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A Methodological Approach on Experimentation Engineering

Abstract:
The current approach aimed in connecting the phenomena occurring within natural system to the conditions that outline the potential disclaim of a hypothesis, through the development of a methodological tool for the experimentation set-up. The outcome is a proposed procedure that shall allow for the identification of the conditions under which the phenomena have to be studied. In order to achieve that, we worked on the knowledge classification that provide a detailed de-structuring of the system into is main descriptors of experience, properties, qualities and characteristics for the main systemic categories of matter, energy, relationships and outcome. Each of these descriptors are to be expressed via physico-mathematical parameters applicable in the system, which are according to the expressed contributing properties/attributes. Thus eventually this procedure should be linking the descriptor to the properties of the contributors, for a potential disclaim of the hypothesis, when tested at certain conditions.

Keywords: Experimentation, engineering, knowledge classification, experimental design, oxidation

Introduction:
A crucial initial step in the study of physical phenomena, is identifying the physical system in order to identify its properties and characteristics. This often involves practical and empirical knowledge much required for the appropriate idealizations and simplifications of the actual system. Then, identifying the physical quantities upon which that system's behavior depends, might involve invoking general scientific principles, such as conservation laws, to identify the descriptors involved (Sterrett 2002).

Industrial success as well, necessitates efficient experimentation both for the improvement of existing products and processes and for development of new ones. Scientific development, formerly based on the conventional iteration of the "theory-experimentation" dyad, is being replaced by the iteration of the "theory-experimentation-simulation" triad, simulation meaning experimentation done using a mathematical model implemented in a computer software environment (Grabarek and Choromanski2005). Quickly known results affect the natural way to experiment by using the information from each group of runs to plan the next ones. Such investigation employs a scientific paradigm in which data drives an alternation of inductions and deductions. This process can suggest at each stage how questions that are still at issue could be resolved. (Box 1999).

The experimentation effort targets a quantitative agreement between the constitutive theory and all experimental results using one set of model parameters for each system under research. Methods for experimentation and data analyses were significantly improved during the 19th and 20th century, but it was not until the mid-20th century when the importance of experiments under controlled conditions, was recognized. According to Spiertz (2014), a system's approach combining knowledge at different scales and incorporating cutting-edge findings from the basic sciences into applied sciences, could significantly promote the developing science, although in certain instances, research will continue to depend on progress made in the related basic sciences and the inherent capacity for research and innovation. Moreover, an experimental method is less flexible because conditions in the trials are more rigidly controlled. However, increased precision in the experimental method has enabled the physical sciences to advance tremendously, making major contributions to theory and practice, (Velasco et al. 2000). Hacking (1983), pointed out though, that each experiment is creating a phenomenon, thus, if the experiment is not reproducible, it has

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probably failed to create the phenomenon in question. Nevertheless, scientist rarely really reproduce the experiments, but they rather try to improve, extend and repeat under the minimum biases possible. So the ultimate researcher's skill is to recognize when the experiment will work. In this sense, lab measurements and observations have less to offer compared to the ability of observing and distinguishing an erroneous, definitive or manipulative result within the lab equipment.

Since the objective has been a systematic experimental design procedure it is necessary to avoid wasting time and resources or aim in maximizing the efficiency through the defined control variables (initial experimental conditions, experiment durations, etc.). Furthermore, the experimental design should incorporate maximum generality allowing for the comparable design of more experiments. Mathematical formulation of the optimal experimental design problem may be considered as a general dynamic optimization problem (Nahoret al.2001;Nahoret al.2003).To overcome some of the aforementioned considerations, mathematical simulations have emerged as a third wing of science that is orthogonal to experimentation and theory. It plays the role of the extended calculator in that mathematical simulation providing a numerical bridge between symbolic theory and hard experimental data (Garland 1990). Accordingly, experimental engineering models have been used both to model general phenomena and to predict the performance of lab-settings ("device") of particular size and configuration in particular contexts. Various sorts of knowledge are involved in the method such as logical consistency, general scientific principles, laws of specific sciences, and experience. Procedures, where model is assumed known *a priori* and fixed, are appropriate for some practical problems and attractive for allowing rigorous development of theories of statistics based solely on mathematics. By contrast, discovery of new knowledge requires the use of the scientific paradigm in which the model is continually changing, while scientific method is thus mathematically incoherent (Velasco et al. 2000).

