CHAPTER 03

PHILOSOPHICAL AND MATHEMATICAL INVESTIGATION OF SIMILAR PHENOMENA IN THE CONTEXT OF AN INCREASED COMPLEXITY

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ABSTRACT

This work presents a mathematically proven approach to scientific field research. It is an attempt that elaborates philosophical principles so as to mark scientific research and technological innovation. For that, this work is focusing on exploring the 'mechanisms' of innovation, within the causes, logics or laws of innovation, as well as in the nature of the actors involved and the role and functionality of an entrepreneurship activity. In order to achieve that, the current work proposes the introduction of 'new productive combinations', made possible by utilizing previous knowledge in a well-defined analytical-combinatorial way. Such derived innovations, may evidently, sweep away the old in favor of a newly defined approach, fill-in the research-based knowledge gaps and, eventually, provide a cognitive completion of knowledge. Although via a rather different approach, the dynamics of innovation and the notion of the entrepreneur researcher as the key actor, seem to have been already present in a Tarde's previous work. On the other hand, we are not standing behind Tarde's position that invention is the (new and original) result of an (originally) combined imitation of previously existing inventions. But then, we try to identify the procedure towards novelty or originality, via a non-static circular process where production functions constantly change in a Centrifugal mode. Research and Development is essentially the outcome following the introduction into such a 'circular flow' of a 'new combination' of existing knowledge and cognition. This work may technically be described as a "classification-transformation method" (CTM), which classifies experiences, qualities, properties and characteristics of the inputs, processes and outcomes, related with a phenomenon taking place in a specific system of the Euclidean & Newtonian world, and mathematically transforms them through levels that is said to represent the complexity in the description of the system.

Keywords: scientific research, knowledge, similarity, physical phenomena, matrix

INTRODUCTION

Science stands as a reasonable endeavor based on valid experimental evidence, criticism, and rational discussion, in order to reveal the knowledge of our physical world. It is, then, the experiments that provide such pieces of evidence that grounds this knowledge, through testing existing theories yet, also often calling for a new theory, either by indicating errors in the so far accepted theory, or by recognizing a new phenomenon that is in need of explanation.[113] Scientists may investigate a phenomenon so that it may be incorporated as evidence part of a theory. All theories have some free parameters that need to be completed via experimentation, where the phenomena are produced in an unchanging and repeatable manner.[114] In fact, the perception of a phenomenon has been emerged in the context of a hypothesis via the logical combination of empirical observations, and conclusive theoretical and practical interpretations.[115] Therefore, there is an infinite number of perceived phenomena, that all and each one, apparently signify an objective reality of higher or lower accuracy. The major tool

113 Reiss, J. and Sprenger, J. The Stanford Encyclopedia of Philosophy. *http://plato.stanford.edu/entries/scientific-objectivity/#EpiConVal.*

114 Hacking, I. *Representing and intervening. Introductory topics in the philosophy of natural science*. Cambridge University Press, UK, 1983.

115 Kuhn, T.S. *The Structure of Scientific Revolutions*. University of Chicago Press, Chicago, 1962.

for obtaining experience in the physical world is grounded on the reproduction of the physical phenomena in a controlled environment, i.e. within a lab or via an in-the-field experimentation procedure. In other words, gaining experience is actually based on similarities between phenomena or classes of phenomena, whose identification exists among the fundamental considerations of any scientist in charge of the experimentation procedure.[116] Indeed, the ability to correctly infer values of quantities for one physical system after knowing these same values of these quantities from a system that is physically similar to the first one, rests on the ability to properly establish that the two systems are similar. Towards supporting such an ability, the necessity of classifying the existing knowledge, has already been acknowledged.[117]

WHAT IS ACTUALLY SIMILARITY?

