experience), about the two facets of the same thing according to our active position of knowing (the externality and the experiencing of this externality). Reality *is* for us – it has the features we “see” and assert following our many experiences – according to our ability to understand and relate, and to give meanings, thus to arrive to concepts and representations of this reality. Thus the *thing-in-itself* is not the essence of things, but just their *entirety* (as later on has Hegel insisted), their *wholeness*, and we approach to it when it appears to us as a *phenomenon*, and thus we know it through the medium of our senses and with our reason, gradually. The exterior objective thing (*in-itself*, without attributes, a being that is only a *something*) sparkles and we borrow its light in order to shed it on what is already a sparkling something, a phenomenon: but this is only a poetical image playing around the Greek meaning of the word *phenomenon*; dryly, the knowledge of the objective world is depending on the *subject-object relationship*, on the subject’s ability to disclose the object: to focus on it (through the intentionality of the consciousness, as later on Brentano and Husserl have showed).

Therefore, the exterior *thing* – or something – *is* for us (and even *has* a being), by the instrumentality of our experiences, representations about it; more clearly, our representations – resulting from the empirical experience¹⁰ in many, even sophisticated, ways and logical reasoning – form/construct the *objects* which are “the thing” as they are presented to us or *the always the most precise “copies” of the thing*: because if they would not be so (in a certain space-time frame, obviously), we could never operate with them (*in mente* and in experience) as if we would operate with “things themselves”. The constructed objects corresponding to reality are not so much imperfect copies of “the world as it is”/copies of the objective existence/reality (so, of course, not copies of ideas, or forms in the superior circle of αἰθήρ, see Plato, *Phaido*, 109c-e), but the *only* reality we know and *through the medium of which we designate the external, objective world*. As the only reality we know, the world of constructed objects is the “copy” of the objective world (Plato’s term is not superfluous at all), it is the *reality* historically constructed by humans, but though there are, therefore, two realities (the objective one and the constructed one), in fact there is only *one* objective world and the knowing subject’s subjective relation with it. If the subjective relation is individual – and thus there is no absolute superposition of experiences, neither of theories

⁹ I arrived to this meaning/deduction on the basis of the old Greek dictionary; and after I read about the same theory – that the verb εἶμι, to be, was at the same time copulative and indicative of the imminence and realisation of a fact or thing, thus of the understanding by humans of this situation, they being thus close to the facts or things, and that the participle of the verb (as made, learned, loved) has signified the true character of those facts or things; but this meant that *the true* (not truth) was synonym to *being* (it’s true that) – in Charles H. Kahn, “The Greek Verb ‘To Be’ and the Concept of Being”, *Foundations of Language*, Vol. 2, No. 3 (Aug., 1966), pp. 245-265, republished in Charles H. Kahn, *Essays on Being* (2009), Oxford, Oxford University Press, 2012, pp. 16-40.

The predicative (as the copulative) function of the verb – sending to the *veridical* aspect of reality – are not only ancient, as in Sanskrit (p. 23), but indicates the very interesting double awareness of things by humans: that there is about both the things they speak about, and their relation to these things, via their understanding that in fact two levels of reality exist: that of things we are speak about, and that of our grasping and speaking about those things.

¹⁰ It was advocated that the empirical experience level is – certainly not separated from, but – anterior to concepts, cf. E.T. Gendlin, “The responsive order: A new empiricism”, *Man and World*, 30 (3), 1997, pp. 383-411.

Anyway, the formation and evolution of the ability and richness of understanding in children emphasise, as the evolutionary psychology of Piaget has showed, the *interdependence* and *intertwining* of a *reflective* “first” experience – where the consciousness is rather “passive” – and the internal construction (organisation) of knowledge generated in the reflective experience. No moment has to be neglected, because in fact, this interdependence and intertwining is the psychological basis of the “correspondence between the logos of kosmos and the logos of man” (or even *adequatio rei et intellectus*) as the philosophers have wondered about later.

and meanings of concepts and nor an absolute unidirectional transmission of meanings, but an individual creative processing of information and construction of one's own understanding and meanings – this individual and subjective character does not mean, however, that instead of truth we aim only the viability of our cognisance and that the differences between different viabilities do not warrant the assertion of truths, as von Glasersfeld holds. Certainly, truth is not an objective and exterior entity to us, it is subjectively and socially constructed¹¹, but for a certain problem in a certain temporal and cultural area its truth can be demonstrated through the questioning of the plausibility of different solutions; this truth is not the absolute Truth, it is obviously historical, it may be only a sketch/a scheme/a method or methodology, but it becomes – following its falsification in different manners – a *criterion* towards which the cognisance related to that problem is analysed; it is possible that a certain cognisance or demonstration refute the existing truth-criterion, and then a new quest for truth begins; but we cannot say that there would not be any criteria because the knowledge we operate with is only viable, adaptive; adaptive *to what, how, by whom* and *why*? Therefore, constructivism cannot be so “radical” as von Glasersfeld insists¹²; our ideas are obviously fragmented – because, first of all, of our separated senses and impressions – and they/some ones of them precede the process of knowing irrespective of their names, but this does not mean at all that we can choose arbitrarily our premises and that we arrive alone to viable knowledge, though we arrive to this knowledge, we assume it, we assert it, through our individual analysis in our individual mind and after this individual analysis; but if the community of researchers, and even the general public, are those who construct and verify not only the *viability* – that suggests an absolute subjective/particular context-dependence, even suspect from a moral standpoint¹³ – but also the (relative and historical, and approximate) *truth* that reflects also some irrefutable aspects, with all the methods of refutation, it means that our mind that constructs the ideas is developing in a way “that complements the external structures, and learns to play its role within a unified, densely coupled system”¹⁴.

Accordingly, the subject and the world (the something) are separated, the objective world is independent from the subject, but this one's knowledge of the objective world is not a perfect copy of this world, but the result of the historical, cultural and interpolated complex process of knowing. More: though the subject and the objective world are separated, the knowledge about the world *relates* the subject and the world; *the world is given to the subject through this relation*.

¹¹ It is *epistemological*, “that is, the truth of judgements and assertive sentences”, Tomàs Calvo, “Ontology and Truth: The Aristotelian Legacy”, in Mircea Dumitru, Gabriel Sandu editors, *Truth*, București, Editura Universității din București, 2013, pp. 13-32 (25).

¹² Ernst von Glasersfeld, “Farewell to Objectivity”, *Systems Research*, 13 (3), 1996, pp. 279-296; “Pourquoi le constructivisme doit-il être radical?”, In: Philippe Jonnaert & Domenico Masciotra (eds.) *Constructivisme, Choix contemporains, Hommage à Ernst von Glasersfeld*, Sainte-Foy, Québec, Presses de l'Université de Québec, 2004, pp. 145-154.

Actually, this point of view is the “practical”/“prudential” one; however, the present level of theory of truth, while recognising “the relational character of truth as a semantical relation between language and world” and from this the relativisation of truth and its contextualist approach, considers the concept of truth as a “model” of the correspondence of language to the world (of the “true” to the “is”, Calvo) assumed in the interpretation of concrete sentences/theories – i.e. as truth-models/structures of those theories, and thus criteria of truth analysis of the sentences of those theories; the assumption of different paradigms by different scientists, for example, “reveal, instead of relativism about truth and reality”, “only instances of the relativity of *beliefs*”. More: “factual truth (or truth defined relative to the actual world) is not relative to persons” with all the degrees of probability, verisimilitude, and gradual approach to the understanding of things, see Ilkka Niiniluoto, “Truth: Absolute or Relative?”, in Mircea Dumitru, Gabriel Sandu editors, *Truth*, București, Editura Universității din București, 2013, pp. 85-99 (95; 93; 90, I underlined; 86).

¹³ As it is showed by the personage Pilate in Pascal Engel, “Une réponse à Ponce Pilate”, in Mircea Dumitru, Gabriel Sandu editors, *Truth*, București, Editura Universității din București, 2013, pp. 33-44.

¹⁴ Andy Clark & David Chalmers, “The extended mind”, *Analysis*, 58, 1, January, 1998, pp. 7-19 (12).

And while the thing is more or less vague, imprecise, the *constructed objects*, always *concrete* – they themselves not only material or palpable, but also relations etc. – are, although historical, circumscribed. But, again letting aside philosophy, linguistics and the cultural studies discussing the language and cultural mediation of the circumscribing and meanings of objects (therefore, the objects are only constructed), the ultimate goal of the subject is not to insist on the relativity of the objects and their knowledge, nor on the problems of the knowledge of objects, but to understand the real objective world: “to discover *what* things are”¹⁵.

