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**FROM PHENOMENON TO REPRESENTATION. PHYSICAL**  
**SPACE AND LOGICAL SPACE – TRANSCENDENTAL**  
**COMPLEMENTS**

Iulian Grigoriu (a)\*,

\*Corresponding author

(a) University „Dunărea de Jos” onn Romania, Galați, Departament of History, Philosophy and  
Sociology, Faculty of History, Philosophy and Theology, email: iulian\_grigoriu@yahoo.com

***Abstract***

In this article I propose to investigate the mechanism by which we represent a certain phenomenon, how we fit into similar phenomena, whether this representation is unique, unitary, which philosophical and logico-ontological resources intervene in such situations. Graphical, formal, logical, conceptual expression in the field of knowledge is not unique, but reflects a certain natural connection between the phenomenon and its form of representation, which is why we use the term representationism. It is proper to mathematics, physics, logic, sociology, psychology and other disciplines. The relativization of the representative framework of science and implicitly of mathematics is very visible in Wittgenstein's work. There are several opinions under discussion on the theoretical model followed by the Austrian philosopher from *Tractatus Logico-Philosophicus* to his later writings. But they all gain unity in the light of the concept of representationism that I support. In this article, I want to stop only at the physicalistic filiation of representationism, expressed by the connection between the Space of phases in physics and Logical Space (conceived by Wittgenstein). This connection is one of a transcendental possibility: as space and time are a priori intuitions (not concepts, not empirical results), intuitions that underlie the coordinates of physics, the same transcendental contact I have with the existential coordinates of truth ("it exists" and "does not exist": "truth" and "false") that are logically and ontologically coordinates. Here we have in mind the fusion of Space of phases in physics (Hertz, Boltzmann) and the Wittgenstein Logical Space that prefigures the same author's Grammatical Space, as a move from Kantian transcendentalism to constructivism and conventionalism.

**Keywords:** Wittgenstein; representationism; mathematics; logical space; phase space; grammatical space;

**1. INTRODUCTION**

Concepts of *phenomenon* and *representation* are considered in their broad philosophical sense, which implies a subject-object interaction, a transcendent availability of the subject to perceive and represent. The discussion is mainly focused on the field of philosophy of science, the objective and

measurable framing of a phenomenon, such as physical phenomenon integrated into Kantian transcendental structures of space and time, considered the frame of every experience.

In this sense, I consider the term "rational generalization" considered by philosopher Ilie Pârnu (2001) a point of view that unifies transcendentalism with the philosophy of science. There is a "theoretical" model of "rational generalization," Ilie Pârnu shows, followed by Wittgenstein in *Tractatus Logico-Philosophicus* (2001) (called TLP), that of Newtonian mechanics, particularly in Hertz's view of critical reconstruction. Thus, not the philosophy of language in the descendancy of Frege and Russell is decisive for Wittgenstein, but the philosophy of science and the interpretations of German physicists: here comes the picture theory of meaning and the representation, with simple terms: Gegenstand, Bild, logischen Form, logischen Raum, logische (mathematische) Mannigfaltigkeit, Strukturen den Sachverhalte, Satz and others. ('Object', 'picture', 'logical form', 'logical space', 'logical (mathematical) multiplicity', 'structure of the state of affairs', 'proposition').

## 2. PROBLEM STATEMENT

I proposed and used the term representationism (Iulian Grigoriu 2017 a, b) to designate the fundamental feature of Wittgenstein's mathematics philosophy but also as an element of unity and continuity of Wittgenstein's entire philosophy. Representationism is the result of two philosophical facts: on the one hand, there is no "pure" thinking, liberated by symbols, concepts, representations (Leibniz 1972, 13), on the other hand, a representation must faithfully convey a phenomenon turn it into an obvious, valid, verifiable fact that reflects an external need for the suitability of the phenomenon to the best representation.

Exegesa observed that especially in TLP a new theory of representation is being established, called "the picture theory" but it was not considered an element of unity of the entire Wittgenstein philosophy. There are two main sources of Wittgensteinian representationism: one is the theory of representation at Frege and Russell, on the line of philosophy of language and logical atomism, another in German physics (Hertz, Boltzmann), with roots in Kantian transcendental idealism.

I consider all these sources equally valid for the Wittgensteinian representationism. The Austrian philosopher uses them, speculates on them, tries to avoid them and even contradicts them, with the elegance of an insidious vision. Philosophy, unlike science, reveals, shows and *silences*, this being her *form* of expression.