The similarity between particular systems is based upon the similarity in respect to a phenomenon of interest. At the same time observing events at a laboratory level, are considered informative about things and events that go beyond the specifics of the observed phenomenon. This is possible due to the assumption that there is a class of events or situations that are similar to the given event, and hence, any given event could be informative of all other events within that same class. Still, a question arises:[118] in the case that an observation has been made on a specific experimental setup, what does indeed determine the class of other events to which it is deemed similar? The answer refers to the assessment of various considerations regarding this same object or to the assessment among various objects of a common hypothesis.[119] Hence, the identification of similarity is quite difficult, since specific well posed criteria are necessary. What has been quite widely accepted was the necessity of the classification of the existing knowledge. However, a major difficulty has been the definition of all the specific similarity criteria, in order to assure that similarity indeed exists. Evidently, a researcher applying improper similarity criteria might obtain erroneous or meaningless results, yet still spending significant amounts of resources. Consequently, poor similarity criteria could lead to duplication of research (and, therefore, to waste of effort), due to lack of deep insights of the existing experience/knowledge on the phenomenon under consideration. Up today, knowledge classification attempts were -in most of the cases- rather empirical, without explicitly defining specific rules, and seemingly, following a time-dependent evolution of an inexplicable form.[120]

In an attempt to fulfill the requirement of selecting and applying solid similarity criteria, the work in hand suggests a solid mathematical treatment of identifying similarity and establishing robust similarity criteria through the application of fundamental Linear Algebra concepts (namely, vector spaces and mapping between them) on the relative philosophical aspects already arisen.

HYPOTHESIZING ON PHYSICAL PHENOMENA

The perception of a phenomenon may derive through a hypothesis context, formed via the logical combination of empirical observations and conclusive theoretical and practical interpretations. Thus, incidents occurring in the real world could be translated to phenomena, as

116 Kroes, P. (1989). Structural Analogies between Physical Systems, *British Journal of the Philosophy of Science*, 40, 145-154.

117 Sterrett, S.G. (2002). Physical Models and Fundamental Laws: Using One Piece of the World to Tell About Another, *Mind Society*, 3 51-66.

118 Glymour, C. (1970). On Some Patterns of Reduction, *Philosophy of Science*, 37, 340-353.

119 Sterrett, S.G. (2006). Models of Machines and Models of Phenomena, *Studies in the Philosophy of Science*, 20, 69-80.

120 Feyerabend, P. *Explanation, Reduction and Empiricism, Scientific Explanation, Space, and Time, (Minnesota Studies in the Philosophy of Science, Volume III)*. ed. H. Feigl, G. Maxwell, University of Minneapolis Press, 28-97. 1962.

far as these are recognized through the human senses and placed within the framework of theory and knowledge, available at the historical time frame.[121]

A theory may explain why some phenomena occur (or do not occur) by modeling the causes or conditions that control their occurrence (or non-occurrence) under the experimental prediction and regulation. Alternatively, a theory may explain a lawful regularity among empirical events, by providing a model of causes or conditions that, if fulfilled, necessitates the lawful regularity among these events. Theoretical questions as expressed by the researcher to sharp and accurate "technological" questions, may provide the way to reproduce nature within the lab, for to mirror theory to reality regarding the expression of the phenomena in question, or vice versa. It is up to the experimenter, to formulate certain "technological devices"/experiments, through which a decisive answer to these questions shall be elicited. Additional pending questions, may also follow a gradual implementation into the experimentation's unfolding, having an apparent impact on research subjectivity and its outcome.

Through the following results' explanation and interpretation process, the human engagement is inevitable for understanding, via providing the expressions of governing principles while, at the same time, humans make sense of themselves, their world, and the manner of being in it.[122] Summing up, the individual characteristics being examined and "adding" them up to make the whole, may not be considered as appropriate compared to total systems' behavior, understood as dialogic, emerging in the interaction between self and other participants.[123]

MATERIALS AND METHODS

Collecting the existing knowledge for a given system, includes both the objectivized pre-understanding, as well as the interpreter and inquirer. Potential users of scientific knowledge may possibly, be sharing a theoretical and practical pre-understanding with professional communities. This variability may be defining the multiple horizons of pre-understanding. Understanding may also occur as an iterated reciprocal movement between (the meaning of) a part and (the meaning of) the whole into which that part belongs. Assuming that any part only makes sense within a whole, yet the whole does not make sense except in terms of a coherent configuration of its parts.[124] Finally, understanding, contains the information-derived-knowledge. Therefore, it also depends on the engineering functionality of the inherent knowledge, which is transforming the existing knowledge, via appropriate justification means, into understanding, which according to Capurro[125], is one of the forms of the knowledge technology. According to Lancaster[126] and Salton and McGill[127], knowledge relevance criteria formulation includes the system's relevance and individual relevance or suitable applicability. Froehlich[128] also added the need for a more productive framework towards modelling systems and user criteria, including users of the collected information and mediation through the system.