In this process, there certainly is what the scientists themselves have discovered (Eddington quoted by Heidegger): *concomitant* different types of constructed objects; the constructed objects of *science* and, on the other hand, different *common* constructed objects from a complex cultural standpoint. These common constructed objects are very different, superposing each other, intertwining or being separate : that called by Aristotle σύνολον, the *concrete face of form making the real thing/concrete substance* (i.e. through the adding of form to matter), so the *concrete* model of the *concrete* thing, as the *form* is the *abstract* model of the same thing¹⁶; or that termed by Goethe as *Urphänomen*, an essential scheme of an object/of a whole but grasped in a sensorial manner, an essential image that can be grasped by the senses¹⁷; or, but also, the cultural collective objects (transposed into precise words and metaphors), the individual communicable objects created in individual experiences, the individual only partially communicable objects (the qualia), and perhaps other objects.

The objects are always concrete: like Aristotle’s substances, or as Heidegger declared them (“the things stand in different truths”¹⁸) as only *particular/individual*, not as an exemplar of a class studied by science (this butterfly from the class of butterflies is, for zoology, an exemplar/a model of all the butterflies from that class), because every thing exists/has a position within a certain space and time – though time, space and the “this” are not determinations of things but arise from our relation to them (for we too lie in a space-time where we refer to and encounter the things) –; or as a *class* of concrete things, or as a concept designating in the last instance something “palpable”, namely having an understandable *meaning*, autonomous from the subject.

A thing is *objective* because it is “thrown against you”¹⁹ and is present in front of you, but in order to understand its peculiarity we need to understand that it is “constructed”²⁰: bearing its qualities and actions and being only the unity of these qualities and of these actions, though they are changeable. Heidegger’s first conclusion is not the dependence of things upon the subject – this already would be a triviality, after Kant – but their objective construction and the role of the subject to *discover this construction*. Truth is the un-concealment of the objectivity, “the disclosure of the thing”²¹.

But certainly, the second observation is, through the problem of the historicity of the truth, that things are constructed by the modern man; i.e. not (only) as mediated through/after the process of knowledge, so being genuine before the process of scientific research, for example, that construct

¹⁵ Martin Heidegger, *What is a Thing?*, p. 8.

¹⁶ See Ana Bazac, “Fidelity towards forms: an ontological approach” I, *Agathos: An International Review of the Humanities and Social Sciences*, Volume 5, issue 2, 2014, pp. 52-62.

¹⁷ See Ana Bazac, “The approach of space and an inter-war anthropological model”, *Analele Universității din Craiova, Seria Filosofie*, nr. 33, (2/2014), pp. 127-161.

¹⁸ Martin Heidegger, *What is a Thing?*, p. 14. And follows: “From what point of view should we decide the being-a-thing of things? We take our standpoint in everyday experience”.

¹⁹ *Idem*, p. 26.

²⁰ *Idem*, p. 32.

²¹ *Idem*, p. 40.

them, but as transformed – “prepared beforehand”²² – even before the research: by putting in front of this research *reduced, simplified* things, like the plants and animals reduced to mere machines/their functionality²³/models. However, is this aspect – though Heidegger’s intention was to criticise the modern science and technology – not a banal form of the *ab initio* preparation of things through concepts and ideas/hypotheses? Anyway, Heidegger has opposed the richness of things (as their essence) – emphasised by the ancient Greek thought that has discovered also: the mediation and peculiarity of language and logic, and the essence of truth as correspondence with the essence of things, as well as the primordially of the *ontos* over the human knowledge – to the modern tendency of reductionism: where the thing is a simple “object” facing the “I”²⁴ that appears as an “unconditioned” subject.

Therefore, the things are always concrete: as, before and after Heidegger, in Reism²⁵; or, the most important, as in Hegel²⁶, the richness of the concrete and, at the same time, the double-mediated knowledge of this richness, as well as the double hypostases of things, as individual and as universal; or as later on Aranyosi²⁷, interpreting Wittgenstein’s *Tractatus*, described the logical space formed by *n* logical spaces/all possibilities and where things exist only as they appear in a concrete region of the logical space and are designed not in general, as Being, but as suchness, as Being-in that manner; nothing exists without existing in a certain manner. Or, as Bryant²⁸, considering the objects as dynamic systems related to the world through operational circumscribing, but which *may be studied without being reduced to the access to them*, and underscoring that the interposing of epistemology between us and ontology was the result of the rise of modernity (“the birth of capitalism, the erosion of traditional authority in the form of monarchies and the Church, the reformation, the rise of democracy, and the rise of the new sciences”) where “questions of knowledge were *political* questions, simultaneously targeting arguments from authority that served as a support or foundation for the monarchies and the Church – the two of which were deeply intertwined – and laying the groundwork for participatory democracy through a demonstration that all humans have the capacity to know (Descartes and perhaps Locke) or that knowledge is not possible at all, but consists of merely custom, sentiment or opinion (Hume)”²⁹.

Approaching the objects

As we know, the naïve objectivism of many of the first philosophers and continued by the euphoric naïve promoters of the modern science consists not only of the assumption of the existence of the external objective world – au fond, this assumption is assumed by all, common people and sophisticated intellectuals too, irrespective of their worldview (even by Plato) – but also the belief that man, the thinking subject, may know this world as it really is, through his senses and reason. However, philosophy and (later on, but step by step) science were interested and questioned just the ways and means of the knowledge of the world as well as this knowledge as such.

The first results have consisted in the emphasis of *senses* as translators of the concrete things surrounding man. Then, the huge role of *reason* with its *logic* and with its bearer, the *language*, was

²² *Idem*, p. 41.

²³ *Ibidem*.

²⁴ *Idem*, p. 47.

²⁵ See *Reism*, Stanford Encyclopedia of Philosophy, <http://plato.stanford.edu/entries/reism/>.

²⁶ G.W.F. Hegel, *The Phenomenology of Mind* (1807), A. Consciousness, I: Certainty at the Level of Sense Experience –the “This”, and “Meaning”, <https://www.marxists.org/reference/archive/hegel/works/ph/phaa.htm>.

²⁷ István Aranyosi, *God, Mind, and Logical Space: A Revisionary Approach to Divinity*, Palgrave Macmillan, 2013.

²⁸ Levi R. Bryant, *The Democracy of Objects*, Ann Arbor, MPublishing, University of Michigan Library, 2011.

²⁹ *Idem*, p. 16.

the object of people's wonder. Consequently, two lines of thinking were developed: one was the *separation* between the external object and the subject, and the other was the *inequality* between senses and reason and their *succession* in time/in the formation and evolution of the human understanding of the world.

At the same time, the first line of reasoning led to at least two other effects: the *scepticism* that the external world can be known and the leaning to the *subject* as the only wellhead of both knowledge and certainty that the world is as it appears.

Anyway, all of these ideas have had an evolution: from the *ancient unitary* and *harmonious* approach of man's sensuous and rational abilities, through activity (Aristotle), applied over the material world that, as the substrate of everything, including of man, may be understood from its concrete appearances toward its essence and the universals; to the *modern* moment when the rising sciences have *decomposed* and *separated* the elements of the world analysed within their *fragmentary* approach: the moments of knowledge – sensations, perceptions, representations, ideas, culture – were *separated*, and thus the weight in the subject-object relation was transferred to the *subject*; the certainty concerning the external world became the certainty of the isolated I with its *cogito*; and then, the same certainty concerning the external world became the result of scientific decomposition and mathematical quantifying that have configured a specific, rather fragmented and abstract reality, different from the unitary world.

The 20th century began to surpass this view. Heidegger spoke about man as an intricated relation with the things which are “given”, and about the objects as the results of their “encounters” with man: the meanings of objects are given by man, while the ability to give meanings is the result of man's original/experiential relationships with the world; *this ability is never depending only on man*.

But the modern moment has contained (at some ones, as noted above) the fundamental role of reason bending on the real world that passively disclosed itself under the lights of the human intellect; and at the same time, the modern moment was linked to the extreme power of the external world that, through the human experience, could but generate copies which, in their turn, did not give too much space to abstract thinking: this was the triumphant empiricism.

Kant had answered to these two extremes by demonstrating that the power of reason has its source and limit in the human experience and sensuous contact with the external world, but also that this contact already involves the power of reason: this one is the transcendental condition of any experience; “Experience is possible only through the representation of a necessary connection of perceptions. Experience is an empirical cognition, i.e., a cognition that determines an object through perceptions. It is therefore a synthesis of perceptions which is not itself contained in perception but contains the synthetic unity of the manifold of perceptions in one consciousness, which constitutes what is essential in a cognition of objects of the senses, i.e., of experience”³⁰. Reason makes possible the abstract concepts (like causality, for example) as necessary and universal judgements only proved in the real world, derived from experience. But a part of experience is reason. And though “all judgments of experience are empirical (i.e. have their ground in immediate sense-perception)”, according to the source of their validity they are, or rather have two versants: as *judgements of experience* which are objectively valid (“based on immediate sense perception”) and as *judgements of perception*, “valid only for us (i.e. for our subject)”. And Kant continues: “Later on we make them refer to an *object*, and mean them to be valid for all people and for ourselves at all times”³¹.