Since the decisive preparation (design) of an experiment, is strongly influenced by any prior knowledge of the experimenter, the optimization of this preparation – could as well be termed as designs' risk management, as is in general, based upon the maximum likelihood approach, assuming that the parameters are deterministic. Researchers, in a continuous dialectic relationship to their activities, are learning how to make it work, know when it works and how it works, for the purpose of creating, producing, improving and standardizing the phenomena in a concrete and repeatable manner, presumably, unbiased by their inner values and beliefs. Then, via such a dialectic process, specific types of experimental practices may, in the end, extensively serve as reference points, i.e. as recognized permanent facts of the phenomenon, in which case, emerges the direct need to adjust any future theory in combination with comparable importance theoretical benchmarks.

The objectives of this study developed towards a methodological design of experiments according to a considered and properly filtered, input. We wish to propose a method and credibly discuss the required methodological frameworks, currently available for modeling and analyzing integrated s, in particular incoming reactive species and corresponding measurable outcome.

Having the goal of a solid, generally applied method, we have been implementing traditional kinetic models as well as predictive mathematical challenges. In the end, the proposed methodology shall work on the prerequisites of input data (knowledge gaps identification), experimental set-up (design assistance)and knowledge classification techniques deriving critical conclusions, in accordance to the previous points. Illustrated case study, evidently demonstrating the method applicability on the experimentation process for preservation, will also be provided.

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Having demonstrated the general conceptual background, this work shall further include:i) the method development on knowledge classification and mathematics, including the corresponding terminology and ii) the supporting case study.

Materials and Methods:

i) Method development

Forming the least *a priori* conception of the possibility of dynamical connections in phenomena, is far beyond the potential pure understanding, since human cognition cannot enable to excogitate any such connections but shall merely help to understand them when met with the min experience. Establishing a chain of reasoning upon conceptions of things cannot be imaginative or inventive of either any object or any property of an object et unknown in experience, and so it cannot be employed in a hypothesis. Consequently, we cannot assume that there is any other kind of coherences within phenomena which are not observable in experience, in space or in time. Simply stated, the conditions of possible experience are the only conditions of the possibility of things and hence, reason cannot venture to form independently of these conditions. Any other conceptions of things, although not self-contradictory, are without object and without application.

It follows that a proof must demonstrate the possibility of arriving, synthetically and *a priori*, at a certain knowledge, which was not contained in the existing conceptions of the phenomena. Otherwise proofs, instead of be indicated by reason, will be mere subjective associations.

a. Methodological setting

The following ,progressively discussed, considerations, aim in setting the necessary terms that disclose the principles and definitions which we used to set the boundaries and the overall experimental concept, we wish to introduce, via an engineering approach.

The developmental process corner-stoneis defining a phenomenon as a visible, a remarkable fact or a particular type of process, which occurs regularly under certain conditions. Hence, a phenomenon is a regularity that is expressed by using the universally accepted and applied laws in nature, presented in a universal language, most commonly the language of mathematics.

Having defined the system borderlines and objectively described its potential performance within the given hypothesis structure, primarily set by the experimenters, it is the history search for similar *situations*, that shall allow for the common ground establishment, among the existing knowledge and results, which will further reveal the knowledge gaps within the same world of phenomena. It is the pure descriptors of the system which, as an essential prerequisite in the formation of the hypothesis, are relying on the physical laws and mathematical principles that depict the systemic phenomena. It is the common recreate design of the over-all principles within the phenomena that shall allow for the reconstruction of the system in order to be studied under controlled conditions.