In order to overcome issues raised up due to the complexity of the phenomena, the human factor engagement and the data collection, we, herein, propose an independent, engineer-

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122 Popper, K.R, Eccles, J.C. *The self and its brain: an argument for interactionism*. Berlin: Springer; 1977. Prigogine I. La fin des certitudes Temps, chaos et les lois de la nature. Paris: Odile Jacob, 1996.
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125 Capurro, R. (1987). Die Informatik und das hermeneutische Forschungsprogram, *Informatik Spektrum*. 10.6, 329–33.
126 Lancaster, K. *Variety, equity and efficiency: product variety in an industrial society.* New York: Columbia University Press, 1979.
127 Salton, G, McGill, M.J. *Introduction to modern information retrieval*. New York: McGraw-Hill. 1983.
128 Froehlich, T.J. (1994). Relevance reconsidered—towards an agenda for the 21st century: introduction to special topic issue on relevance research, *Journal of the American Society of Information Science*;45.3, 124–34.

ing-based method, which aims in offering the experimenter scientist a tool for designing and executing the reproduction of the phenomena in the lab, inside a clearly defined experimentation "device".

For achieving the aforementioned goals, it is our suggestion to include the formation of a knowledge database step, along with a classification scheme, under a strict research field terminology. That will be actually an objectivized pre-understanding collection of the phenomena descriptors, following specifically coded classes of data, that can be dialectically experimentally explored and/or enriched by the scientific community.

THEORETICAL BACKGROUND

The description of a system needs to consider both the physical principles of the system along with a validation step for the physical description of the system. Such a consideration must discretize in-space and in-time the investigation in order to provide a holistic approach of the system, including the cohesive points of the phenomena occurred. Nevertheless, this description has to be transformed accordingly to human cognition, in order to obtain a description that is consistent with the way that intelligence translates the phenomena. Actually, a system description based on fundamental principles is the initial condition for deriving the picture of the system, recognizable by human mind. This step produces the necessary categories, i.e. the expression of the system behavior and the definition of the boundary conditions, both classified in terms of logic. Finally, at least one macroscopic quantity must be estimated, against which the engineering tool should be developed and assessed.

Any system of physical interest can be described through a typical "in-process-out" context. In accordance with principal "categorical descriptors", a system is actually described through the expression:

(1) $$\text{matter} + \text{energy} \xrightarrow{\text{relationships}} \text{outcome}$$

That, results to a classification scheme that correlates these four categories (namely, matter, energy, relationships, outcome) with three, empirically defined, levels. From left to right, these levels follow a pattern of increased complexity, as clearly described in the following Table 1. From a mathematical point of view, the number of levels is the minimum number of points which might describe a non-linear curve on the Euclidean plane. At the same time, three is the least number of points that might be linearly independent, - which is a crucial subject in terms of linear algebra -, since these levels actually describe the degrees of freedom for each category, indicating therefore the impact of each systemic descriptor on the macroscopic outcome. Furthermore, it should be stressed out that the human cognition about the coherence of the system, does exist naturally within the cells of this matrix. To visualize the above concept, a 4X3 classification matrix has been constructed and depicted in the following Table 1.

CATEGORIES	LEVELS		
Matter	One	Many	All
Energy	Reality	Disallowance	Restrictions
Relationships	Inter-dependent	Reasons	Intra-dependent
Outcome	Potential	Existence	Necessity

Table 1. The classification matrix.