³⁰ Immanuel Kant, *Critique of Pure Reason* ((1781)1787 second edition improved), Translated and edited by Paul Guyer and Allen W. Wood, Cambridge, Cambridge University Press, pp. 295-296.

³¹ Immanuel Kant, *Prolegomena [= Preliminaries] to any Future Metaphysics that can Present itself as a Science* (1783), Jonathan Bennett, 18, p. 26.

The object is certainly objective, outside us, but its understanding – its “existence” as it appears to us – is translated with the help of senses and reason.

But if so, the subject itself is no more an independent entity towards the objects, but constructed following its experiences, its connections with the eternal world, with the senses and with the human intellect. Therefore, *both* the object and the subject are *constructed* through their complex and multiple relationships.

What kind of object?

First of all, the objects are macro: or, better, *mezzo* – medium size, observable only through senses, because the macro (celestial) objects are observable only through instruments –; they are, obviously, in the three forms of aggregation of *matter* (and the old Greeks have edified on liquid and gas beautiful ontologies), but the “prototype” of objects was *solid* for the modern science; only from this level have the scientists descended or ascended to micro and macro.

All these objects had *stretch*, they were, as Descartes said, *rei extensae*, opposed to the only one special type of object, *res cogitans*, the human mind.

But soon enough, and not only from modernity on, the main quality of objects appeared to be not the constituent matter – since this matter was the basis of everything, thus not this basis (at least until it could be decomposed and understood scientifically, and not speculatively) was the end of the scientific research, but just its concrete results: as the Aristotelian *substances* and *organisms* of animals – but the *relations* constituting the (concrete) objects. These relations were the *genus proximum* of the later scientific laws.

Modernity was, certainly, the epoch of the constitution of *scientific* explanations and thus of the development of priority of relations towards “matter” – priority both at the ontic level and the epistemological one, where a certain autonomy of relations towards their material basis led to the ulterior methodologies of structures –: this priority was related to the progressive mathematization of science where, as Bachelard has observed, the mathematical object is not only a form/manner of expressing the real interdependences, but rather a construction/a “new” *content*.

However, on the one hand, long time the *inertia* of search for “the last” inherently material “bricks” – epistemologically, search for “the last explanation” – has opposed to the relational explanation: as Newton’s conceiving of the space as *substantial* characteristic of the physical world, and independent from the objects, towards the Leibniz’s conception where space was *substantial* too but depending on the relations between objects³²; and long time this quest for “substantiality” did exclude the constructed character of concepts and theories: only Kant has provided this constructivist view, calling *ideas* the transcendent representations – i.e. which “cannot be projected in an image, something that can be intuited”³³ – arising from the procedural potentiality of reason, and doubling the *ideas* with *intuitions*: immediate knowledge resulted from the conscious experience of man; all theories and concepts were seen “critically”, as resulted from “reason” which “has insight only into what it itself produces according to its own design”³⁴.

On the other hand, the development of sciences has led to the *complementariness* and *interdependence* of theories of objects as matter and as relations. Only historically we are the witnesses of opposed theories from this standpoint: today³⁵, the objects as relations cannot be

³² Ana Bazac, “The approach of space and an inter-war anthropological model”, quoted journal.

³³ Martin Heidegger, “On the Essence of Ground” (1929), *Pathmarks*, Edited and translated by William McNeill, Cambridge, Cambridge University Press, 1998, p. 117.

³⁴ Immanuel Kant, *Critique of Pure Reason* (1781), Translated and edited by Paul Guyer and Allen W. Wood, Preface to the second edition B, p. 109.

³⁵ But in Aristotle too, the substance was the relation between matter and form.

understood without their “static” and material characteristics, while these ones cannot be understood without their dynamics and relational constitution.

Therefore, the objects are *relations*, where the continuous gives the structure/theory of “self-regulator system of transformations”³⁶, *processes* (reversible and irreversible), *transitions*³⁷ from potentiality to actuality and virtuality, or only *potentiality*, *virtuality* (as the virtual particle, that is not potential, but a transient fluctuation showing some characteristics of an ordinary particle but limited by the uncertainty principle, so with a very short life), *actuality*. The objects are dynamic systems in relation with the environment (but, certainly, we can conceive of isolated systems, in order to better understand their dynamics).

The relational characteristic with the environment supposes that the objects are related to the subject too. In other words, we can study the object without being disturbed by the fact that the object is being mediated by our knowledge.

The objects as contents

The object is not only the *concrete* thing, not only the *chosen* thing – i.e., that we are focusing on with our consciousness that is in fact intentional –: it is a *problem* (and people are always conscious of it) and thus, a *content*.

What does this mean? The example of the concept of “human nature” is revealing. As we know, the modern discovery of the *context* and its power to structure the human thoughts and acts has led to the replica of the supporters of this discovery to the traditional essentialist promoters of the idea of human nature: “no, there is no such thing as fixed human nature (constituted from reason, or given by God and being a humble mixture of clay and spirit), because man is the result of its relations with the environment, including with his fellow humans, and thus man’s responses are always dynamic and adaptive to a mobile milieu”. The existentialist thesis seemed to lead to relativism and neither the beautiful emphasis of the *situation* and man’s capacity and duty to construct and change it did the essentialists to be more conciliatory with the relativistic destroyers of the necessary stable.

But is really a conciliation of essentialism and existentialism possible? The psycho-philosophical theory that put the problem of translating the concept of human nature (or human essence) as *contents* of the human being has showed rather the possibility of their continuity. The content is always concrete and, thus, relative: consequently, the translation of something supposed to be universal into something which is not is absurd. Certainly, the constitution of man from its biology, its feelings and ideas, as well as the framing of feelings and ideas by cultural historical patterns is universal: but this universal (description) is not the content of the human being. Because the content is *lived* and is created by living beings, and living means not only to be “patterned” by biology and culture and social roles, but especially to experience the patterns in a changing environment and thus to give *original* answers (just by controlling the social roles and the interference of biology and culture): “To *live* is an experiential process, a necessarily creative process, a feat”³⁸. A creative process, as Bergson showed before³⁹.

The experiential process is felt, is difficult – with all the frames and patterns of biology and culture – it is both verbal and implicit, both bodily and conscious, and feels *situations* (remember

³⁶ Jean Piaget, *Structuralism* (1968), Translated and edited by Chaninah Maschler, New York, Basic Books, 1970, p. 36.

³⁷ An example of objects as transitions is information.

³⁸ Eugene T. Gendlin, “Neurosis and human nature in the experiential method of thought and therapy”, *Humanitas*, 3(2), 1967, p. 141 (pp.139-152).

³⁹ Henri Bergson, *L'Évolution créatrice* (1907), Paris, PUF, 1959, 86e édition ; and « La conscience et la vie » (1911), in H. Bergson, *Essais et conférences*, Paris, Félix Alcan, 1919, pp. 1-29.

Sartre) (and not feelings). This feeling of the situations transforms them into problems: so, at the level of consciousness. How are they solved? They are only on the basis of this consciousness and also only when the solving means the accomplishment of the *telos* of facts and situations conceived by people. Consequently, the solving inducts not only biological (culturally framed) adaptation and fulfilling of functions and roles, but also the *contentedness* of the individuals, the *joie de vivre* as Bergson drew our attention⁴⁰: another feeling but also *values* /a feeling involving values and the observation that the values shared by the individuals “are true”, i.e., are not only shared by many other individuals or society but also that the realisation of these values leads to the betterment of experiences and their frame.

The *contents* of the human nature involve all these feelings in experiencing: because without them the vital *adaptation* is not possible; and thus the contents have not only a temporal, but specifically an *anticipative* tendency, as already Kant and Hegel have noticed, as well as the neurophysiological researches about the passing from the material origin of the “world 2” to this one and the “world 3”, if we use Popper’s formula.

The human experience has its truths, formulated just in the dynamics of experience, with words, at the logical level, but also at the level of the implicit, as a permanent process of revision, of ability to grasp the problems and to choose the answers. As a result, the human experiencing creates its own space of freedom. Indeed, “freedom is only that hard-to-find next step of words or acts which carries what we are *further* and resolves it, and only that sort of ‘making ourselves’ is real”⁴¹. This space of freedom, this anticipative state of the whole experience as subordinated to the continuation of solving in front of ever new situations is the content of multiple contents of experience: the *content* of the human nature. The human essence – as a simple model of intertwining of biological and cultural – is no longer enough in order to understand the humans, but it “resists” as it is: a simplified and a-historical model.

