DOMAIN LIMITS FOR MODELS? MODELING AS A TOOL FOR BRIDGING NATURAL AND HUMAN SCIENCES.

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Abstract

Models are used in a variety of forms to achieve different goals in our scientific exploration of natural phenomena. Within this view, models can be either specific for a particular phenomenon, or general, and hence can be applied to a particular domain of phenomena. In this article we address the problem of the domain of models. We propose that the model, in its general form, can cover as wide as both natural and human domains. This leads to an interesting result, which is that modeling in such a case can be implemented to resume the efforts to unify natural and human sciences. In this case, model will replace theory and our aim would be shifted to the 'model of everything' instead of the 'theory of everything'. The basic difference is that the theory is essentially reductive whereas the model, due to its formal character that can span different domains, would be non-reductive, and hence, can work as a bridge to close the gap between the two realms.

ملخّص

تستخدم النماذج بصور عديدة من أجل تحقيق أهداف مختلفة في فحصنا العلمي للظواهر الطبيعية. في هذا الإطار يمكن أن تكون النماذج خاصة، وبالتالي تختص بظاهرة محددة، أو عامة، وبالتالي تصبح قابلة للتطبيق على مجال محدد من الظواهر. في هذا البحث نطرح مشكلة حدود المجال للنماذج. ونحن نقترح أن النموذج، في صورته العامة، يمكن أن يصل اتساعه لأن يغطي كلا من مجالي العلوم الطبيعية والإنسانية. وهذا يقودنا إلى نتيجة مثيرة للاهتمام، وهي أن النمذجة، في هذه الحالة، يمكن الاعتماد عليها من أجل استمرار جهودنا لتوحيد العلوم الإنسانية والطبيعية. في هذه الحالة سوف يحل النموذج محل النظرية، وهدفنا سيتحول إلى "نموذج كل شيء" بدلا من "نظرية كل شيء". الفرق الأساسي هو أن النظرية من حيث المبدأ "ردية"، في حين أن النموذج، نتيجة لطبيعته الصورية يمكن أن يشمل عدة مجالات مختلفة، وبالتالي سوف يكون "غير ردي"، وهذا

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سوف يسمح له بأن يعمل كجسر من أجل أغلاق الفجوة بين العالمين.

Résumé

Les modèles sont utilisés sous une variété de formes dans le but de réaliser des objectifs différents dans l'exploration des phénomènes naturels. Dans ce cadre, les modèles peuvent être ou bien spécifiques à un phénomène particulier ou bien généraux et dans ce ca, ils peuvent s'appliquer à un domaine particulier de phénomènes. Nous proposons que le modèle, dans sa forme générale, soit capable de couvrir aussi bien les domaines des disciplines naturelles qu'humaines. L'une des conséquences remarquables de cet état de choses se trouve le fait que la modélisation peut être utilisée dans un tel cas pour résumer les efforts visant à unifier les sciences humaines et naturelles. Dans ce contexte, le modèle va se substituer à la théorie, et nous passons de la 'théorie de tout ' au 'modèle de tout '. La différence fondamentale c'est que la théorie est essentiellement réductrice, alors que le modèle, grâce à ses vertus formelles qui le rendent capable de couvrir plusieurs domaines à la fois, serait non-réducteur et jouerait, par conséquent, le rôle d'un pont supprimant le vide entre les deux mondes.

III. Introduction

Throughout history, philosophers and scientists have always endeavored to reduce the vast and enormous forms of existence into relatively simple pictures. So, in the ancient world we had the four basic elements (water, fire, air and earth) simplified picture of the world, whereas in the modern age we had the interacting idealized impenetrable atoms, simplified picture. Partial 'simple' pictures have been constructed too in order to explain many phenomena, such as celestial movements of planets and stars, dynamics of bodies, disease treatment, structure of buildings, etc.

These simple pictures are no more than simple 'models' that are used to deal with reality. Therefore, they are not in any way a complete or even approximately true picture of reality. Today, with the advancement of science we make the same move, we construct "more advanced and intricate" models to deal with the different and diverse phenomena of the different fields of science. But what are models and how do they work, this is a question that is still unclear till the present time.

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Only in the last two decades, Philosophy of science has shown a shift in interest from the concepts of the theory and law to the concept of the model[94]. However, there is a great variety of views about the nature of models, how does it work in scientific practice, its relation to theories and laws, from one side, and to reality, from the other, etc.

Stathis Psillos defines the concept of the model as follows:

> Term of art used in understanding how theories represent the world. Though according to a popular view, the semantic view of theories, theories are families of models, there is little agreement as to what models are, how they are related to theories and how they represent whatever they are supposed to represent... According to Cartwright, models are devices employed whenever a mathematical theory is applied to reality. This view has recently been developed into the models-as-mediators programme, according to which models are autonomous agents that mediate between theory and world.[95]

On the other hand, Ronald Giere[96] introduces a pragmatic view of models in which he proposes explicitly to provide a space for purposes in our understanding of representational practices in science. So, the relationship to be investigated has the form: Scientists use *X* (which is a model) to represent some aspect of the world for specific purposes. Focusing on scientific practice, one quickly realizes that *X* can be many things, for example, words, equations, diagrams, graphs, photographs, and, increasingly, computer-generated images (Giere: 743).

Therefore, making use of models is not confined to specific forms, disciplines, or fields of scientific applications, rather, models are used in accordance to the purposes of the scientist, or the scientific community.

The Question of Domain Limits of Models

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[94] Xavier de Donato Rodríguez, Jesu´s Zamora Bonilla (2009), "Credibility, Idealisation, and Model Building: An Inferential Approach", *Erkenntnis*, 70:101.

[95] Psillos, Stathis. 2007, "Philosophy of Science A–Z", Edinburgh University Press, P. 153-154.