Each column of the above matrix within the levels of the categories, represents a specific situation within the system also indicating a specific level of complexity in the description of the system. The general trend is the increase of the description complexity, when moving from left to right. The first Level column refers to only one object/variable as a major representative for describing the system. Following a conservation law and/or a relative mass/energy balance, only one mathematical equation seems adequate to describe what takes place in the system. A single factor might be as well selected to describe the macroscopic behavior of the system, on the basis of one specific relationship between the variables selected and the outcome quantity produced. In brief, the first Level column of the matrix refers to *one* variable involved in *one* algebraic, differential or integral equation that produced by applying *one* fundamental principle in the system, while *one* quantity is selected to macroscopically describe the system. This column produces a rather primitive ideal outcome, which can roughly represent the system.

The mid-second Level column is produced by the transition from the one-dimensional events to multi-dimensional ones, with finite dimension. This vector-space dimension might represent the number of variables selected to describe the system (matter) or the details on the phenomena occurred (energy/relationships) or both. In any case, a system of differential or algebraic equations is produced by applying the corresponding fundamental principles on the system -parameters and reactivity-, while a single *one* parameter is selected to macroscopically describe the system. Although a single macroscopic outcome is defined, the difference from the first column's outcome is significant, since this second quantity includes the inter-effects of more variables and parameters, being therefore more accurate in satisfying more efficiently the approach.

Finally, the third Level column, describes the system in infinite dimensions that signifies an infinite number of variables. Since it is not possible to define a system of equations with infinite size, they must be treated through asymptotic techniques. The selection of *one* macroscopic quantity which is not only adequately describing the system's behavior (despite the problems arisen due to infinite dimensions), but also considers all the parameters impact (although not necessarily known in full details). The above-described overall concept is summarized in Table 2.

SYSTEM DESCRIPTOR	LEVEL 1	LEVEL 2	LEVEL 3
Dimension	One	Finite	Infinite
Mathematical treatment	Equation	System of Equations	Asymptotic
Macroscopic quantity	One (produced by the solution of the equation)	One (produced by the solution of the system)	One (appropriately selected)

Table 2. The translation of Table 1 to the language of mathematics.

The "System descriptor" column of the above table, contains the principal components of the system, commonly describing the three "Levels" in Table 1. These descriptors are considered to be logically adequate all together, to express each, and all, of the Categories. The remaining columns in Table 2, incorporate the particular requirements, per Level, in acquiescence to the theoretical background, presented in Table 1. In brief, the first Level column represents a simple, one-dimensional description of the hypothesis, the second one corresponds to a next level transition in a multi-dimensional space, while the third Level column depicts the influence and the cohesions in an infinite, multi-dimensional vector, space. Regarding the macroscopic description of the phenomenon/-a occurring as part of the systemic behavior under certain conditions, both columns of Level 1 and Level 2, denote the selection of one representative factor/quantity, but they clearly differ in the number of parameters whose influence has to be taken into account. So, the factor/quantity of the Level 1 column, represents inevitably the effect of just one parameter. For the factor/quantity of the Level 2 column, a finite number of parameters is assumed to affect the systemic outcome, while for the Level 3 column an infinite number of parameters as well as their impact are incorporated.

MATHEMATICAL TRANSFORMATIONS: SIMILARITY MAPPING

In support of the above, an example of engineering interest, could be the problem of instantaneous sorption of a substance "A" into a solid media. The "A" is assumed to be diluted in a Newtonian fluid flowing towards the solid surface under laminar flow conditions. When no reaction among the media is assumed, the available mass transport mechanisms are the convection (i.e. mass transport due to the motion of the medium) and diffusion (i.e. mass transport due to concentration gradients/differences), which have been mathematically described through the well-known convective diffusion equation[129]. Recognizing the time-dependent spatial distribution of the concentration of "A" as the desirable outcome, results into a typical vector $\underline{v}$, (which is one of the above-mentioned vectors):

(2) $$\underline{v} = \left\{ A \;,\; convective-diffusion \;,\; \frac{dC_A}{dt} + \underline{U}_A \cdot \nabla C_A = D_A \nabla^2 C_A \;\; with \;\; C_A(interface) = 0 \;,\; C_A(\underline{r}, t) \right\}$$