During the reproduction of nature in the lab, i.e. when experimenting, a phenomenon ,eventually at its original state, should be realized within a “device". Since, this “device” has to accommodate the originality of the phenomenon, it has been commonly designed solely on a moderate number of basic truths for entities, so that other phenomena to be investigated, may also be produced therein. From a point of view, that is like believing in the entity, because we anticipate that it will behave as "device". The threat of this process to turn into a considerable misleading bias, is

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quite noticeable. The reason being that when the experimenters' line-up the entity, so as to allow themselves - through its controlled behavior - to see what happens to something else, the experimentation set-up is quite inadequately adhered to a straightforward way for organizing the cognition of the evolving phenomenon(-a) coherence, but rather to their salvation through recorded observations.

As a consequence of the aforementioned approach and in accordance to our prospective goals, we will present the supporting evidence of the existence of those ways to recreate phenomenal events within an *independent* area, yet still with physical substances, such as the experimenting lab. In specific, we shall now demonstrate an investigation on whether entities with in classes, can be tools that lower the "noise" and naturally isolate the properties of those entities that are expected to be realized in a progressive and coordinated series of experiments. A consecutive additional derivative of such a procedure shall be the identification of "bugs" and the correction of the problems (issues and obstacles) in the "devise". That undoubtedly, will promote the experimental design process, to its existence, not as a matter of a theoretical explanation or an error prediction process anymore, but, as a matter of exempting the "noise" in the "device".

In order to achieve a proper functioning of this "device", we elaborated a series of steps that contained the use of the experimentation object (system) descriptors-based classification matrix and the empirical and mathematical judgments imbedded within the fundamental natural laws that cohere this system. The term "Experimentation Technology", will be defining this ultimate linkage of the selected systemic descriptors to the conditions for a potential disclaim of the hypothesis under research.

b. *The establishment of a knowledge classification matrix.*

For the justification of certain phenomena, no other things and no other grounds of explanation can be employed than those which stand in connection with the given phenomena according to the known laws of experience. The conceptions of the conditional reasons for the phenomena existence, need to be related to any object in any kind of experience. At the same time, they have to indicate possible objects in order to, consequently, be employed as hypotheses in the explanation of real phenomena.

Therefore we shall, beforehand, deal with the empirical and cognitional – the hypothetical and productive history of knowledge accumulation - which must be distinguished within the nature and mathematicalsciences.As, will be shown in the next section this approach involves the following group of classes:

i) *Categories*, the main descriptive systemic components. Within the Newtonian world we may incorporate materials, energy, relationships and outcome as major principal systemic categories of species reactivity (process based systems);
ii) *Descriptors*, being each and every thing in experience, the properties, the qualities, and the characteristics of the relevant category, as defined above.
iii) *Parameters*, of physical and mathematical origin, translate the ideas of the two preceding groups, by known scientific suggestions, to definable, measurable, controlled and applicable pragmatism for purposefully contribute to reveal the coherences inside of the phenomenon.
iv) *Contributing properties*/*attributes*, are the particular, measurable and definitive values that are logically applicable during the description of the empirical experience of the parameters. To further explain, these are the values we have to monitor/measure for to experience the parameter. Thus, if parameters are the phenomenological causes, the properties/attributes are their physical aesthetical perception. These provide the empirical conditions thatshall allow and satisfy the description of the properties expressed within the phenomena.
v) *Levels* of the categories, represent situations of specific complexity, increasing form left to right, as the major representative objects/variables for describing the system, increase from a single object/variable (Level I) to all the potential objects/variables (Level III). In the same manner, the levels are also changing

from aa single one-dimensional description of the events (Level I) to the holistic one (Level III) through the most complex currently available multi-dimensional description of finite dimension (Level II) (Kanavouras and Coutelieris 2015b).