[96] Giere, Ronald (2004), "How Models Are Used to Represent Reality", *Philosophy of Science* 71, Supplement, S742-752.

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In general, models are used in science to understand and represent different levels of scientific phenomena; from subatomic Quantum physics (the standard model), through cell and evolutionary biology, to human neurology and cognitive science. Hence, an essential question arises, is there a limit for the domain covered by a specific model, i.e., should models be limited within one specific scientific field, or one and the same model can be constructed in a way that covers completely different scientific fields.

For example we use basic statistical models (such as normal or Gaussian distribution model, Bayesian theorem, etc) to represent random variables in physics (ex., Quantum Theory), in economics (ex. Stock market), as well as collective human behavior (ex. Poll surveys), which are completely different scientific fields. Similarly, we use chaotic non-linear systems models in completely different fields such as physics, biology, economics, sociology, computer science, etc.

In addition, atomism as a general model has been used in a wide scope of essentially different fields with 'theoretically' different formulations: in physics (corpuscular theory of matter); in social sciences (methodological individualism); and in language (logical atomism). In all these manifestations of such a general model a general form is preserved whereas specific theoretical forms (mathematical, qualitative and logical) are constructed.

In these examples, such models apply to different fields of knowledge without reducing it to the physical level. Humans obey statistical laws as much as elementary particles, without being reduced to the physical level.

In the case of the general statistical model, despite that both natural and human 'entities' follow the same 'statistical' model the sense of the elements of the model differs in each. The statistical elements in the case of the human level represent 'human decisions' or human behavior that is based on human decisions, whereas in the case of the physical level, the statistical elements represent physical movements of elementary (or more complicated) particles.

This means that the statistical model applies to both completely different fields, only formally. The form of the model is exactly the same, whereas the nature of

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the elements is completely different. Hence, the result of application of such a statistical model is radically different in its nature.

If we extend such reasoning, we may ask the following question: is it possible to construct some general model that covers all scientific domains as well as all levels of nature without reducing such levels to the physical one. For example, can human behavior, cell behavior, and elementary particles interactions follow one general model, without embracing the reductionist thesis? Or, such an aim is essentially illogical, given the very concept of model.

In this paper we address such a basic question in view of contemporary transformation of our scientific view, from reductionism to antireductionism. A situation that resulted in a shift of interest from trying to construct one general model of nature, namely the mechanistic model, to giving up the hope for discovering the 'reductionist' theory of everything in favor to theories of specific sciences, and consequently to models of specific sciences.

In order to deal with such a problematic we have to establish, first, our basic concept, which is the concept of the 'general' model that covers the whole domain of existence (non-living, living and human), which is termed here 'the model of nature'. In this sense of the model, the ancient four substances and the modern reductive mechanistic models are but specific instances of such a general model. Consequently, we will have to elucidate the unresolved challenges to the mechanistic model, as a necessary step before moving forward toward discussing the prospects of constructing a true general non-reductive model of everything.

Hence, in sec.2, we will discuss the concept of 'model of nature' with emphasis on the problem of domain limits, as a necessary preparation for our discussion of the central thesis in this paper. In sec. 3 we will discuss the mechanistic model with a brief review of the ancient four substances model of nature as a means of presenting the problem of domain limits in real practice. In sec. 4, we review the new scientific concepts that contradict the basic principles of the mechanistic model as well as the new views that point out to the need of an alternative non-reductive model. Finally, in sec. 5 on the basis of contemporary new anti-mechanistic scientific views as well as the virtues of the successful

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model, we discuss the prospects of introducing an alternative non-mechanistic model that covers both domains of natural and human sciences[97].

IV. The Concept of the 'Model of Nature'

If we are to question the possibility of constructing a general model that covers the whole range of existence, then we are trying to construct a model for whole nature, or in short, a model of nature. But what is nature and what are the basic processes through which we may come to such an aim.

Nature is all what we experience as humans: non-living material, living animals as well as other humans. With advancement of science such a concept has included newly discovered entities such as atomic and subatomic elementary particles, on the micro level, as well as planets, stars and galaxies, on the macro level. Human endeavors to explain phenomena related to such entities necessitated two basic moves: classification of such entities into categories, and reducing some categories of such classification to some other more basic category. In this way, such a vast and enormous number of different entities are reduced to a small number of basic categories. In addition, the process of explanation necessitated establishing specific form for the relations between such categories. The result is a simplified picture or model of nature.

With the appearance of modern scientific thought, the first move produced the concept of reduction in which we reduce all that exists in nature to some elementary entities that comprise together all existence. The second produced the mathematical (or logical) relations between such constituents of reality. These elementary entities and the mathematical relations between them 'represent' the real world, and hence, comprise a model of nature. Therefore, through such basic constituents and the mathematical relations between them we should be able to explain all the natural phenomena around us.

[97] Note that the terms 'natural sciences' and 'human sciences' are established in literature albeit we define nature as a whole as including both human and non-human existence. Hence, we may here speak about 'natural and human sciences', as well as about the model of nature that includes all existence, with no contradiction.

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Due to these two basic features of the 'model of nature', any such model is basically linked to the scientific theories about nature, or more precisely to 'laws of nature'. However, Roman Frigg and Stephan Hartmann argue that laws of nature govern entities and processes in a model rather than in the world. Fundamental laws, in this approach, do not state facts about the world but hold true of entities and processes in the model.[98]

Therefore, if we are speaking about 'general' Laws of Nature, then such laws should be inferred from the general model of nature constructed about reality. Models, in this sense, are not worldly systems but abstract entities, Stathis Psillos defines such a notion as follows:

> The claim that models are abstract entities is meant to imply that (a) they are not concrete and (b) they are not causally efficacious. In this sense, models are like mathematical abstract entities. But there is a notable difference. I take models to be cases of what Dummett (1991, p. 300) has aptly called 'abstract physical objects'. As such, they are characterised by non-logical (and in particular, physical) concepts related to some domain of reality. Besides, their very existence is both contingent (i.e., they do not exist necessarily) and also dependent upon the existence and behaviour of concrete objects: they are such that if all concrete physical objects were to be wiped out, they would be wiped out too[99].