At this point, it is important to clarify that eve ry vector of V includes all the previously defined vectors, thus identifying the evolution of the knowledge about a specific phenomenon with the time. Therefore, a type of arrangement $\prec$ is defined through the time $\hat{t}$ when the perception $\underline{v}(\hat{t})$ has been formulated, as follows:

(3) $$\hat{t}_1 < \hat{t}_2 \Leftrightarrow \underline{v}_1(\hat{t}_1) \prec \underline{v}_2(\hat{t}_2)$$

To further understand the arrangement $\prec$, it has to be mentioned that $\underline{v}_2$ in the above eq. (3) contains all the knowledge existed in $\underline{v}_1$, since $\hat{t}_1 < \hat{t}_2$. In this context, every new perception of a phenomenon contains all the current knowledge about this phenomenon, plus a new contribution. Obviously, there are several cases where a newly obtained knowledge actually contradicts and eventually cancels a part or all of an existing knowledge on a phenomenon. In such a case, the existing knowledge is just proven as false knowledge. The overall achievement of proving the existing knowledge as actually false, can be treated as a new affirmative knowledge, by itself. In that sense, the arrangement previously defined in eq. (3) is always valid, even for the case that a new knowledge negates any previous one.

Now, let's define the internal operation $\oplus$ as follows:

(4) $$\forall \underline{v}, \underline{w} \in V \; \exists \underline{u} \in V : \; \underline{u} = \underline{v} \oplus \underline{w} = \left\langle \begin{matrix} \underline{v} & \text{if} & \underline{w} \prec \underline{v} \\ \underline{w} & \text{if} & \underline{v} \prec \underline{w} \end{matrix} \right.$$

The above process actually identifies existent accumulated experience about a phenomenon under investigation, following any recent scientific contribution towards its knowledge. The specific relationship (operation) defined through eq. (4) is commutative and associative, while it includes an identity element as well as inverse elements. Detailed proofs are given in the Appendix section. Still, it is important to underline that the above-mentioned accumulation

129 Bird, R.B., Stewart, W.E., Lightfoot, E.N. *Transport phenomena*. Wiley, New York, 1960.

also includes fractions of knowledge that may, partially or totally, negate the existing knowledge. In terms of mathematics, this accumulation represents a series where each term is accompanied by its own particular sign.

By defining the amount of the accumulated knowledge included in the vector $\underline{v} \in V$, $\lambda = \|\underline{v}\| \in \mathbb{R}$, as the regular norm of the vector, is able to calculate the evolution ratio between every two elements of *V*. If λ_i and λ_j are the amounts of knowledge embedded in $\underline{v}_i \in V$ and $\underline{v}_j \in V$, respectively, then:

(5)
$$\mu_{ij} = \frac{\lambda_i}{\lambda_j} = \frac{\|\underline{v}_i\|}{\|\underline{v}_j\|} \in \mathbb{R}$$

Obviously, $\mu_{ij} > 1$ when $\underline{v}_j \prec \underline{v}_i$, while $\mu_{ij} < 1$ when $\underline{v}_i \prec \underline{v}_j$.
Now, let's define the external operation $\times$ as follows:

(6)
$$\forall \underline{v}, \underline{w} \in V \; \exists \mu \in R: \; \underline{w} = \mu \times \underline{v} \Leftrightarrow \mu = \frac{\|\underline{w}\|}{\|\underline{v}\|}$$

The above operation actually quantifies the relative significance of the knowledge evolution through any two perceptions of a phenomenon under investigation. Operation $\times$ defined through eq. (6) presents compatibility with scalar "multiplication", satisfies the distributivity of + over $\times$ as well as distributivity of $\times$ over $\oplus$. Detail proofs are again given in the Appendix section.