Ilie Pârnu believes that the genesis of thinking in the TLP belongs to the philosophy of science, to Newtonian mechanics and, to the same extent, Kantian transcendentalism and German physics, represented by Hertz, Boltzmann, Helmholtz. That is why I want to apply the *method of rational generalization* based on a concrete case of representationism of a physical phenomenon (I have chosen the amortized motion of an elastic spring to which an object is attached) to highlight the steps of the method in a concrete situation. Finding the connection between the Wittgenstein's Logical Space and the Phase Space of Physics outweighs the simple filiation (in the sense that Wittgenstein is inspired by physics). The Austrian philosopher discovers an *internal structure* of combining truth values, according to which any complex state of reality can be expressed. Thus the unity between those interpretations that see the TLP either in the filiation of German physics - Toulmin and Janik (1973, 139 sqq), Griffin (1965), Harré (2001) - or in the line of Kantian transcendental idealism - Stenius (1960, 214 sqq), Stegmüller (1969, 417 sqq).

## 3. RESEARCH QUESTIONS

My objective is to exemplify on a concrete case (a simple physical phenomenon) the way in which its representation framework can be transformed. Based on the rational generalization model, I will investigate the theoretical similarities and differences between phase Space and logical Space. Thus, they can explain on what the possibility of representing a phenomenon is based, and why representation is not unique in physics and mathematics, nor in logic. A logical or rational form is not expressed univocally, which is related to the transcendental sources and resources of representation. The concrete objectives of the article are mainly two: the exposure of the rational generalization model approached and its

application in the field of physics, on a concrete example, as well as the problem of the transcendental affinities between the two spaces (physical and logical).

#### 4. PURPOSE OF STUDY

The purpose of the article is to study the theoretical and functional link between the Wittgensteinian Logical Space and Phase Space in Physics, to find matches at transcendental categorical level (even idealized) between phenomenon and representation. The working hypothesis is to highlight a common background (internal space-time structures and logical-existential truths) between the two frames, logical and physical in which phenomena can be represented.

#### 5. RESEARCH METHODS

The rational generalization model is not simple and straightforward (Pârnu, 2001, 263-264) but comprises two stages: a "logical and ontological" one, "enrichment of ontologies" where the realm is enriched with ideal entities, "pure possibilities" as a support for the functioning of the theoretical laws; the second stage is "transcendental and metaphysical", the structures generated by the first stage become "conditions of possibility" for reality, they constitute an enriched basis that can generate more generous possibilities of representation in the sense that they can unify various phenomena or a certain phenomena has a more appropriate representation. In this context reference is made to Boltzmann (1974, 226) which postulates the existence of elemental, fictitious objects in order to maintain the applicability and universality of the laws of physics; at Hertz (1899), which involves concealed accomplices in the background of the laws of physics and making them possible; to David Hilbert (1983) discussing "ideal elements" such as complex numbers, transfined numbers, the point of infinite encounter of two parallel, etc., provided that these ideal elements do not introduce contradictions, in other words, compete to the establishment of a non-contradictory theory.

The second step of rational generalization relates to a "transcendental gambit" (Pârnu, 2001, 267): "there is now a change of ontological weight between the field of empiricism and that of the possible transcendental, in the sense that possible, the ideal, becomes fundamental in the face of the empirical reality" (Pârnu 2001, 265, 2002, 18). It is a metaphysical stage of establishing the theory, which is the kantian transcendentalism that extracts from the laws of physics the a priori structures of space and time and makes them the general conditions of any experience.

And the Space of Phases in Physics and the Tractational Logical Space are the beneficiaries of this "transcendental gambit" and "rational generalization." They extend logic to the abstract level, which intercedes and gives us new resources for our imagination.

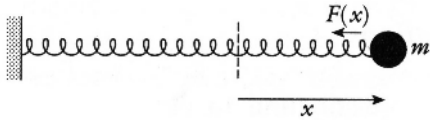
As Hertz observes, our power of representation is based on "the consistency of nature and our thoughts" with the philosophical projection characteristic of a transcendental necessity corresponding to this "profound" level that ensures the generality of correlations between the states of things and their representation by propositions, images, formalisms etc.:

"We form for ourselves images or symbols of external objects; and the form we give them is such that the necessary consequences of images in thought are always the images of the necessary consequences in the nature of the things pictured. In order that this requirement may be satisfied, there must be a certain conformity between nature and our thought." (Hertz 1899, Introduction, 1).