Within such a view, in this paper we will take any model of "nature as a whole" as composed of three basic concepts or presuppositions: the final constituents of reality, the 'vertical' relations between the successive levels of nature, and the 'horizontal' relations that realize motion and change within the each level.

For example, the mechanistic model is composed of the solid atoms as the final constituents of reality, reduction as the vertical relations, and Newton's mechanistic laws as the horizontal relations.

[98] Frigg, Roman and Hartmann, Stephan. 2006, "Scientific Models", in Sahotra Sarkar and Jessica Pfeifer (eds.), *the Philosophy of Science – An Encyclopedia*, Routledge, p. 748.
[99] Psillos, Stathis (2011), "Living with the abstract: realism and models", *Synthese*, V. 180, Pp. 3–17.

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These basic concepts represent what Ronland Giere calls 'principles'. In his view, the function of such principles is to act as general templates for the construction of more specific abstract objects that is called “models.” (Giere: 745). In addition, the same holds for the term *law*. What is commonly called Newton’s second law of motion, for example, is for him a central principle of classical mechanics (Giere: 746).

Consequently, he adds, the relations between such principles and models are such that models should be abstract objects constructed in conformity with appropriate general principles and specific conditions. What is special about models is that they are designed so that elements of the model can be identified with features of the real world. This is what makes it possible to use models to *represent* aspects of the world (Giere: 747).

With such understanding, what are the virtues of the credible model? What makes a specific model better than another? Within their view of models as tools for surrogative reasoning, Rodríguez and Bonilla propose that the main use of models is in helping us to draw inferences from the system they represent. According to their inferential approach, they introduce the following properties that constitute what we may call the basic model’s virtues:

- Its ‘‘size’’
- Its coherence
- Its manageability
- Its heuristic capacity to produce new and more reliable models. (Rodríguez and Bonilla: 108).

Thus, one of the basic virtues of a model is its size, which means that the wider the domain of the model, the more credible it is. However, it should also fulfill other virtues, especially, coherence and manageability, which makes it difficult to construct a model that covers both natural and human sciences in an efficient way, albeit this is not an impossible task.

V. The Mechanistic Model

Keeping in mind such a general view of the concept of 'model of nature', there are several types of 'scientific' models of nature that are introduced along the history of human thought. In general, these models can be classified into: mechanical, teleological, process, organic, and Complex, in addition to the

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multiple levels view of nature (material/live/mind levels).[100] However, two major models have dominated human thought, namely, the Aristotelian teleological model and the mechanistic atomistic model.

These two models are characterized by being models for both natural and human domains. Moreover, the mechanistic model has aimed at achieving such a goal through reducing upper levels (including the human level) to the physical level. In comparison to the teleological model, the mechanistic model has proved much more successful in explaining natural phenomena, to the extent that we gave up completely the teleological model in favor to the mechanistic one.

In order to show in real practice how humans implement the concept of modeling to represent nature as a whole, we will review in the following pages, in brief, these two models, before discussing the failure of mechanistic model and the need to a solution to the problem of the model of nature.

The Aristotelian Model

The Aristotelian model of nature is well known in history of philosophy as the exemplar of a teleological model. Such a model has dominated human thought since the Greek age till modernity. According to Jonathan Barnes[101], Aristotle offers a clear view of the nature of reality. The elements or fundamental stuffs of the sublunary world are four: earth, air, fire, and water. Each element is defined by way of four primary powers or qualities – wetness, dryness, coldness, and hotness. The elements have each a natural movement and a natural place. Fire, if left to itself, will move upwards; earth naturally moves downwards, to the centre of the universe; air and water find their places in between. The elements can act upon and change into one another. Beyond the earth and its atmosphere come the moon, the sun, the planets, and the fixed stars. (Barnes: 98)

[100] Stephen C. Pepper mentions six 'metaphors': animism, mysticism, formism, mechanism, organicism, and contextualism that produce different Worldviews or 'World hypothesis', see,

Koltko-Rivera, Mark. 2004,"The Psychology of Worldviews", *Review of General Psychology*,V.8, P 9.

[101] Barnes, Jonathan. 2000, "Aristotle -A Very Short Introduction", Oxford University Press.

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However, Aristotle’s main contention is that the physical universe is spatially finite but temporally infinite: it is a vast but bounded sphere which has existed without beginning and will exist without end (Barnes: 100). In such a model, there is a basic difference between the earthly sub-lunar realm and the heaven that is composed of planets and stars.

The heavenly bodies, which Aristotle often refers to as ‘the divine bodies’, according to Barnes, are made of a special stuff, a fifth element or ‘quintessence’, so that the heavenly bodies, being divine, must therefore be alive and intelligent. Aristotle, according to Barnes, argues for the existence of a changeless source of change – an ‘unmoved mover’ as it is normally called. If there is to be any change in the universe, there must, Aristotle holds, be some original source which imparts change to other things without changing itself. The unmoved mover is outside the universe (Barnes: 102)

The core of Aristotle’s account of explanation is his concept of 'change' and his doctrine of ‘the four causes’, a concept that encounters a considerable degree of vagueness. For it is usually presented as four types, 'the material cause', 'the formal cause', 'the efficient cause' and the 'final cause'. However, according to David Cooper, Aristotle's original writing in Greek didn't point out to the term cause as understood in English, rather, for him a 'cause' is what is cited in answer to questions beginning 'On account of what…?'. On such a basis, cooper asserts, he is clearly right in that people offer answers of all four kinds[102]. However, the central concept that explains change in the Aristotelian model, as well known, is the last kind of the four causes, which is the final cause.