The above definitions and properties guarantee that the structure $\{V, \oplus, \times\}$ is a vector space of a basis containing the four vectors $e_m = \{m,0,0,0\}$, $e_e = \{0,e,0,0\}$, $e_R = \{0,0,R,0\}$ and $e_0 = \{0,0,0,o\}$. Obviously, the dimension = 4. To prove that the above structure is indeed a vector space, it is necessary to show that (a) the elements e_m, e_e, e_R and e_o are linearly independent, and (b) that they might produce the whole vector space. Indeed, the categorical descriptors defined in eq. (1) are independent to each other, because there is no straightforward transformation to produce anyone of them as a linear combination of the others three. For the matter, the energy and the relationships, this is rather obvious. On the other hand, the liberty of selecting any appropriate macroscopic quantity to represent "outcome" actually assures that this descriptor is independent on the others three. Finally, it is rather obvious that any vector of *V* is a linear combination of e_m, e_e, e_R and e_o.

It is now straightforward to define a mapping m_p^{In} on this vector space, as follows:

(7a)
$$\mathbb{R}xV \xrightarrow{m_p^{In}} M_{3x1}(V): m_p^{In}(\underline{v}) = \{\lambda_1 x\underline{v}, \quad \lambda_2 x\underline{v}, \quad \lambda_3 x\underline{v}\}$$

with

(7b)
$$\lambda_1 \to 0 \;,$$

(7c)
$$\forall \lambda_2 \in \mathbb{R} \exists M > 0: \lambda_2 > M$$

(7d)
$$\lambda_3 \to +\infty$$

The first element of the mapping, $\lambda_1 \times \underline{v}$, represents a nearly zero amount of knowledge, the second, $\lambda_2 \times \underline{v}$, represents any finite amount of knowledge and the third one, $\lambda_1 \times \underline{v}$, the almost total infinite amount of knowledge that can me accumulated for the physical phenomenon under research. This classification is consistent with the philosophical wit of “one-many-all”, encountered in the modern philosophy.[130]

The above mapping [eq. (7)] produces a matrix with four lines, each one standing for each of the elements $\{m,e,R,o\}$, and three columns, the first for the vector $\lambda_1 \times \underline{v}$, the second for the $\lambda_2 \times \underline{v}$ and the third for the $\lambda_3 \times \underline{v}$. In terms of rationalism, each column of this matrix represents a specific perception of the phenomenon, as presented in detail elsewhere.[131]

As previously stated, the first column refers to a vector containing the minimum non-zero knowledge of the phenomenon, where only one variable, along with only one mathematical equation produced by one simple conservation law or a relative mass/energy balance, are considered adequate to describe the particular perception. In fact, the first column of the matrix produces a rather primitive ideal outcome, which can roughly represent the phenomenon. The second column refers to the maximum finite knowledge currently available, where a finite number of variables are selected to describe the phenomenon and, therefore, a system of equations is produced, while a single one parameter is again selected to macroscopically describe the phenomenon. Briefly speaking, the second vector is a more accurate and more efficient representation of the phenomenon under consideration. Finally, the third column describes the absolutely holistic perception of the phenomenon, taking into account an infinite number of variables that define a system of equations with infinite dimension. In other words, the third vector describes the overall currently available knowledge about a phenomenon, identifying all the parameters’ impact, although not necessarily known in full details.

It is important to note that:

$$\lambda_1 x\underline{v} \prec \lambda_2 x\underline{v} \prec \lambda_3 x\underline{v} \qquad (8)$$

i.e. the last column of the matrix includes all the knowledge embedded in the previous two columns. Although sounds valid at a glance, the direct use of only this third column is impossible without the use of the previous two, due to the high complexity of the description and the infinite quantities involved. In this context, the values of the mapping m_p^{In} produce the necessary classification of knowledge through eq. (7). Apparently, the above mapping builds an internal similarity between the columns of matrix, as far as they are produced through the same mapping expression.

The aforementioned theory has been developed in order produce a tool for the detection of internal and external similarities under specific similarity criteria. For the application of such a theory, the development of a detailed methodology is crucial. In order to achieve potential internal similarity, it is necessary to complete the 4X3 matrix, i.e. to define a mapping of the form given by eqs. (7). Obviously, there are more than one options (definitions) of such a mapping, therefore the matrix is not unique. What is important here is to carefully follow the decisive rules, presented in detail elsewhere.[132]. Moreover, the use of this matrix allows for the identification of lack of knowledge about the phenomenon under investigation: this lack exists if it is not able to fill all the cells of the matrix, i.e. whether is not able to define the three real numbers λ_1, λ_2 and λ_3 in eqs. (7).