But we can take also another example: that of the culturally different focusing on the “essence” of things. For example, the object is one and universal – the human *body* – but its analysis and the interest concerning its parts and aspects are different in the ancient Greek and Chinese medicine⁴²: the result is highly subjectively constructed worlds, following different signs of the body but refining their understanding through experience that, in its turn, strengthens and creates patterns/theories substantiating the ways experienced before and again. The manner to see the object, to focus on some signs and not on another ones, is related to the general worldview/philosophy – and their social conditions⁴³ – of a certain historical cultural area; for example, the interconnectedness of the energetic points of the organism, realised by the blood – and sensed through pulse – is related to the Asian holism where the parts live because of the life of the whole; in the Greek culture and perhaps letting aside Aristotle, the whole is only a means, the goal is the individual autonomous will: this was expressed as attention to the muscles, while in the Chinese medicine the attention was directed to veins, blood and breath. But these different medical

⁴⁰ And not simply as pleasure, said he, though the pleasure is the sign of life/rather the phenomenon the life has given to man in order to be felt. Later on, Ladislav Kováč arrives to the concept of *hedonotaxis*, i.e. impetus to escape suffering, the result of self-awareness and the new evolutionary force of emotions where the hedonic utility and experiencing pleasure have become an end in itself, “The Biology of Happiness”, *EMBO Reports*, (2012) 13, pp. 297–302;

⁴¹ Eugene T. Gendlin, “Neurosis and human nature in the experiential method of thought and therapy”, p. 151 (I underlined, AB).

⁴² Shigehisa Kuriyama, *The Expressiveness of the Body and the Divergence of Greek and Chinese Medicine* (1999), Revised Edition, New York, Zone Books, 2002.

⁴³ Geoffrey Lloyd and Nathan Sivin, *The Way and the Word: Science and Medicine in Early China and Greece*, New Haven, Yale University Press, 2002.

views – where “alternate visions of the body reflect alternate readings of the vital self”⁴⁴ – challenge even the concept of truth: this one once more appears to be *multiple*, not just opposite – supporting the conclusion of moral relativism and of scepticism and impotence of reason – but rather *complementary*, strengthening the possibility of truth and knowledge of the objects which are in this situation more coloured, with a richer content and, thus, reality. It is the same with philosophy: the Greek aimed at understanding the causes (causality), while the Chinese – rather the correlations.

Therefore, the contents of objects consist of varied *meanings*, made obvious as *qualities*, *aspects*, *quantitative measurement*, *relations*, *correlations*, *dynamics*, *processes*. The more these aspects are “dis-covered”, the more the meanings or contents of objects are appearing more clearly. In this manner, the world appears more precise, different from the initial impression of vagueness of a (primary holistic) system of things.

It is very important to note that there is no identity between the first impression generating (a necessary, in present) holism/the first *idea* of holism and the scientific objects realised as (temporary) final steps of the modern scientific research, and also the present *idea* of holism: because the initial idea of holism was deduced with the help of analogies and imagination, while the present conclusion of holism is the result of scientific *demonstrations* and constructions, and not of the primary ideas (even though we reduce – and especially when we explain to laymen – the complex theoretical constructions to simple, primary ideas).

Science advances in the profundity of the world, emphasising new meanings related to new “objects”/new aspects (as new objects) in different new areas: “little” infinity (“starting from nothing”) in quantum or between 0 and 1, “big” infinity, structures and strata of reality. *Topologically*, all of these are explained step by step, from near to near; *logically* or *philosophically*, there is about *structures* of reality (made intelligible as concepts and modes of inferring, so there are, “for the same structure”, two kinds of reality: one, that which it is spoken of, and one the linguistic stratum) whose truth⁴⁵ is the result of *both* the *internal coherence* of cognisance and the *correspondence* with the real facts. The result of science is the scientific object, *true* because it is the consequence of truth generating processes, cross and multi demonstrations of the correspondence of theoretical and factual structures and strata of reality. Truth is the sign of the scientific quality of a theoretical object, because *in science* we arrive to know only what is true. But since truth is a permanent demonstration, the theoretical/scientific object proves to being true by acquiring of concrete qualities and meanings through both logical and factual means. Neither the true premise – a true theory – of an object (a theory), nor the logically correct inferences, and nor the demonstrations of correspondence are not, separately, enough for the truthfulness of a theoretical object. All these conditions give *together* the system of *criteria* for the scientific objects.

Heidegger has warned that an object – meaning a precise content – may become again a vague something, when it no longer carries the solving of *further* problems: just because it is no longer understood in its habitual frame of *functions*. For example, science constructs objects in order to help people to fulfil necessary activities. But when the constructed objects impair these activities and the *telos* of man⁴⁶, we can conclude about the misuse of objects⁴⁷ and their loss of meanings: their re-transformation in “something”.

⁴⁴ Shigehisa Kuriyama, *op. cit.*, p. 192.

⁴⁵ Once more, truth is the quality of only the propositional knowledge, see Duncan Pritchard, *What is this thing called Knowledge?* (2006), 3 edition, Abingdon, New York, Routledge, 2013.

⁴⁶ See Ana Bazac, “The philosophy of the *raison d'être*: Aristotle’s *telos* and Kant’s categorical imperative”, *Biocosmology – Neo-Aristotelism*, Vol. 6, No. 2, 2016, pp. 286-304.

⁴⁷ Raymond Malewitz, *The Practice of Misuse: Rugged Consumerism in Contemporary American Culture*, Stanford University Press, 2014.

How to arrive to objects

Once more, we must not forget the history of knowledge/science. First, the things seem very complicated (anyway, they are not known) and thus they are explained (rather metaphorically) in this complicated manner: simply included within the big whole, while the technological transpositions, inherently distinct constructed entities, are scarce. Then, by being the objects of curiosity, things are understood by simplifying them: one arrives to the “principles”, then to laws, and to “simple” realisations (diode, magnet, antenna, even machines of the first industrial revolution, or even the computing machine). Here is not about reductionism in the pejorative sense, but about the first steps of understanding through *differentiation*, *separation* and *simplification*. But then the objective interdependence of things pushes to the focusing on this interdependence and to the reintegration of fragmentary research and separated objects. It is a return, in *spiral*, to the integrated and holistic approach that is now demonstrated, not guessed.

Or, in other words: a) first, the understanding is vague, the coherence is unitary, holism, everything matches everything; b) this image cannot be transposed in rigorous words: this is only “understanding”, not knowledge; c) for knowing, the whole must be decomposed, transposed into words – so, words must be found/constructed –, reasoning must be realised; d) first knowledge – (let say, related to the advent of modernity, though I am not interested here in the historical localisation – inherently fragmentary); (the cliché that is not interested in the understanding of the real correlations, but that is a simple use of words “as sign of knowledge”, belongs to this modern fragmentary and isolated type of knowledge); e) internalisation of this first knowledge, the linking of things, search for profundity, for significances and intertwining of causes and processes; understanding of structures and a structured knowledge; f) the world/the world of cognisance become more and more complicated, but ordered – as much as they can be – with laws, mathematical demonstrations, which, all of them and together, offer a complicated architecture of knowledge and, at the same time, image of the objective world; many aspects of this architecture and of this image are still separated; g) but the above process of internalisation and the problems arisen from the above simultaneity of complication and fragmentariness require and lead to a new focusing on integration and holism; in this dynamics, one arrives to new simple principles, *demonstrated* under rigorous scientific and epistemic conditions.

Thus, to “arrive” to the present scientific objects means to travel through the history of the scientific⁴⁸ knowledge, and to understand the level humans have arrived at. Three remarks should be added:

- the first is that however useful and thus verified are the new objects, they are not copies (“perfect copies”) as the concepts/cognisance/representations were considered in the naïve objectivism, because they are only *models* (structures, selective architectures, collections of some qualities/ relations/ processes); in the naïve objectivism, people have considered their notions and propositions as naturally perfectly superposing on the natural objects (Heidegger pointed that “natural” as that is “self-evident’ in the realm of everyday understanding”⁴⁹. But the “everyday familiarity” is historical and local, it is not self-evident);
- the second is that, as the goals of knowledge and the objects of knowledge become more complicated, so the truth becomes/ is less and less immediately evident; this is the reason

⁴⁸ Here, Plato and Aristotle’s understanding of science as founded, valid, true *knowledge*, not only plausible but demonstrated and verified – in this, knowledge is more than *belief*, however grounded it would be – is enough.

⁴⁹ Martin Heidegger, *What is a Thing?*, p. 39.