For the great majority of thinkers and philosophers such a model constituted a huge obstacle to scientific advancement of humanity. The basic reason for such a position is that it adopts teleology in scientific explanation. With the advent of the mechanical 'causal' explanation, a new era for advancement of science has commenced[103].

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[102] Cooper, David. 1996, "World Philosophies – An Historical Introduction", Blackwell, Pp. 117.

[103] Major critics of Aristotle are Descartes in his 'The World ' (1633) and Francis Bacon in his 'the new Organon' (1620), and Bertrand Russell in his 'A History of Western Philosophy' (1946), among many others.

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The Classical Mechanistic Model

Modernity is marked by the appearance of the mechanistic view to nature. Nature, in such an account, is composed of tiny microscopic indivisible atoms that interact continuously according to laws of motion generating everything we experience in nature. It is usually referred to the Newtonian Mechanics as the most complete theoretical form of such a view.

Stathis Psillos defines the concept of mechanism as "any arrangement of matter in motion, subject to the laws of mechanics". More specifically, he adds, it was thought that all macroscopic phenomena were the product of the interactions (ultimately, pushings and pullings) of microscopic corpuscles. The latter were fully characterised by their primary qualities".[104]

However, the mechanistic model of nature has never been introduced in a complete formulation, even in the Newtonian version where the force of gravity violates the principle of direct interaction. Instead, such a model has appeared gradually with different versions. It was first introduced by figures such as Descartes, Gassendi and Boyle in the seventeenth century as opposed to the Aristotelian model in general, and to the teleological explanations, in particular. In this period, the mechanistic view was a part of what is termed the corpuscular theory of matter.

During the period of its early formulation, according to Stephen Gaukroger, Gassendi set out the programme of the mechanistic view in broad terms as follows: There is no effect without a cause; no cause acts without motion; nothing acts on distant things except through itself or an organ or connection or transmission; nothing moves unless it is touched, whether directly or through an organ or through another body.[105]

Stephen Gaukroger points out that the classical notion of 'Mechanism' existed in many varieties, and that it is difficult to characterize in the abstract. However, he construes in some detail, the ideal-type mechanism, in that period, as which has the distinctive feature that it reduces all physical processes to the activity of inert

[104] Psillos, Stathis. 2007, "Philosophy of Science A–Z", Edinburgh University Press, P. 149

[105] Gaukroger, Stephen. 2006, "The Emergence of a Scientific Culture - Science and the Shaping of Modernity, 1210–1685", Clarendon Press, Oxford, P. 253.

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corpuscles making up macroscopic objects, where the behavior of these corpuscles can be described exhaustively in terms of mechanics and geometry, and where they act exclusively by means of efficient causes, which require spatial and temporal contact between the cause and the effect. We can assume, he continues, that the corpuscles contain no empty spaces, that they are spherical, and that they are all of the same order of magnitude. The space in which they move is a continuous, complete, isotropic, three-dimensional container which acts as a reference frame for the location of bodies (Gaukroger: 260).

Carl Craver and William Bechtel state that the notion of mechanism has four aspects: (i) a phenomenal aspect, (ii) a componential aspect, (iii) a causal aspect, and (iv) an organizational aspect.[106] The phenomenal aspect is related to the appearances of the mechanism. The componential aspect is related to the final constituents of the mechanism. The causal aspect is related to the cause and effect relations between the components of the mechanism. Finally, the organizational aspect is related to the structure of the mechanism.

In the case of the mechanistic model of nature as a whole, the phenomenal aspect is the different levels of nature (the micro subatomic level, the normal macro level, the vital and the mental). The componential aspect is the final constituents of matter which was seen in the classical mechanistic view as the indivisible atoms. The causal aspect is that based on direct contact between the final constituents. And the organizational aspect is represented by the concepts of reduction (the vertical relations) and determinism (horizontal relations).

With respect to the final constituents of the mechanistic model, its well known today after the appearance of Quantum mechanics (by the first third of the twentieth century as well as the complete formulation of the standard model by the second third of the century), that atoms are composed of final elementary particles (Quarks and Gluons) that are of dual nature (wave/particle duality). Furthermore, the ultimate nature of such final constituents is not known,

[106] Craver, Carl and Bechtel, William. 2006, "Mechanism", in Sahotra Sarkar and Jessica Pfeifer (eds.), *the Philosophy of Science – An Encychlopedia*, Routledge, p. 469.

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whereas the phenomenon of wave/particle duality is not explained till the present time[107].

On the other hand, with respect to the two essential relations, determinism and reduction things are not less ambiguous.

According to John T. Roberts, the most famous exposition of the doctrine of determinism in the context of modern science is due to Pierre Laplace:

> We ought to regard the present state of the universe as the effect of its antecedent state and as the cause of the state that is to follow. An intelligence knowing all the forces acting in nature at a given instant, as well as the momentary positions of all things in the universe, would be able to comprehend in one single formula the motions of the largest bodies as well as the lightest atoms in the world, provided that its intellect were sufficiently powerful to subject all data to analysis; to it nothing would be uncertain, the future as well as the past would be present to its eyes.[108]

However, such a concept has become more complex, especially when related to laws of nature. According to Roberts, it is taken to be of a deterministic theory, where the property of determinism is defined by quantifying over all the physically possible worlds allowed by the theory. Alternatively, he adds, one can define determinism as a property of a set of laws, proceeding as above, but quantifying over all the possible worlds allowed by that set of laws. (Roberts: 200)

Similarly, the concept of reduction is no less complicated. Reductionism is the thesis that the results of inquiry in one domain -be they concepts, heuristics, laws, or theories- can be understood or are explained by the conceptual resources of another, more fundamental domain[109]. According to Michael Silberstein, historically, there are two main construals of the problem of reduction and emergence, ontological and epistemological:

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[107] See more details in the following section.