Conditions, are those "technically established" situational environments that allow for the reproduction of the phenomena within which, the hypothesis disclaim risk will be evaluated. These environments/conditions derive as the existing-non-existing ("yes/no" confirmation) or minimum-maximum("how much" setting up) countenance requirements. These requirements are to be applied according to the needs for an empiric experience of the definitely concerned hypothesis parameters, in order to validate the potential disclaim of the hypothesis outcome. Conditions are in a sense, the qualitative relationships for the categories' transitions and the quantitatively defined levels of the experimentation device/system margins, providing a side-to-side filed of experimentation. Conditions may be affecting the expression of the parameters properties as may be inter-combinatorial similar, interchangeable or different for all, few or each of the parameters. Hence, conditional margins for one property expression may or may not affect other(s). This inter-process-effect should be filtered through a step-by-step progression of empiricism gain, initiated at Level I and proceeding up to Level III. Such a procedure will be eventually revealing adequately justified experimental applications, subsequently associated to a comprehensive technological outline, as judgments enounced by "pure reason" are necessary, since otherwise they must not be enounced at all.In accordance, Table 1,summarizes these categorized groups of knowledge.

In Table 1, we are presenting a sequence of events aiming to proceed from the empirical conception of the phenomena occurring within a system (via the categories and their descriptors, according to a defined hypothesis), to the technology of this system that is described, controlled and expressed, through the natural laws (translated into a physico-mathematical language) and their contributing parameters that these laws are made of within a Newtonian world, up to the technique which may be applicable in a research environment (as the Levels of conditions within which the initial hypothesis may be potentially disclaimed). Itgoes without saying, that the pathway of knowledge can also be developed in multiple sequences, as the case of a technique preceding the technology ,which leads to a theoretical background creation, or even more, in the case thatthe experience in one empirical field will initiate the hypothesis within a different field, or a technique or even a technology, that shall create new experiences and potentially a theory for this newly developed or newly approached field.

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T E C H N O L O G Y

KNOWLEDGE CLASSIFICATION AND TRANSFORMATIONS							POTENTIAL DISCLAIM CONDITIONS AT THREELEVELS OF CONCEPTUAL JUDGEMENT		
D E S C R I P T O R S	SYSTEMIC CATEGORIES: EMPIRICAL, PHYSICAL AND GEOMETRICAL	CATEGORIES	DESCRIPTORS	PHYSICO-MATHEMATICAL PARAMETERS WITHIN THE SYSTEM	CONTRIBUTING PROPERTIES/ATTRIBUTES	CONDITIONS	LEVEL I	LEVEL II	LEVEL III
		MATTER	experience				one	many	all
			properties						
			qualities						
			characteristics						
		ENERGY	experience				reality	disallowance	restriction
			properties						
			qualities						
			characteristics						
		RELATIONSHIPS	experience				inter-dependent	reasons	intra-dependent
			properties						
			qualities						
			characteristics						
		OUTCOME	experience				potential	re-existence	necessity
			properties						
			qualities						
			characteristics						

Table 1. Knowledge classifications and transformations linking the descriptor to the properties of the contributors, for a potential disclaim of the hypothesis, when tested at certain conditions.

Independent of the sequential developmental process, it is the completeness of the knowledge classification that shall allow for the understanding of the phenomenal world and shall potentially face the theory on that field. Having gaps in that classification may only be perceived as a gap in understanding, a gap in confirming the universality of the theory and a potential luck of efficiency in forming present of future hypothesis on the phenomena under research.

Furthermore, we support via this work, that independent of the sequence of the triptych of experience-technology-technique, the knowledge of the phenomenal nature is only completed in the presence of all of the three sciences, or otherwise the available knowledge shall not be in position to be correlated and the research "device" cannot be formed for additionally exploring the system and confirming the hypothesis in the higher efficiency possible.

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Having realized the aforementioned three prerequisites, it is in a sense logic to conclude that Table 1 has an additional function, as a quite descriptive format in defining the "step-by-step" procedure on how the progress from the systemic descriptors to the technological implications involved into the experimentation "devise", is evolved. This essential function is theoverall fundamental prerequisite containing the existing knowledge and experience that will be transformed into the experimental conditions. Thus, Table 1, may be actually perceived as a "mechanism", which technology will be completed by experience and cognition input, by the experimenter. The three table columns following the Descriptors and preceding the three Levels, are to be filled from left to right as follows.