(and result) of mathematical “translations” of the “real”⁵⁰, of measurements and experiments. And indeed, the measurements and experiments are necessary only when they add proofs and demonstrations to the hypothesis/theory, or are not useful when they supply new examples that add nothing to the theory⁵¹; but if they arrive to a systematic demonstration, it is no reason to reject them in the name of eventual other new tests or proofs which in fact cannot annul that demonstration; anyway, the difficulty and intermediary steps of demonstrations, the non self-evidence of theories have led – but they must not lead – to both a moral relativism concerning truth and a cognitive scepticism, with important epistemological and practical results;

- the third is related not to the old search for wisdom in a reduced number of principles, but – paradoxically – to some present dreams concerning the possibility to explain everything through one principle, or to explain “the system” through one principle. In reality, a hierarchy of principles could explain the architecture of structures and relations of a system, but only if we precise the level of this hierarchy: a general methodological/cognitive level or a specific level related to the objective system had in view. The methodological level does not involve many problems, but the specific level indicates that the hierarchy cannot be reduced more than it is already reduced.

The evolution of science – related to the evolution of the constructed object

Quickly, we can remind that there is a *transition* from the ancient holism to the present holistic (only) *tendency*.

In the Greek antiquity, the separation of science from philosophy was very weak; the object of intellectual curiosity was the *natural* one, given by senses, and the speculative constructions created by simple intuitions based on analogies. *Everything was related to everything* – this is the ancient holism – at the same level of reality (let say, the *mezzo*) and between the levels: the micro with the *mezzo* and the macro. Man was intertwined with nature, and thus the *continuous* was favoured towards the *discrete* which depended just on this continuous. The intuition of relations, of interdependence, of harmony – this was the *simple complex* – without the scientific knowing of reasons of these relations and harmony, but the tableau was plausible from a rational standpoint. With all the metaphors/metaphorical language that seem to contradict the following phrase, the tableau was constructed however without reference to an extramundane authority, but based on and generating the belief that the human *logos*/rationality is tantamount to the *kosmic* one.

The second moment, after the ancient holism, was the fragmentation and specialisation of modern sciences (from the 15th to 19th, even the first half of the 20th centuries): the separated study of levels of reality, favouring the *discontinuous* towards *continuity*⁵²; this is the *complex simple*: separation of structures from relations, separation of man from nature, the architectonics/the structure is the sign of a high abstractisation and construction and re-construction of the object. Relation, reciprocity, functionality: unidirectionality is an extreme case. The main preoccupation: to work/demonstrate *laws of systems*, which, on their turn, lead to the comparing of laws. Separation of science and philosophy, with not too good consequences for both: but without this moment of

⁵⁰ Mathematics is not a conflict – between measures, or in the solving of problems – but an accord: just for this reason is it applicable, said Grigore Moisil, in Afrodita Iorgulescu, Solomon Marcus, Sergiu Rudeanu, Dragoş Vaida (editors), *Grigore C. Moisil și continuatorii săi / Grigore C. Moisil and his followers*, Bucureşti, Editura Academiei, 2007.

⁵¹ Emile Durkheim, *Les Règles de la Méthode Sociologique* (1894). Paris, Les Presses Universitaires de France, 16e édition, 1967, p. 77.

⁵² See even the quantum mechanics where a particle can “exist” / can be studied without connections to the rest of phenomena.

scientific demonstrations, construction of scientific means, and rigorousness, the next (tendency of) holism would be only declarative⁵³. From philosophy, but rather from the inside of science, this moment generates the awareness of the limits of fragmentariness and “scientism”.

The third moment is related to the expansion of the scientific object: the necessity of the understanding of functionality, in laws, supposes the environment of the system too, thus an *expanded* system; while following this object, the process of knowledge is better understood. In the inter, multi and trans disciplines, arisen in the second half of the 20th century, the integrative and holistic characteristics of the objects are *demonstrated*. But though the tendency to integration of philosophy and science was suggested at the beginning of the 20th century and in its first half, though this would mean a “return”⁵⁴ to the Greek spirit where man was a part of the kosmos⁵⁵, today we do not yet have a large and holistic institutionalised view able to coordinate, critique and integrate the yet separated and narrow researches. From this standpoint too, we live in a *transitional* epoch: but a scientific holism is as much important as the structures we focus on usually.

The historical evolution of the scientific knowledge does not annul the *dialectic* character of every stage, with its pluses and minuses, and of the evolution of science as such. Some methodological remarks concern that:

- without the separated focus on, bracketing the *holos*/the environment of the studied system/the system of systems, the sciences would have not been successful in the understanding of the many existing and created objects. The success of knowledge means the solving of concrete problems, from near to near, irrespective of how abstract are they and the means of solving;
- the fragmentation and separation of the scientific objects have lead to a dogmatism of these ways;
- the inter, multi and trans approach do not exclude the deepening of specialisation;
- the integrated explanation of the existence means unified theories integrating the peculiar characteristics of different objects and holism; the *substrate* is not that of the “last bricks”/relations, but *the whole*; for this reason, a “theory of everything” cannot be reduced to a single relation;
- the process of knowing the mezzo and macro has led to decomposition and separation (thus, the process was from the complex to “simple”); once arrived to the simple, a (new) process, this time of re-composition, or articulation of the complex arrived (thus, the process was from the “simple” to the complex); but the end is that of unitary principles; however, all of these are only theories, thus constructions;
- during the process of the knowledge of complexity, from the point of view of *logic* one passes from the first stage, where the contradictions of the system are grasped and the logic is that of the *excluded middle* and of *choice* between the two alternatives, to the second stage, where the *included middle* logic of unity does not annul the contradictions but includes them in an expanded object and knowledge.

⁵³ It's already the idea of Peter Kropotkin, in P. Kropotkin, “The Teaching of Physiography”, *The Geographical Journal*, Vol. 2, No. 4, Oct. 1893, pp. 350-359.

⁵⁴ Obviously and as it was already mentioned, it is a return in *spiral*, based on the new *questions*, objects and demonstrations of science. It is not about a return to only a metaphorical explanation, since science has tried just to transpose that metaphorical explanation into rigorous scientific demonstrations.

⁵⁵ P. Kropotkin, “The Teaching of Physiography”, *ibidem*.

From Kant's constructivism

That the quantum mechanics has demonstrated the dependence of knowledge on the subjective world of observers and mechanisms/tools, is already a well-known cognisance. But quantum mechanics – and moreover a phase (the present phase) of knowledge – is not the last Truth about knowledge, is it not? It certainly questions the naïve empiricism, as well as the *a priori* rationalism, but that's all. Knowledge means its progress starting from the limits of sense organs to the understanding of what is *beyond appearances*.

In this process, what is beyond appearances was conceived of as existing in *far away* strata of reality: in the deep down of material things – the atoms – or in the heaven of ideas: specific entities as *parts* of the world or of objects. These “last bricks” were thought to be “the essence” hiding under the coloured surface of appearances.

Later on, the essence was no longer imagined as separated from the existence; Aristotle said that the world – of objects – was the world of *relations giving complete things: substances*, where every one was formed from matter *and* form, so substances were concrete and definite, and the *organism*, where the parts existed only as its parts, not as its origins. Hegel said that *truth is the whole*, and Marx – that the essence is the existence as such.

Consequently, what do we know – or the objects scientifically constructed – are the result of both the *correspondence* with this complex and moving existence, and the *coherence* of *ideas* related to existence/to aspects of existence: the constructed objects are not only relative, so through them we do not know only the subject, but nor are they the absolutely independent object from the subject. We must be aware that the world as we know it is *in relation* with the world outside us, though the *ontos* and the object resulted from knowing overlap only partially. Therefore, the scientific construction of the object signals that the world is not only constructed (though we arrive to it through our subjective processes), and that the world must not be ignored because of the expansion of epistemology. A robust realism allows to understanding what and how is the world, independently from the epistemological mediation.

In other words, in order to understand the world, science constructs objects which are not copies of that we arrive at through senses/suppose to arrive at via senses, but which are theories (first, hypotheses and problems, though a theory does not exhaust its function of promoting problems after it is demonstrated): the theory as such is a scientific object but here its topic is the scientific *object*, consisting in a *combination of properties and relations, taken under some specific conditions*; a selection, a *model*.