[108] Roberts ,John T. 2006, "Determinism", in Sahotra Sarkar and Jessica Pfeifer (eds.), *the Philosophy of Science – An Encychlopedia*, Routledge, p. 198.

[109] Wimsatt, William C. and Sarkar, Sahotra. 2006, "Reductionism", in Sahotra Sarkar and Jessica Pfeifer (eds.), *the Philosophy of Science – An Encychlopedia*, Routledge, p. 696.

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1. The ontological construal: is there some robust sense in which everything in the world can be said to be *nothing but* the fundamental constituents of reality (such as super-strings) or at the very least, *determined by* those constituents?
2. The epistemological construal: is there some robust sense in which our scientific theories/schemas about the macroscopic features of the world can be *reduced to* or *identified with* our scientific theories about the most fundamental features of the world. [110]

Yet, according to Silberstein, these two construals are inextricably related. He explains, moreover, that reductionism is the view that the best understanding of a complex system should be sought at the level of the structure, behavior and laws of its component parts plus their relations. The ontological assumption implicit is that the most fundamental physical level, whatever that turns out to be, is ultimately the "real" ontology of the world, and anything else that is to keep the status of real must somehow be able to be 'mapped onto' or 'built out of' those elements of the fundamental ontology (Silberstein: 81).

Thus, the three basic presuppositions of the classical mechanistic model of nature, namely, the indivisible corpuscular final constituents, determinism, and reduction, by advancement of science turned out to be mere philosophical or theoretical constructs, instead of being true in the real world. As we will see in the next section, this leads to the conclusion that the mechanistic model in its classical or realistic sense has in effect failed.

These difficulties that confront the mechanistic model have forced its proponents to defend it in several ways. Despite its increasing inconsistency with natural phenomena, such a defense is now bearing heavily on the metaphysical assumption that future advancement of science will bring with it scientific justification of such a view.

[110] Silberstein, Michael. 2002, "Reduction, Emergence and Explanation", in Peter Machamer and Michael Silberstein (eds.), *The Blackwell Guide to the Philosophy of Science*, Blackwell, P. 80.

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The main problems that confronted the mechanistic model, due to the advancement of contemporary science, are on the subatomic, biological and mental levels. This leaves true and complete success of such a view confined to only one level, namely the natural normal level, with the exception of chaotic systems. Till today there is no agreed upon or complete mechanistic explanation of the Quantum phenomena at the subatomic level, the organic and cellular vital phenomena, and the human intentional and consciousness phenomena, in addition to chaotic and self organization systems.

These problems usher for two points; first, the failure of reducing all levels of nature to the physical one; second, as a consequence, the appearance of the concept of the special sciences[111], which assumes no general model of nature. In addition, an essential gap between natural and human sciences is established, making the appearance of one general model of nature essentially impossible.

However, giving up the reductionist thesis, along with implementing the concept of the model in 'wide' but legitimate sense seems to promise to bridge again the gap between natural and human sciences, from one side, and between physics and special sciences, from the other side.

VI. **Failure of the Mechanistic Model**

Today, in the mainstream scientific community, nobody defends the existence of final indivisible constituents of mater. For, effectively, advancement of science in the twentieth century, especially, the standard model of the subatomic realm, has proved that the atom is composed of an extremely complicated system of elementary particles (Quarks and Gluons). Moreover, nobody can define realistically the nature of such particles, for the standard model itself is not complete yet due to our inability to unify the gravitational force with the other three basic forces of nature. Michael Silberstein describes the current situation as follows:

[111] See for example the famous article by Jerry Fodor,

Jerry Fodor, 1974, "Special Sciences (or: the Disunity of Science as a Working Hypothesis), Synthese, V. 28, 97-115.

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> The world is not just a set of separately existing localized objects, externally related only by space and time. Something deeper, and more mysterious, knits together the fabric of the world. We have only just come to the moment in the development of physics that we can begin to contemplate what that might be (Silberstein: 97**).**

As a consequence, the mechanical postulate of the interaction between the final corpuscular constituents of matter is rendered to the status of a philosophical speculation instead of being a realistic representation of nature.

Similarly, nobody, in the main stream science, defends today determinism as a concept that mirrors reality. For Quantum Mechanics has shown that subatomic particles interact probabilistically. For example John Roberts states clearly that the probabilistic nature of state reduction entails that the standard formulation of quantum mechanics is indeterministic in all of the senses of the term. (Roberts: 204)

As a consequence, we can't ascribe determinism to individual particles or systems, but we can define the overall probabilistic outcome of one particle over a sufficient period of time or of sufficiently great number of particles in a specific time. This led to the appearance of the concept of 'probabilistic determinism', an obvious endeavor to save 'philosophically' the concept of determinism.

Moreover, the appearance of chaotic and self-organized systems, in which we can't follow the deterministic interactions between the particles, and hence can't predict its outcome in advance, have led to giving up the classical notion of determinism in such systems. To the extent that John Roberts states that it is now known that classical physics is not deterministic, in either the predictability sense or the ontic sense. More generally, he adds, many classical systems exhibit the feature known as chaos, which rules out the possibility of predictability (Roberts: 200) .

Besides the physical systems, determinism has proved to be not applicable to other non-physical systems, such as organic chemical combinations, living cells, animals, and human beings. This leads to the conclusion that the classical notion of determinism is applicable only to extremely limited special cases,

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which is the idealized mechanical system in the normal scale, such as an idealized group of billiard balls on an idealized flat table.