1. The column of the "physico-mathematical parameters within the system" contains the knowledge/data which defines the descriptors. These can only be the mathematics of the physical laws with natural and geometrical principles, much related to the descriptors and thus to the categories of the predefined system (and its phenomena) in question. This relation derives directly from the existing knowledge which has to be treated by cognition, filtered by experience and understanding and selected in regards to relative cohesion to the phenomena.
2. The column of "contributing properties/attributes", is the next step in moving forward to the translation of the physical and chemical parameters into their properties and attributes. Needless to say, these can only be relevant to describing the previous parameters, thus, they can only derive as the factors and indicators included in the equations defining the natural laws, mentioned directly above.
3. Finally, the column of "conditions" is the next analytical treatment of knowledge and experience. At this stage, the experimenters have to be aware of those conditions that impact on the properties and attributes selected above. They can only have physical meanings and can only be applicable within the experimenting environment, not simply as conditions, but mostly as the fine-tuning of the systemic expressions. In other worldsthey define the system's functionality, explicitly as the "know-how" factors defining the "technology" of the experiment.

Having completed these three steps of knowledge treatments, the experimenters should be in position to identify the knowledge gaps and define the particular similarities and di-similarities in knowledge (see Coutelieris and Kanavouras, 2015) and eventually, deal with those conditions available in experience, or not yet studied, or of additional potential interest (innovation, invention, creativity).

Needless to say, that the table-mechanism is continually subjected to a cyclic process of improvements and refining, as long as new experiments and experience is collected and properly categorized. In that sense, Table 1, at each stage of the experimentation, simply refers to the system itself, improving the theoretical background of the phenomena's cohesions within the systemic world. In a reverse order of actions, the table shapes-back the theory of the phenomena.

Although the conditions for potential disclaim of the hypothesis have been identified, Table 1 goes even further, beyond the selected conditions, up to their application in a-well-defined structure of experimentation steps, within the subsequent three Levels of judgment. That is more than obligatory, since according to a preceding work of Kanavouras and Coutelier is (2015b)each Level represents a specific situation within the system. This signifies that among the three Levels, complexity increases from the first to the third Level, as we are proceeding experimentally from only one object/variable as a major representative for describing the system, to the next level of a multi-dimensional space of finite dimension, to the final inclusion of all the possible variables and parameters, being therefore more accurate in satisfying in higher efficiency the technological outcome, with the consideration of all potential impact.

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Each and every column corresponds to one group of classes, while within each group a number of exemplary relevant factors is presented. Yet, a classification scheme involving the above four categories and the descriptors, should - at a minimum – be considered at three (3), empirically defined, levels that need to also firmly satisfy the mathematical requirements for being a vector-space base. As described in details elsewhere (Coutelieris and Kanavouras 2015), all the possible perceptions of the phenomenon under research constitute a vector-space of dimension = 4, where each one of its base vectors is formed by the above defined categories. The aforementioned levels are actually the minimum amount of necessary vectors that have to be specified in order to adequately describe the vector-space (Coutelieris and Kanavouras 2015). These three levels per each descriptor, essentially, represent a set of conditions, along with the incorporated degrees of freedom within a critical judgment, which adequately link the descriptor to the hypothesis in question. Schematically given, all the 3 levels of a categorical descriptor condense the impact for this systemic participant against the disclaiming of the hypothesis. (Kanavouras and Coutelieris 2015a).

Each individual cell contains distinctly particular conditions for a definite systemic activity. In that sense, each cell is a structural contributor to the possibility of the overall preservation hypotheses' disclaim and needs to be treated as such. Furthermore, it is among all 12 classes where the cohesions within the system context actually exist and need to be revealed. Finally, the cross sections of the classification cells provide an inter-subjective validation of the preservation hypothesis, since the common ground among all classes' interactions may eventually deliver the basic and only physically meaningful and accountable potential conditions of knowledge, (Kanavouras and Coutelieris 2015a).