Wittgenstein discusses the theory of representation in the same hertzian spirit (TLP 2.1-3.0321), encompassing physical space, phase space, geometric space, reality in general. In particular, the image is logical if it refers to the logical form of the phenomenon (TLP 2.181). Phase space has in common with Logical Space that it preserves the logic of the phenomenon.

In order to see how this rational generalization model manifests itself in the field of physics, I will further illustrate the way in which the oscillatory motion is represented in space-time coordinates and in the phase space to investigate the elements that appear in a process of mathematical representationism, formally, of a physical phenomenon, and to see what the transcendental resources of representation are. It is finally to reveal on a concrete case how an "isomorphism" appears between language and reality.

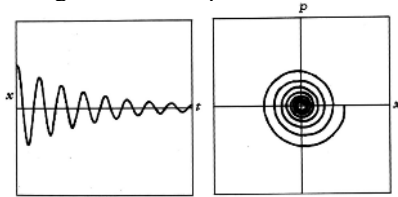
I consider a spring that is fixed to a body of mass  $m$  and oscillates on a surface (with friction) under the action of the elastic force  $F(x)$ :



(1)

That is why the representative frame of figure (1) is "poor" because we do not have here the logical (general) form of the phenomenon, but rather the own form of the phenomenon that remains always individual.

Further, in figure (2), an assimilation of the ideal elements and a mathematical synthesis that more appropriately represents the attenuated oscillatory movement has already taken place: the elongation is a sinusoidal function (whose amplitude decreases in time for a real phenomenon), and in the figure (3) the movement is represented in the phase space ( $p = p(x)$ , the impulse is the position function) where other mathematical representation laws appear. What I want to highlight here is precisely this possibility, this freedom to represent the physical phenomenon. It no longer depends on a certain system of coordinates, a certain image, and everything is done with the preservation of the "intuitive", more clear, the logic of the real phenomenon.



(2)

(3)

A point on the ellipse (as a trajectory in the space of the phases) has the coordinates  $x$ -spatial and  $p$ - impulse,  $p = p(x)$ , the ellipse being directly proportional to the total energy and inversely proportional to the frequency of the movement. When the movement is lossless, their ratio is constant. The spiral is mathematically derived from the ellipse, it is an ellipse that "breaks" because the body loses energy; the ellipse semiaxes diminish when the fictitious body of the Phase Space passes from one dial to another. Figure (3) shows how energy is lost, figure (2) rather how the movement (impulse) is lost.

If under ideal conditions, the oscillatory motion can be easily transposed from the sinus on the ellipse, under real conditions, it becomes a diminished sinusoid, a spiral, which allows us to perceive the phenomenon more easily.

The philosophical problem is: are there any representations that represent (explain by simple representation, transpose our thinking on reality to the end) for any physical-mathematical phenomenon and in addition, the representative framework is unique, immutable, or can the framework change? Is there an orleigh environment? After Kant, the frame is unique and transcendental, a situation to which Wittgenstein inclines to the TLP; more specifically, any representation is based on an a priori possibility specific to the knowing subject; In the second part of his philosophy, Wittgenstein no longer adheres to a single transcendental, logic-ontological representation framework, and language is seen to be better translated into different language games, regardless of transcendental structures. And when it comes to mathematical language games, their only justification lies in the power to represent, but the framework is no longer necessary, but formal, constructivist and even conventional. Space, time, logic are no longer a priori, but interact with the phenomenon of reality, the subject is increasingly viewed in a solipsistic way.

Figures 2 and 3 are closer to the logical form of the physical phenomenon (so the perceptual and knowledgeable subject is closer to his comprehension, "helped" by the chosen logic-mathematical framework).

## 6. FINDINGS

The plurality of representational cadres derives from the fact that the empirical and ideal entities coexist on a superior level of logic-ontological abstraction, where they homogenize: The ontologic has or

gets the same logical form as Logic, becoming an Onto-Logical whole (Wittgenstein said steadily, the Ontologic has in addition to Logic, "The Substance of the World" (TLP 2.021).