In addition to the above, the concept of reduction, whether in its ontological or epistemological senses, couldn't be justified in reality. Efforts to reduce the mental level to the biological, as well as the biological to the chemical have not been successful along the course of the last few decades despite the great advancement of scientific technology.

On the theoretical side, efforts to reduce human action to laws of physics, have failed due to our inability to explain human intentional states as well as the human phenomenon of consciousness. Similarly, biology could not be reduced to the laws of physics. The end result was the appearance of the concept of special sciences, in which there is no privilege to physics as the base of all science as mentioned above.

This becomes clear in recent works about the problem of reduction. Sahotra Sarkar states that a very common belief among philosophers is that reduction leads to the unity of science.[112] However, William Seager, states clearly,

> It has become clear in the later stages of the century that despite the rich and complex interrelationships that prevail among scientific theories, there is little or no prospect of even roughly fulfilling the dream of the grand unification of all theories into a complete hierarchy of reduction.[113]

With the failure of realizing the three pillars of the mechanistic model of nature (the solid atoms, determinism and reduction) it becomes clear that such a model, at least in its classical sense, has failed. However, such a view is still prevailing not in a realistic sense but in philosophical sense, even though without a complete formulation as a means of inquiry. This situation is clear in the following statement of Mark Couch in a very recent paper,

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[112] Sarkar, Sahotra. 2008, "Reduction", in Psillos Stathis and Curd Martin (eds.) *The Routledg Companion to Philosophy of Science*, Pp. 430.
[113] Seager, William. 2001, "Supervenience and Determination", in W. H. Newton-Smith (ed.) *A Companion to the Philosophy of Science*, Blackwell, P. 480.

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> The notion of a mechanism has become increasingly important in philosophical analyses of the sciences. Many philosophers now accept that explanations that appeal to mechanisms have a fundamental role to play in scientific practice. The notion of a mechanism, however, still remains inadequately understood. There is unclarity about what precisely makes something count as the mechanism for a capacity, and no agreement about the criteria we should use in making this determination.[114]

The failure of the mechanistic explanation as a general model of nature has, among other reasons, led to the appearance of new concepts that contradict directly the presuppositions of such a model.

The New anti-Mechanistic Philosophical Concepts

New concepts that are in direct contradiction with the basic presuppositions of the classical mechanistic model of nature have appeared gradually during the last decades of the twentieth century.

The corpuscular postulate of the final constituents of matter has been contradicted by the appearance of the theory of Quantum mechanics, and consequently, our inability to define the nature of the subatomic elementary particles, as mentioned above. In addition, the postulate that such corpuscular particles are passive in nature is contradicted by the appearance of the concepts of disposition and powers.

According to Rom Harré, to attribute a disposition (or power) to a thing or substance is to say that if certain conditions obtain, then that thing or substance will behave in a certain way, or bring about a certain effect – that is, that a certain outcome will occur[115]. However, Alexander Bird asserts that this endows 'dispositional' essential causal powers for properties. For, "the dispositionalist regards properties as having their nomic and causal powers essentially". He explains that "this means that the relevant nomic and causal relations will have to hold necessarily and not contingently"[116]. Moreover, Nancy Cartwright confirms this view, for " there are a number of features on account of which we

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[114] Couch, Mark B. 2011, "Mechanisms and constitutive relevance", *Synthese*, V. 183, Pp. 375.

[115] Harré, Rom. 2001 , "Dispositions and Powers", in W. H. Newton-Smith (ed.) *A Companion to the Philosophy of Science*, Blackwell, Pp. 97 .

[116] Alexandr Bird, 2004, "the Dispositionalist Conception of Laws", *Foundations of Science* 152: 1–18.

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might call something a disposition or a causal power: a- Substance causation". She explains, "the causal relata are not events but rather the cause is an enduring substance and the effect a change in another substance. This, she comments, was Aristotle's view; so too Kant's according to Eric Watkins".[117]

On the other hand, the concept of reduction is contradicted by the concepts of emergence and holism. According to Michael Silberstein, Claims involving emergence are now rife in discussions of philosophy of mind, philosophy of physics, various branches of physics itself including quantum mechanics, condensed matter theory, nonlinear dynamical systems theory (especially so-called chaos theory), cognitive neuroscience (including connectionist/neural network modeling and consciousness studies) and so-called complexity studies (Silberstein: 93).

Emergentists, following Justin Garson, generally hold an ontological premise and an epistemological one. The ontological premise is that (i) there are properties (or laws) that obtain of certain complex physical entities that do not obtain of any of the individual parts or lower level constituents of those entities. The epistemological premise is that (ii) the instantiation of those properties cannot be derived from an exhaustive knowledge of the nonrelational properties of the parts, in addition to any laws of composition that obtain among lower-level entities (e.g., additivity, fundamental forces) and statements of definition. Hence emergentism takes its place in contemporary philosophical parlance as a variety of nonreductionist physicalism.[118]

Similarly, the concept of holism, which is in direct contradiction with reductionism, has appeared in the last decades. The term "holism", according to Christopher Hookway, refers to a variety of positions which have in common a resistance to understanding larger unities as merely the sum of their parts, and an insistence that we cannot explain or understand the parts without treating

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[117] Nancy Cartwright, 2002, " What Makes a Capacity a Disposition?", in Julian Reiss (ed.) " Causality: Metaphysics and Methods – Technical Report 10/03", Centre for Philosophy of Natural and Social Science, London School of Economics, P. 1.

[118] Garson, Justin. 2006, "Emergence", in Sahotra Sarkar and Jessica Pfeifer (eds.), *the Philosophy of Science – An Encychlopedia*, Routledge, p. 230

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them as belonging to such larger wholes.[119] Therefore, instead of reducing the 'larger unities', such as the mind, the living cell, etc, to the physical level, without a remainder, such unities are understood as wholes that lose its significance if reduced to its constituent parts.