The authors concluded in a relevant study that the empirical experience (field/lab observations), that could create "gaps" in understanding may then apparently be revealed by an experimental approach that will answer and complete the inconsistencies in knowledge about the phenomenon under question and allow for the most "economically" efficient experimentation plan (Kanavouras and Coutelieris 2015b).

ii) Mathematics

A fully filled in matrix, as described above, actually embeds all the existing knowledge about a phenomenon investigated under a disclaiming hypothesis, while simultaneously presents the necessary and only the necessary evolutionary steps towards knowledge acquisition regarding this phenomenon. As elsewhere proven (Coutelieris and Kanavouras 2015), only three of them are necessary: the minimum non-zero knowledge of the phenomenon, the maximum finite knowledge currently available and the absolutely holistic perception of the phenomenon. Therefore, a filled in matrix defines the vector of the research pathway towards obtaining the total amount of knowledge. As far as the transition in the matrix is from left to right and from up to down, this vector has initial point at the cell defined by the first column and the first row and terminal point at the cell defined by the third column and the fourth row, being for the reason diagonal.

As far as one single cells of the matrix is unfilled, the above mentioned vector has to diverge from his original direction, pivoting against its initial point, to pass through the empty cell. In the case where more than one cells are unfilled, the torsion of the vectors follows the least-distance principle: first, the vector must pass through the cell being closest to the diagonal, then to the closest to its new direction and so forth. It has to be stressed out that the direction of the research about a phenomenon under a specific disclaiming hypothesis, is totally defined in any case, through the vector previously defined.

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iii) Case studies

For the purpose of demonstration, we shall now proceed with implementing the aforementioned methodology to the following particular situation.

Oxidation of packed edible oils

a. *Categories*, the main descriptive systemic components, incorporating materials, energy, relationships and outcome are definedas matter, energy, relationships and outcome. These remain similar to Table 1.
b. *Descriptors* include experience, properties, qualities and characteristics. These remain similar to Table 1.
c. *Parameters*, a set of physical and mathematical origin descriptive terms are provided. These are known scientific proposals and assumption given in the literature that can be measured for to reveal the phenomenon. In the case of packaging materials, a rather extensive list is provided in Table 2.
d. *Contributing properties/attributes* include the particular, measurable and definitive values that are logically applicable during the description of the empirical experience of the parameters. In the case of packaging materials, a rather extensive list is also provided in Table 2, according to literature.
e. *Levels* of the categories also remain similar to Table 1.
f. *Conditions* are the consequent outcome of the contributing properties/ attributes, which in the case of packaging materials, is provided in Table 2, according to literature.

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KNOWLEDGE CLASSIFICATION AND TRANSFORMATIONS

D E S C R I P T O R S

SYSTEMIC CATEGORIES: EMPIRICAL, PHYSICAL AND GEOMETRICAL

CATEGORIES	DESCRIPTORS	PHYSICO-MATHEMATICAL PARAMETERS WITHIN THE SYSTEM	CONTRIBUTING PROPERTIES / ATTRIBUTES (e.g. PKG)	CONDITIONS
MATTER	experience	Physical dimensions	geometry, volume of content, area	N/A
	properties	Mass transfer	permeation, transparency	T, RH
	qualities	Indicators, markers, factors	integrity	T, RH
	characteristics	Molecular chemistry, internal composition	food-packaging active/passive interactions	T, RH
ENERGY	experience	Requirements	activation energy - thermal properties	T, RH, hv
	properties	Transport, storage, capacity	energy transport	T, RH, hv
	qualities	Transformations	energy transfer	T, RH, hv
	characteristics	Rate/coefficient, frequency, wavelengths	thermal capacity	N/A
RELATIONSHIPS	experience	Reactivity	amounts	N/A
	properties	Affinity	Polarity	S, D
	qualities	Rate/coefficients, sequence, levels	active/passive interactions	S, D
	characteristics	Dependencies, adequacies, deficiencies, restrictions, catalysts	active reactivity sites	?
OUTCOME	experience	Quantity	sorption	S, D, T, RH
	properties	Identification	N/A	N/A
	qualities	Indicator, marker, significance	N/A	N/A
	characteristics	Molecular chemistry	N/A	N/A

Table.2. The knowledge classifications and transformations that link the food-packaging-environment systemic descriptors to the packaging materials properties, for a potential disclaim of the edible oils preservation hypothesis, when tested at selected conditions.