The scientific object does not (perfectly) superpose to the empirical objects (given/thought to be given through experience), but it always must be correlated with them: because, at least at the last instance, these empirical objects are which do interest us. Constructing the scientific object, science *selects* and *chooses* the properties, the relations and the conditions, and certainly *demonstrates* its selection and the reason of its specific selection. The properties, relations and conditions are *constant* – or their variations are *controlled* in constant schemes – as long as they are *efficient* for the *understanding* of variety/variation (variables) and of the dynamics/transformation of or within the empirical world: so, as long as they point out regularities not leading to incongruence or paradoxes. A classical example here is the separate demonstration of the light's behaviour as particle (photon) (Newton) or as wave (Huygens, Maxwell), until the demonstration that there is always about a “duality” particle-wave, because every quantum particle (not only light) manifests through wave function, and every wave has its corpuscle properties/quantisation of physical quantities, depending on the aspect interesting the research, but all these aspects being real

in the same manner⁵⁶. Or, in the same domain, the separate demonstration of the energy density of the radiation emitted by a black body was described by two different theories: in the region of long-wave radiation or, respectively, in the region of short-wave radiation, while Max Planck has united these theories in his own demonstration that the energy exchange between radiation and the black body is discontinuous, and the above theories describe limit-situations⁵⁷.

The scientific object changes with the change of theories. It is not speculative, but it is demonstrated, measured, compared. The theoretical correlations of properties, relations and conditions in space and time – their dynamics – are theoretical *events*, and in the calculus of the succession of events two types of methodology/laws were constructed: one (logical, of structures and architectures) where time and space do not matter, and one where they do matter. Both are devoted to the scientific knowledge of both the scientific objects and the real ones – irrespective here that the “real” arrives to us always through the medium of our mental construction – and this means the understanding of new meanings, aspects, correlations, as well as new practical applications.

The principles of the world of objects are simple and unitary

These characteristics mentioned in the above title “illustrate” the ancient belief of the same essence of the human and kosmic *logos*. They arrive from our *need* of simplicity: without this *simplicity* we cannot understand complexity; for this reason we equate simplicity with theoretical “elegance” and we consider as elegant a parsimonious explanation where language is clear and not metaphorical⁵⁸.

The forms of expressing the principles of the world of objects show the constructed character of these principles, defined through *properties* (this meaning relations and functions configuring architectures, structures and systems (wholes) and thus suggesting their historicity).

⁵⁶ Walter Greiner, *Quantum Mechanics: An Introduction* (1989), Fourth edition, With a Foreword by D.A. Bromley, Berlin, Heidelberg, New York, Springer, 2001, esp. pp. 29-37.

⁵⁷ *Idem*, pp. 19-27.

⁵⁸ As we know, metaphors are tools of science rather in its first stage of research, in hypotheses and analogies. After the constitution of theories – and letting aside the popular expression of their contents – the metaphors are transposed into clear descriptions. More precisely, the results of a scientific theory must be more consistent than the first hypotheses, analogies and metaphors: otherwise their reason to be simply would not exist.

Yes, the world is much more than the theories constructed about it, we always know this – beyond any “fundamentalism” of either “the real given to us through scientific theories” or the “mystery that is sufficiently revealed through metaphors” –. But though we agree that metaphors have a formidable revealing power, we do not consider them absolutely autonomous from the scientific research. We do not think that metaphors are the expression of metaphysics and religion, *equally legitimate* as science is, because some questions would be put only by metaphysics and religion, and not by science, as von Glasersfeld claims (“to ask what was there before the Big Bang. Which turns out to be a metaphysical question. And science does not deal with metaphysical questions”, Ernst von Glasersfeld, “The Incommensurability of Scientific and Poetic Knowledge”, *World Futures* 53, 1998, pp. 19–25). As tools of poetry, metaphors are certainly legitimate. But as tools of metaphysics and religion, metaphors are only *historical moments* in the understanding of the world. And science deals also with old metaphysical questions: after the agglomeration of “normal” scientific results (here, “normal” is in Kuhn’s understanding). Metaphors too are constructed by man. The problem is that in science, through demonstrations, it is possible to pass from some spaces of reality to other ones; it is possible to “translate” in scientific language and solving something that before was “untranslatable”. (For the reference to Hans Blumenberg, *Paradigms for a Metaphorology* (1960), Translated from the German with an afterword by Robert Savage, Ithaca, New York, Cornell University Press and Cornell University Library, 2010, and the understanding of metaphors as “foundational elements”, see Ana Bazac, “Daimon, creativity and science (transdisciplinary flight)”, *Noema*, XIV, 2015, pp. 203-256 (pp. 214-215)).

The scientific research targets what is unknown, and starts from what is known: through comparisons and analogies. Hypotheses (through analogies and imagination) provide architectures for structures and algorithms for movements. But hypotheses must be plausible – *in their new theoretical universe* –, and this plausibility challenges the “scale reduction” and “scale up”, i.e. the complexity and complexification of the scientific objects.

Simplicity arises also from analogies: not only from the anterior (system/fact) to the ulterior, but at the same time from the later to the former (see the analogies from nature to the artificial, but also from artificial to nature; from nature to culture, but also from culture to nature). Simplifications and reductionism are positive if they are considered as only *moments* in the process of thinking.

The *measurement* and the *mathematical* construction are *sine qua non* means of proving the simple character of the principles of the world. The construction of tools of measurement and constitution and manifestation of relations is cogent: from the intuitive level to the formal one and to the dependence of the formal on the contents; the history of *precision* and its correspondence in *ontos* is relevant too.

The concepts and instruments⁵⁹ for *order* (they generate laws which are rather the same in different universes and structures, only manifesting in different manners according to the specific conditions) and *disorder* describe “simple” processes, some ones known from the Greeks, other ones “new” and created on the basis of “key experiments which are idealised”⁶⁰ or developed in order to see the variance: fusion, attraction/discord, separation, difference, symmetry/asymmetry, complementary opposites (emission, reflection and absorption, diffraction and interference, velocity, mass, energy, tension, frequency, stability, temperature, mass, plasticity, patterns, frugality/economy and development, levels, conservation, function, structure, system and system of systems, control, feedback, reorganisation, integration, proliferation, bifurcation, cascades of change, differentiation, variability, adaptation, “learning”, entropy, creativity, information) but actually, “reducible” to the old *integrative* and *splitting* processes and concepts.

The laws show the *telos* of things, through all the *randomness* and concrete *consequences* of relations (measured as laws) at cosmic and statistical scale leading to *bifurcations*.

Scientific objects are not only the objects studied, but also the methods or laws of knowing the objects: the “*genetic*” methods/laws, *dynamics* (evolution, transformation), *context dependence*, *relations “with” the environment*, *simplicity* (in order to realise new objects, efficiency, material and energy saving) and *complexification* (including the constitution of new levels of reality).

Instead of conclusions: practice as certification of scientific theories

I twisted so much around the problem of the construction of (scientific) objects because my aim is to not reducing *praxis* to technological realisation of science and everyday quest for living. Praxis is an obvious cultural concept – as all are – but in relation with the scientific objects, we have, first of all, to discuss the *practice of science*. Practice means not only experiment, facts and observations, empiricism but also speculativism, to hypothesise, to make conjectures: but rather verification of a theory through all the above-mentioned means. A theory, related to scientific objects, has its historical limits given by these objects. A theory bounds the aspects questioned with the help of/by those objects: at the “local” level of the structures existing in those objects. However, the scientific practice – related to the *family* of scientific objects discussed in our example of theory – is larger than the “simple” demonstrations of correlations within the structures emphasised by the scientific objects of our theory. As a result and after the agglomeration of problems related to the

⁵⁹ Where the *cosmological constants* are very important scientific objects.

⁶⁰ Walter Greiner, *Quantum Mechanics: An Introduction* (1989), Fourth edition, p. XIII.

family of our concrete scientific theory, scientists are interested to solve these problems and transcend the strict theory: they *interpret* it and the problems in new theories, they make larger bonds than those from our original theory.

Science is, thus, *evolutionary, progressive* in its very nature. Its logic is just that to refute itself/to go forward beyond the frame of a certain concrete theory in order to better understand the real world. This is the big difference between science and non-scientific cultural creations⁶¹.

But science takes place in society. It cannot remain a process on its own, isolated from society. And, since society is ordered by the *power relations* – i.e. the historical domination-submission relations – it follows that science too is strongly influenced by these relations, irrespective of how much it influences society.

The practice of science, namely the scientific manipulation of objects having concrete results in theories and premises of technologies and social strategies, starts from this framework. And both scientists and the general public must be *aware* that both the “independence” of science and the independence of scientific education happen only at the level of concrete logic of the development of *a* theory once it is worked. But the choice of the funding of science and the concrete conditions of science are exterior to scientists. Consequently, the possibility as such of debating scientific problems and critically treat them is *dependent* on these exterior social conditions and power relations.