Therefore, it can be stated that in contemporary scientific thought, the mechanistic explanation survives alongside other numerous concepts that are in contradiction with it. Such a state of affairs points out to the current fragmented situation of the philosophical community. In addition, it points out that humanity currently lacks a unified understanding of diverse phenomena of reality.

Scholars from different orientations, both scientists and philosophers of science, within the mainstream science pointed out clearly to such a situation. For example, Henry Stapp, a well known physicist and philosopher of science, in his 'Mindful Universe'[120], stresses on the failure of the mechanistic model to incorporate the mental phenomena. In his view, the conflating of Nature herself with the impoverished mechanical conception of it invented by scientists during the seventeenth century has derailed the philosophies of science and of mind for more than three centuries, by effectively eliminating the causal link between the psychological and physical aspects of nature that contemporary physics restores. But the now-falsified classical conception of the world, he adds, still exerts a blinding effect (Stapp: 2).

The solution in Stapp's view is to embrace a specific interpretation of Quantum mechanics in which human consciousness plays essential role. Therefore, in Stapp's view, the final constituents of matter are continuously engaged with human consciousness as well as its free will, generating what is called the Psychophysical Building Blocks of Reality (Stapp: 96). A situation that produces closing up the gap between the material and the mental.

[119] Hookway, Christopher. 2001, "Holism", ", in W. H. Newton-Smith (ed.) *A Companion to the Philosophy of Science*, Blackwell, P. 162 – 164.
[120] Stapp, Henry P. 2007, " Mindful Universe - Quantum Mechanics and the Participating Observer", Springer.

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VII. A Bridging Non-reductive Model?

By now, it should have become evident that the model of nature we implement is crucial in advancement of science. We have already seen that for many scholars, the Aristotelian model represented an obstacle for advancement of science. And with the increasing inconsistency between this model and scientific facts it was inevitable to abandon it in favor to the newly admitted mechanistic model.

Similarly, today we experience inconsistency between the mechanistic model of nature and scientific facts as well as new trends in philosophy of science. Such inconsistency is represented by our inability to explain phenomena related to Quantum Mechanics, our inability to unify the natural and human realms, our inability to explain the phenomenon of consciousness, and by giving up the presuppositions of the mechanistic model, as shown above.

The picture in reality is much more complicated. The aforementioned views are no more than examples of the different views that are introduced in the last few decades in order to overcome the difficulties that confront contemporary modern science with its already failed mechanistic model of nature[121].

Given such a picture, in this last section we will show how the current shift in our scientific thought from the concept of the theory to the concept of the model can help us to make advancement toward a new unified non-reductive model for nature. However, our aim is not to present a proposal for a new model, rather, we aim only to show that, within contemporary analytic tradition, it is possible, in principle, to bridge the gap between natural and human sciences through the concept of *Modeling*.

[121] The new views of science cover a wide range of proposals both within mainstream science as well as outside orthodox academic circles. For detailed exposition of such proposals see our,

Abuzaid, Samir. 2008, "Science and Conditions of Renaissance – the New scientific Conceptions and the Scientific Grounding of the Arabic Renaissance", Madbouli, Pp. 84 – 127. (in Arabic)

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Possible Principles for a Non-Reductive Model

With such a characterization of the problem in mind, what would the formulation of such an alternative model look like, what would be its basic presuppositions.

There are many proposals that lurk around in contemporary literature, in which different formulations of the presuppositions of a new view to nature are introduced. However, the prospective model of nature that we expect to be a real alternative should be: 1) consistent with proven scientific facts; 2) internally consistent.

In the following we will review the possible positions that are introduced in contemporary literature in each of the basic components of the structure of the possible new model that fulfill those two conditions[122]. The first represents the basic constituents of nature which is supposed to substitute the postulate of the final indivisible 'atoms'. The second represents the vertical inter-levels relations that are supposed to be in place of the postulate of reduction. Finally, the third is the horizontal relation which is supposed to be in place of the concept of the direct contact mechanical causal relations.

1- Postulates of the final constituents of nature[123].

Eliminating the postulate of the solid indivisible entities, as proven to be in contradiction with proven facts of science, and eliminating the postulate of radical emergence, for being inconsistent with the concept of 'a unifying model of nature', we have the following:

- The final constituents are energy particulars that are not corpuscular, but in some way compose elements that are endowed with specific dispositions, at the different levels of the hierarchy of nature.

[122] David Chalmers introduces six basic positions with respect to the nature of consciousness, which will be reflected on our view to the non-reductive model, three versions of Materialism (A,B and C), in addition to dualism (D), epiphenomenalism (E), and monism (F), see,

Chalmers, David. 2003, "Consciousness and its Place in Nature", in Stich, Stephen and Warfield, Ted A. (eds.), *The Blackwell Guide to Philosophy of Mind* , Blackwell, P. 102 – 142.

[123] The concept of nature excludes by definition the existence of the supernatural entities; hence it is not part of our discussion of the elements of the model of 'nature'.

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- The final constituents are energy particulars that are not corpuscular, but compose a double sided or dipole 'matter-mind', (the psychophysical constituents), which is responsible for the appearance of dispositions and intentionality.
-

2- Postulates of the vertical inter-levels relations

Eliminating the postulate of complete reduction as proven to be inconsistent with contemporary scientific facts (the failure of reducing the mental, and the failure of the grand unifying theory), then we have the following:

- Partial reduction between only two successive levels (supervenience in the week sense), based on disposition, governed by inter-level vertical laws.
- Holism, upper level affects lower level (downward causation), based on the psycho-physical constituents, governed by inter-levels vertical laws.
-

3- Postulates of the horizontal causal relations

Eliminating the postulate of determinism as well as non scientific teleology (i.e., that which is not linked to functionalism or human intentionality) as in contradiction with contemporary scientific facts, we have the following:

- Probabilistic causal indeterminism (including self-organizing systems), based on dispositions endowed to the final constituents.
- Probabilistic mental causation (including intentionality), which is based on the psycho-physical properties

Hence, instead of the indivisible atoms that represent all levels of nature through reduction and interact through Newtonian laws, we have a new picture. That is a

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world composed of energy particulars that are not corpuscular, but endowed with specific dispositions that interact vertically according to vertical laws in order to compose in some way the different levels of existence, and horizontally, according to horizontal laws, to compose in some way the different forms of existence at each of such levels.