130 Kant, I. *The Critique of Pure Reason*. (Translated by J. M. D. Meiklejoh). University of Adelaide Press, Adelaide, 1924.

131 Kanavouras, A. and Coutelieris, F.A. (2017). Systematic Transition from Description to a Prediction Engineering Model for the Oxidation in Packed Edible oils, *Journal of Food Chemistry*, 229, 820-827.

132 Coutelieris, F.A. and Kanavouras, A. (2016) Preservation engineering assets developed from an oxidation predictive model, *Open Chemistry*, 14, 357-362.

SIMILARITY DECISIVE RULES

Following the above demonstration, we consider equally important to define the rules regarding the matrix content completion. It goes without saying that consideration and application of these rules will eventually reassure a trustworthy and acceptable model development for engineering purposes. It should also be possible to define the transition functionality and efficiency, from the Level 1 to the Level 3 activities of Table 2, in practice and within the empirical experience available.

Therefore, the key rules for filling the matrix, are:

Rule 1: The transition from a description of a system to a model is able if, and only if, all the cells of Table 1 are appropriately filled according to a given hypothesis.

Rule 2: A system may allow for more than one transition pathways from description to model, as the content of the cells in Table 1 are not obligatory unique.

Rule 3: For cells in Table 1 that may contain more than one values, the selected macroscopic quantity has to be different, in accordance with the selected parameters. Although all the potential different quantities in a cell are totally equivalent among each other, it is always possible to interchangeably translate each one of them to another through a simple relating process.

Subsequently, the completion of the twelve cells in Table 1, transforms the systemic mathematical description into an engineering tool that is self-confidently obtained through a well-established methodology of the classified available knowledge.

Additionally, it also makes sense that through this engineering model's mathematical shelf assessment and development process, the whole system and its classified knowledge may be intellectually screened for riffles and open points. These are original knowledge or existing knowledge "gaps" in understanding, which restricts a proper and adequate compliance of theory to mathematics, through the empirical experience (field/lab observations). Simultaneously, the aforementioned process shall then, apparently, reveal the particular experimental approach needed in order to answer and complete the inconsistencies in knowledge regarding the phenomenon in question and allow for the most "economical" experimental technology, towards an overall efficient experimentation plan.

CONCLUSIONS

The aim of this work was to tackle the matters of hypothetically questioned events, as part of a world of increased complexity, in order to reveal the cohesiveness among the complexity levels, as well as the similarity identified via the interconnection of these levels and the potential transition among levels of increased complexity, i.e. the columns of a of within a well-defined classification matrix.

The phenomenological expressions of the systemic participants can be strongly associated with forceful fields of classification and their descriptors. Accordingly, the goal was to critically describe the evolution patterns of the existing phenomena via their expressions under certain conditions.

Our method assumes that all relations in a Euclidian and Newtonian world, are inherently existing, although not clearly revealed, therefore they remain misperceived, unexplored or unknown. This work supports the classification of the existing knowledge regarding a phenomenon, in a strict mathematical way. In specific, it was proven that the set of all the perceptions of a phenomenon under investigation, sustained by closely defined operations, constitutes a vector space. For knowledge classification being essential for identifying similarities among perceptions of phenomena, a non-linear mapping over this vector space has been also defined. This mathematical treatment allows for a deep insight on a specific phenomenon, becoming therefore an engineering tool for locating lack of knowledge, avoiding repetition of results and managing waste of research effort, in general.

Conclusively, this work is a constructivist approach in that tries to avoid non-essentialist explanations of events, research repetition or missing of particular research challenges and potential innovations. The ultimate target is to explain a successful theory by understanding the combinations and interactions of elements under well-defined conditions that make it effective and efficient, rather than recording the “true” and “false” perceptions of the events.

Finally, we support that our approach describes and tries to explain the world by focusing on the cohesions among the principal system descriptors, rather than in their description itself.

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