The *use of science* is all the more a *social* process. Nowadays people have experienced that science and the faculty graduates are treated as merchandises⁶², and that there is “an imbalance between public interest and intellectual property”⁶³; and that the laboratories of the multinational pharmaceutical companies impose the clause of confidentiality, the frightening of practitioners, and thus the unverified reproduced experiments related to drugs⁶⁴; that 54% of the global installed hydropower capacities compete with irrigations, and that it is important for policymakers to assure *all the functions* of this technology⁶⁵; that science was and is used as a *weapon* of the decision-makers, and that *non-conformist scientific questions are prohibited* under the danger of annihilation⁶⁶; that science is subordinated to *profit*, and not to the detection and solving of problems which are not so much “problems/diseases of the industrial civilisation”, but diseases resulted from the exclusion of scientific criticism and prevention of some consequences of its own use far from its scientific logic⁶⁷; that “moral” is which missing in the last decades of geosphere

⁶¹ Actually, philosophy too is scientific from this standpoint: because its end is not to reproduce philosophical theories, but to interpret them critically. Philosophy may thus converge with science: their relative integration is possible.

⁶² See Mircea Malița, 2013, <http://www.mediafax.ro/social/mircea-malita-schimbarile-in-educatie-nu-trebuie-sa-se-vada-altfel-intram-in-zania-universala-10582993>: “Education is a question of public interest...Labour market, is a frightening notion for me. To be a graduate and to be treated as the vegetables sold in the market...harnessed, controlled and decided by the market games...here is any market. It is the public interest the state is watching over. Science is of public interest and the state watches so as a good science be produced”.

⁶³ Kanaga Raja, “WTO TRIPS Council debates IP and the public interest”, *Southnews*, No. 164, 29 June 2017.

⁶⁴ Angela Spelsberg et al., “Contribution of industry funded post-marketing studies to drug safety: survey of notifications submitted to regulatory agencies”, *BMJ*, 2017; 356 doi: <https://doi.org/10.1136/bmj.j337> (Published 07 February 2017); Simon Gouin, *Allemagne. Les laboratoires entravent-ils les signalements des effets indésirables de certains médicaments?*, Mondialisation.ca, 22 mars 2017, <http://www.mondialisation.ca/allemanne-les-laboratoires-entravent-ils-les-signalements-des-effets-indesirables-de-certains-medicaments/5581306>.

⁶⁵ Ruijie Zeng et al., “Hydropower versus irrigation—an analysis of global patterns”, *Environmental Research Letters*, 12, 2017.

⁶⁶ Elana Freeland, *Planetary Lockdown, Geoengineering and ‘The Deep State’*, Global Research, February 13, 2017, <http://www.globalresearch.ca/planetary-lockdown-geoengineering-and-the-deep-state/5574404>.

⁶⁷ Rob Wallace, *Big Farms Make Big Flu: Dispatches on Infectious Disease, Agribusiness, and the Nature of Science*, New York, Monthly Review Press, 2016.

destabilization⁶⁸; that neither prevention nor significant limitation of damages are possible in the present system⁶⁹; that the material and spiritual conditions of life supported by the scientists of the political mainstream lead to the weakening of the human species⁷⁰; etc.

Unfortunately, one could give many examples of studies discussing the contradistinction between the *power of science* as *approach/technique/logic* and, on the other hand, the *facts* in the present society made also with the subordination of science and scientists. In fact, the power of science is ascertained not only by its technical/logical model, but by the *state* of the human world.

However, practice is not “the reality”, but the human *action*; it is a permanent relation of *confrontation* of the model of scientific knowledge and the combined actions of people. Praxis means application, embodiment, making of the theory, action according to theory. Praxis means not only to make objects (material, immaterial, performance), but first to construct them *in mente*, “in theory”.

However, only the mental construction – though absolutely necessary – is not enough for the human knowledge and existence. *Communication, projects, application, verification* as the theoretical control of knowledge, *confrontation* follow and develop the mental construction. And since confrontation or practice involves the mixing of direct observation and indirect theoretically based action, practice is *at the same time* observation, adjustment, and change of theories.

Practice is relation, a process *integrated in knowledge*, it is not exterior to knowledge. Consequently, it has an epistemological function, as *mediation* between the subjects and objects, and the knowledge as such. It mediates the images/relations between theories.

Because of its huge role – as that of other aspects of knowledge – practice is distorted. The untruth, false, and inadequacy throughout the whole process of knowing *in mente* (selection of information, hypotheses) are historically determined by the level/lack of scientific information, procedures and instruments (this lack supports the inertia in the process of intellectual mobility).

But obviously, there are also political, social, ideological causes of progress in the *in mente* process of knowledge, and they are stronger as they are interrelated with the social moment of knowledge, of confrontation. Practice is verification: confirmation or refutation of theories.

Because of the power relations, the distortion of practice takes place when theories are confronting false theories but supported from without the scientific logic; in this confrontation the last win, but this means that the result is false (theories are calming, even euphoric, the alternative theories are forbidden, data are hidden); and when theories confront distorted transpositions of theories, the result is that – however clever – they are impotent, there is no increase in knowledge. Both *vita contemplativa* and *vita activa*, to borrow Arendt’s concepts, are distorted.

Distortion of practice as distortion of the whole process of knowledge means:

- *late assumption* of the integrated character of existence and of the necessity to approach it in a holistic manner
- *inertia* of the *fragmentary, isolated* view

⁶⁸ Karine Danielyan, Tatevik Poghosyan, Sirine Kosyan, “On Moral Aspect of Sustainable Development: Theory and Practice”, *Wisdom*, 2(7), 2016, pp. 35-43.

⁶⁹ Helen Caldicott, *The Fukushima Nuclear Meltdown Continues Unabated*, Global Research, February 14, 2017, <http://www.globalresearch.ca/helen-caldicott-the-fukushima-nuclear-meltdown-continues-unabated/5574756>; Gerardo Ceballos, Paul R. Ehrlich, Rodolfo Dirzo, “Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines”, *Pnas Plus*, 2017, pp.1-198.

⁷⁰ Janet Phelan, *MIT States That Half of All Children May be Autistic by 2025 due to Monsanto*, 05/02/2017, <http://www.defenddemocracy.press/mit-states-that-half-of-all-children-may-be-autistic-by-2025-due-to-monsanto/>; Helmut Burtscher-Schaden, Peter Clausing und Claire Robinson, *Glyphosate and cancer: Buying science. How industry strategized (and regulators colluded) in an attempt to save the world’s most widely used herbicide from a ban*, Vienna, Global 2000, 2017.

- *inertia* of favouring the *elements and structure*, instead of relations
- *inertia* of favouring *concepts*, instead of the analysis of reality
- non-understanding of the dialectic of the *simple* and the *complex*
- “learning from nature” – reduced to *fragmentary* models (we have learned how to make the wing of the plane, but not the necessity to keep the natural habitat)
- learning from artefacts/machines/artificial models – still *reduced* and the dominant conception is that nature would regenerate in fragments
- *imbalance in the treatment of time*: continuity is supposed, discontinuity – un-understood (*the state of urgency is not understood*)
- *imbalance in the treatment of space*: autonomy of subsystems leads to considering their integration as of being of inferior value (and vice versa)
- *imbalance in the treatment of order and disorder*: order – supposed, disorder – ignored (and vice versa: the supposed disorder – inevitable, order – impotent).

Maybe the most important conclusion of the confrontation of science “with practice” is the necessity of questions related to the *telos*:

- of science, in general: today the dominant view is the separation of the *telos* of theory/knowledge from the *telos* of practice, of human action; but the truth of science is *practice and the world* (from this standpoint, the present science is somehow primitive);
- of the instruments of science (its laws in relation with randomness, their consequences at cosmic and statistic scales, bifurcations generating regularities); (“genetic” laws, context-dependence, relations with environment, simplicity and complexification); what is the *telos* of these different instruments?