This Whole Onto-Logic has formal valences as transcendental possibilities of representation. If at Hertz and Boltzmann it is the "space of phases" (the frame in which the motion of a body in the impulse coordinate according to space, thus being a physico-mathematical representation) in Wittgenstein, the state of things appear in the Logical space, a logical skeleton of the whole possible. It is a "possible" simplified, that is recomposed as the elemental unity of the world, of the facts that take place in it. The difference between the two "spaces" is one of nature, one is a space in physical coordinates, the other in logical coordinates. In the first, an infinite number of trajectories can be represented, so it is a framework in which any trajectory can be constructed, does not bind or constrain in any way the phenomenon, the other, the logical framework, is as generous as the power of representation formal, but not necessarily visual, geometric. Logical space is not phenomena, but links, structures, logical senses of phenomena.

To emphasize the transcendental complementarity between the two types of spaces (physical and logical), we emphasize that Phase space can be considered a transient space between the purely physical (in space-time coordinates) and the logical (it benefits from transcendental resources by which it surprises the logical nature of what it represents otherwise than purely physical space). Simply pure physical space is causal, spatial-temporal, progressive, continuous (it suggests a development, it captures the progress of a phenomenon, a posteriori (it expresses what exists after the phenomenon manifests itself); The logical space appears a-causally, a-spatially and a-temporally, simultaneously, discreetly, expressing a logical sense given at once, a priori (expressing the whole possible before something existed).

The game between a priori (logical) and a posteriori (physical and experimental) is not a rigid one, especially because of complexity, meaning that both spaces are dimensioned according to the phenomenon represented to capture its complexity, the concrete situation on which must express it.

In both cases the phenomenon can be represented in many ways, but it is a normalized transcendental, with a certain meaning. Also, any possible phenomenon is updated in a finite number of representations. The physical phase of phases reduces the multiplicity of occurrence of the phenomenon to two coordinates, the logical, more abstract, is a space of the functions of truth. The representation of the phenomenon hits the manipulation of the complexity of the phenomenon: in the physical space it is the solving of the specific differential equations in the logical space of the degree of the respective logical formula. A representation that simplifies the phenomenon is not a simple one, on the contrary. Evidence to which representation tends usually involves a more complex representation framework than another leading to a weaker record. (To represent here is to establish a correlation between the physical or logical event and its way of appearing, in a specific way, the logical space is predominantly formal).

## **7. CONCLUSION**

The purpose of the study is considered to have been achieved by questioning and highlighting transcendental equivalences and complementarities between Logic Space and Physical Space. Through the highlighted characteristics, they appear as transcendental complements. Phase space can be considered a superior synthesis of them. Hence, in the same representational context, other "representation spaces" that tend to free themselves at least from the a priori categories of space and time may, if not from the whole transcendental charge, tributary to a transcendental unity of sensibility and intellect that is no longer present.

In the TLP, Wittgenstein examines the uniqueness of the logical form by targeting the limits of representationism: we can not say why when we see something, we see it in a certain way and not otherwise, although "everything we see might be otherwise" (TLP 5,634). That is, we could have perceived things in a different way, provided they do not deviate from logic. The fact that any image is logical (and not necessarily spatial) (that is, the case of Phase Space, a perfect transcendental equivalent of the Logical Space that it encompasses) carries a given beyond which one can not and can not be given up, anyway, I would represent a certain phenomenon, physically or mathematically.

Any phenomenon is one that takes place in the Logical Space, and "the existence of this Logical Space is guaranteed by the existence of the parts that make it" (TLP 3.4). The logic of every fact consists of its "vectorial" decomposition of the truth coordinates of the elemental sentences that make up it, within a Logical Space that potentially contains all the possibilities of the combinations of states of things. This is the framework for the reconstruction and generalization of the tractarian propositional sign that will later transform into Grammatical Space, on the same transcendental physicist but also of logical atomism.

Both Spaces investigated here are structured as co-ordinates of coordinates, starting from precise constitutive units: "truth" and "false" in Logical Space, Space and Time in Phase Space. Further, Phase space assimilated space and time (empirical) into a more "expressive" coordinate unit (spatial impulse); there are representations in physics that tend to relativize and eliminate space-temporal determinations. These are representations and formalisms in quantum mechanics, statistical physics, etc. Here either causality is eliminated, or space and time are no longer those basic units of Kant's representation. Such recursive assimilation of the basic coordinates (space-time of physics, truth values of logic) does not guarantee the elimination, but only their overcoming. The logic space assimilates the truth values in the coordinates expressed by the elementary propositions  $p(0,1)$ ,  $q(1,0)$  which in their turn are assimilated by the logic space coordinates (the 16 functions of truth, from contradiction to tautology, TLP 5,101 ). And these can also become coordinated according to which any logical phenomenon can be represented. And Logical Space has internal resources to grow further.

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