According to the above example, it is an open point whether we may proceed with the experimentation when there are either non-applicable (N/A) conditions, or similar conditions applicable in more than one occasions. On that apparent discrepancies of the main principle of fully filled columns in order to investigate in full and in depth the phenomena, we may comment that it is a matter of cognition and existing knowledge whether a N/A condition may be indeed so. Meaning that within the experimentation process, the constructed lab device shall allow for a confirmation of this, or any other decision on conditions that we have selected, by not providing any or significant different results. I.e., when there is indeed a dependency of a contributor or property on a certain condition, there will be a relevant output that should be considered on the next experiment as an applicable set up. This shall impact on the three levels matrix as one stable and non-changeable value of supposedly, no impact at any level, unless otherwise notified by the experience following the experiment.

Furthermore, it is the same conditions that may have a different physical meaning among the properties or attributes under investigation. In that sense, solubility (S) is indeed the same condition under investigation, but the result of the investigation is different according to the origin of this condition, i.e. on the origin of the descriptor or the category preceding. It has been previously shown by Kanavouras and Coutelieris, (2015a; 2015b) that filling the matrix is not feasible in only a single manner. According to the authors a cell containing more than one values shall provide a different output, nevertheless related directly to each other.

Discussion:

This work's outcome is solely aligning on natural resources and applications. In the end, the complete procedure was methodologically developed, supported by mathematical description of the concept, all within a fully described and defined framework, termed as system. Finally, but equally important, this procedure has indirectly indicated that it is much relying on the human cognition that has a major role in the efficiency level of such a venture. Consequently, the technology for experimentation we have proposed, has an esoteric risk of applicability and functionality, which nonetheless exists in the majority of design procedures, especially those meant for creating new phenomena, for approaching unknown fields and new areas, such as the research for optimum food preservation.In brief, this procedure described above, has input and output, functionality, potential for transforming the inner parts of the hypothesis and yet, is a human-depended process.

Respectively, the "experimental device" that enables these processes, should be viewed as a process, itself. Built in a technical system (cluster),the "object for experimentation" becomes progressively less of a real independent entity that could develop an indeterminate number of different and distinct relations. It becomes a moment in a system of predetermined relationships. These relationships or their procedures are converted into a primary reality within which, the substances (hypostases) are functioning as moments (Mitcham, 1994).

Engineering the experimentation device in the above proposed way, will allow to surpass the judgmental capabilities of the predictive and verifying mathematical models, allowing for the selection of the lowest risk options, or the minimum possibility of disclaiming the hypothesis. As a requisite for the admissibility of a hypothesis is its sufficiency, we need to determine the consequences which are given in experience and which are supposed to follow from the hypothesis itself. For that, an added value point is the knowledge matrix use to classify the empiric consequences and in addition practically confirm the experimental design for the outmost pragmatic "technological" output.

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Therefore, we may as a final point conclude that an insightful use of knowledge at hand to determine which appropriate conditions shall be allowing us to infer what we do not know from what we are able to observe, will engender a better understanding.

Conclusions:

Within the goals of this work, we had stated the development of a technology for the experimentation. We aimed in a solid knowledge based practice that has eventually derived via a straight forward mathematically confirmed procedure.

Overall, the procedure we wish to propose can evidently stand as a "technology" for that it can provide pragmatic effects in the experimentation set up. Moreover, the procedural use of the knowledge (input) classification (process) and the relevant treatments (transformations) produces realistic results (outcome) and the matrix itself is integral part of these results. Accordingly we worked on the basis of the available knowledge that we have treated in the view of providing, at least, the directions to gain new one, or set the potential actual conditions for that. Due to the fact that the classification of knowledge may provide the so far, experimentation gaps and the non-applied conditions to fill them in, the whole proposal has also a direct advisory role and a potential application for filling the gap. Both of these shall derive from within the knowledge classification procedure itself, as this is based on experience and cognition of nature.

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