References

1. Aranyosi, István. *God, Mind, and Logical Space: A Revisionary Approach to Divinity*, Palgrave Macmillan, 2013.
2. Bazac, Ana. “Fidelity towards forms: an ontological approach” I, *Agathos: An International Review of the Humanities and Social Sciences*, Volume 5, issue 2, 2014, pp. 52-62.
3. Bazac, Ana. “The approach of space and an inter-war anthropological model”, *Analele Universităţii din Craiova, Seria Filosofie*, nr. 33, (2/2014), pp. 127-161.
4. Bazac, Ana. ”Daimon, creativity and science (transdisciplinary flight)”, *Noema*, XIV, 2015, pp. 203-256.
5. Bazac, Ana. ”The philosophy of the *raison d’être*: Aristotle’s *telos* and Kant’s categorical imperative”, *Biocosmology – Neo-Aristotelism*, Vol. 6, No. 2, 2016, pp. 286-304.
6. Bergson, Henri. *L’Évolution créatrice* (1907), Paris, PUF, 1959, 86e édition.
7. Bergson, Henri. « La conscience et la vie » (1911), in H. Bergson, *Essais et conférences*, Paris, Félix Alcan, 1919, pp. 1-29.
8. Bryant, Levi R. *The Democracy of Objects*, Ann Arbor, MPublishing, University of Michigan Library, 2011.
9. Burtscher-Schaden, Helmut, Peter Clausing und Claire Robinson, *Glyphosate and cancer: Buying science. How industry strategized (and regulators colluded) in an attempt to save the world’s most widely used herbicide from a ban*, Vienna, Global 2000, 2017.
10. Caldicott, Helen. *The Fukushima Nuclear Meltdown Continues Unabated*, Global Research, February 14, 2017, <http://www.globalresearch.ca/helen-caldicott-the-fukushima-nuclear-meltdown-continues-unabated/5574756>
11. Calvo, Tomàs. “Ontology and Truth: The Aristotelian Legacy”, in Mircea Dumitru, Gabriel Sandu editors, *Truth*, Bucureşti, Editura Universităţii din Bucureşti, 2013, pp. 13-32.

-
12. Ceballos, Gerardo, Paul R. Ehrlich, Rodolfo Dirzo, “Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines”, *Pnas Plus*, 2017, pp.1-198.
 13. Clark, Andy & David Chalmers, “The extended mind”, *Analysis*, 58, 1, January, 1998, pp. 7-19.
 14. Danielyan, Karine, Tatevik Poghosyan, Sirine Kosyan, “On Moral Aspect of Sustainable Development: Theory and Practice”, *Wisdom*, 2(7), 2016, pp. 35-43.
 15. Durkheim, Emile. *Les Règles de la Méthode Sociologique* (1894). Paris: Les Presses Universitaires de France, 16e édition, 1967.
 16. Engel, Pascal. “Une réponse à Ponce Pilate”, in Mircea Dumitru, Gabriel Sandu editors, *Truth*, București, Editura Universității din București, 2013, pp. 33-44.
 17. Freeland, Elana. *Planetary Lockdown, Geoengineering and 'The Deep State'*, Global Research, February 13, 2017, <http://www.globalresearch.ca/planetary-lockdown-geoengineering-and-the-deep-state/5574404>
 18. Gendlin, Eugene T. “Neurosis and human nature in the experiential method of thought and therapy”, *Humanitas*, 3(2), 1967, pp.139-152.
 19. Gendlin, E.T. “The responsive order: A new empiricism”, *Man and World*, 30 (3), 1997, pp. 383-411.
 20. Glasersfeld, Ernst von. “Farewell to Objectivity”, *Systems Research*, 13 (3), 1996, pp. 279-296; “Pourquoi le constructivisme doit-il être radical?”, In: Philippe Jonnaert & Domenico Masciotra (eds.) *Constructivisme, Choix contemporains, Hommage à Ernst von Glasersfeld*, Sainte-Foy, Québec, Presses de l’Université de Québec, 2004, pp. 145–154.
 21. Glasersfeld, Ernst von. “The Incommensurability of Scientific and Poetic Knowledge”, *World Futures* 53, 1998, pp. 19–25.
 22. Gouin, Simon. *Allemagne. Les laboratoires entravent-ils les signalements des effets indésirables de certains médicaments?*, Mondialisation.ca, 22 mars 2017, <http://www.mondialisation.ca/allemande-les-laboratoires-entravent-ils-les-signalements-des-effets-indesirables-de-certains-medicaments/5581306>
 23. Greiner, Walter. *Quantum Mechanics: An Introduction* (1989), Fourth edition, With a Foreword by D.A. Bromley, Berlin, Heidelberg, New York, Springer, 2001.
 24. Hegel, G.W.F. *The Phenomenology of Mind* (1807), A. Consciousness, I: Certainty at the Level of Sense Experience –the “This”, and “Meaning”, <https://www.marxists.org/reference/archive/hegel/works/ph/phaa.htm>
 25. Heidegger, Martin. “On the Essence of Ground” (1929), *Pathmarks*, Edited and translated by William McNeill, Cambridge, Cambridge University Press, 1998.
 26. Heidegger, Martin. *What is a Thing?* (1962 (1935)), Translated by W. B. Barton Jr. and Vera Deutsch, with an analysis by Eugene T. Gendlin, Chicago, Henry Regnery Company, A Gateway Edition, 1967.
 27. Iorgulescu, Afrodita. Solomon Marcus, Sergiu Rudeanu, Dragoș Vaida (editors), *Grigore C. Moisil și continuatorii săi / Grigore C. Moisil and his followers*, București, Editura Academiei, 2007.
 28. Kahn, Charles H. “The Greek Verb 'To Be' and the Concept of Being”, *Foundations of Language*, Vol. 2, No. 3 (Aug., 1966), pp. 245-265, republished in Charles H. Kahn, *Essays on Being* (2009), Oxford, Oxford University Press, 2012, pp. 16-40.
 29. Kanev, Alexander. “On The Nature Of Wittgenstein’s Revolutions Of Philosophy”, in *Wittgenstein und die Zukunft der Philosophie. Eine Neubewertung nach 50 Jahren/ Wittgenstein and the Future of Philosophy. A Reassessment after 50 Years*, Beiträge der Österreichischen Ludwig Wittgenstein Gesellschaft/Contributions of the Austrian Ludwig Wittgenstein Society, 2012, pp. 1-12.
-

-
- Wittgenstein Society, Volume IX (1), Band IX (1), Herausgeber Rudolf Haller, Klaus Puhl, Kirchberg am Wechsel, 2001, pp. 372-377.
30. Kant, Immanuel. *Critique of Pure Reason* ((1781)1787 second edition improved), Translated and edited by Paul Guyer and Allen W. Wood, Cambridge, Cambridge University Press, 1998.
 31. Kant, Immanuel. *Prolegomena [= Preliminaries] to any Future Metaphysic that can Present itself as a Science* (1783), Jonathan Bennett.
 32. Kováč, Ladislav. "The Biology of Happiness", *EMBO Reports*, (2012) 13, pp. 297–302.
 33. Krapotkin, P. "The Teaching of Physiography", *The Geographical Journal*, Vol. 2, No. 4, Oct. 1893, pp. 350-359.
 34. Kuriyama, Shigehisa. *The Expressiveness of the Body and the Divergence of Greek and Chinese Medicine* (1999), Revised Edition, New York, Zone Books, 2002.
 35. Lloyd, Geoffrey and Nathan Sivin, *The Way and the Word: Science and Medicine in Early China and Greece*, New Have, Yale University Press, 2002.
 36. Malewitz, Raymond. *The Practice of Misuse: Rugged Consumerism in Contemporary American Culture*, Stanford University Press, 2014.
 37. Malița, Mircea. 2013, <http://www.mediafax.ro/social/mircea-malita-schimbarile-in-educatie-nu-trebuie-sa-se-vada-altfel-intram-in-zazania-universala-10582993>.
 38. Niiniluoto, Ilkka. "Truth: Absolute or Relative?", in Mircea Dumitru, Gabriel Sandu editors, *Truth*, București, Editura Universității din București, 2013, pp. 85-99.
 39. Phelan, Janet. *MIT States That Half of All Children May be Autistic by 2025 due to Monsanto*, 05/02/2017, <http://www.defenddemocracy.press/mit-states-that-half-of-all-children-may-be-autistic-by-2025-due-to-monsanto/>
 40. Piaget, Jean. *Structuralism* (1968), Translated and edited by Chaninah Maschler, New York, Basic Books, 1970.
 41. Popper, Karl. (1978). *Three Worlds*. The Tanner Lecture on Human Values, <http://tannerlectures.utah.edu/lectures/documents/popper80.pdf>
 42. Pritchard, Duncan. *What is this thing called Knowledge?* (2006), 3 edition, Abingdon, New York, Routledge, 2013.
 43. Raja, Kanaga. "WTO TRIPS Council debates IP and the public interest", *Southnews*, No. 164, 29 June 2017.
 44. *Reism*, Stanford Encyclopedia of Philosophy, <http://plato.stanford.edu/entries/reism/>
 45. Spelsberg, Angela et al., "Contribution of industry funded post-marketing studies to drug safety: survey of notifications submitted to regulatory agencies", *BMJ*, 2017; 356 doi: <https://doi.org/10.1136/bmj.j337> (Published 07 February 2017).
 46. Wallace, Rob. *Big Farms Make Big Flu: Dispatches on Infectious Disease, Agribusiness, and the Nature of Science*, New York, Monthly Review Press, 2016.
 47. Zeng, Ruijie et al., "Hydropower versus irrigation—an analysis of global patterns", *Environmental Research Letters*, 12, 2017.
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