What makes itself clear in such a formulation is the division between the material and the mental, if we may use such dividing terms. Hence, we have 'different' sets of 'laws of nature' at each level of existence: the material 'natural laws' and the human mental 'natural laws'. However, we should notice that this is a simplified picture, for in reality we should be speaking about at least four basic levels of nature, the material, the chemical (including organic matter), the biological and the mental[124].

We should notice also that such a model establishes vertical relations between the successive levels of nature through some other type of 'natural laws'. Hence, we should expect that such vertical laws establish continuity across the hierarchy of the successive levels of nature, which leads to symmetry we notice in nature both horizontally across each level as well as vertically across levels.

Generalization of Natural Laws

In physics it is possible to generalize basic laws on different phenomena like electric current, flow of fluids, movement of bodies, etc, through general terms such as energy, work, resistance, flow, etc. The concept of generalization, therefore, is the basis upon which we apply general mathematical 'formal' expressions on different phenomena. Such a move is legitimate on the basis of assuming that the 'physical' objects comprise one and the same domain. John Taylor describes such a concept as follows:

[124] Others include a specific level for the subatomic particles, as well as for the animal kingdom, which makes it six levels. Moreover, taking the concept of levels as an artifact, we can add more levels according to our needs of study. For example we can add the level of Organic matter as distinct from the non-organic chemicals, which includes huge molecules such as RNA and DNA that play crucial role in heredity; or the level of the cells in biology as distinct from other biological organs and plays specific crucial roles, such as brain cells (neurons) of the human brain.

> Quite often, different branches of physics have seemed to contradict each other when taken together. The contradiction is then resolved in a new, consistent, wider theory, which includes the two branches.[125]

If we set aside the concept of complete reduction, as shown above, as well as the concept of radical emergence, then logically we have only one alternative in order to preserve continuity we notice in nature, which is the concept of generalization. Therefore, we may as well speak about generalized 'formal' laws that apply on both domains of natural and human sciences. In such a case, the content of such formal laws will be different in accordance to the domain upon which it is applied.

This view is not new in literature, albeit it does not belong to main stream philosophy of science. For example Frederick Zaman explains a similar point of view as follows:

> [T]he social sciences perhaps can start to imitate the natural sciences, but—as advocated by Latour—in a way very different than before. For a Latourian 'deep redescription' of the social, developed in terms of a corresponding redescription of Newton's laws of motion using equivalent physico-social forces, truly reconfigures the meanings of what it is to be 'social' and what it is to do 'science.' I suggested in the earlier essay that the redescription of Newton's laws of motion using equivalent physico-social forces may allow the practitioners of social science to accomplish, at least in principle, what previously has been limited to the natural sciences.[126]

This view tries to establish a formal relation between classical Newton's laws and the field of sociology by analogy through transforming the three basic presuppositions of the mechanistic model into formal principles rather than definite ones. Hence, the indivisible atoms are the individual humans; matter that is composed of huge number of atoms is represented by social groups composed of great number of persons; and the mechanistic Newtonian forces

[125] Taylor, John. 2003, "Hidden Unity in natural Laws", Cambridge University Press.

[126] Frederick Zaman, 2001,"A Physico-social Theory Of Weberian Ideal-types: The Newtonian Deconstruction Of Classical Sociology", Theory & Science, V.2, Issue.2.

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that generate motion are represented by the physico-social forces that govern change in the society.

Transforming these three presuppositions into formal ones represents generalization of Newton's laws to cover both natural and human sciences. Hence, Newton's three principles (Inertia, action and reaction, and gravitation) apply qualitatively on higher levels of existence. Humans experience 'attraction' to other humans (or thoughts); every 'human' action stimulates an 'equal reaction'; humans keep their choices unless they are affected by an external effect (same like the concept of inertia). If we add to the above the view that the very concept of 'force' is of cultural source, and it can be replaced by other concepts such as the concept of the state (in Quantum Mechanics), the concept of generalization becomes clear.

In the same way the indeterministic nature of individuals is a common formal concept that is shared both between subatomic particles and individual humans, where great numbers of individuals in both levels follow formally what is termed 'probabilistic determinism' (or probabilistic indeterminism).

On the other hand, it is well known that physical objects are endowed with some general values, such as simplicity, following the least energy path, obeying mathematical formulations, and organizing itself in accordance to statistical rules. These qualitative 'values' mirror formally similar human values, albeit the later is much more complex.

In addition to the above, as mentioned before, basics of complex systems and self-organization, such as sensitivity to initial conditions, autonomy, adaptation, etc, apply to every level of nature with suitable formulation.

Bridging Set of Laws of Nature

Speaking about four or six levels instead of two, then, we may also apply the concept of generalization to other levels of existence, creating a general model for the general laws that govern the different levels of nature. With the establishment of the concept of generalization of laws across levels of existence we should then be equipped with the concept needed to achieve our goal, which is bridging natural and human sciences.

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However, if we move forward to discuss the logical basis upon which we may apply the concept of generalization we will find that the vertical set of 'natural laws', presented above, play the role of the unifying principles of nature in place of the principle of reduction. These sets of 'vertical natural laws' are responsible for the 'formal' symmetry and uniformity we notice in nature. Such a set of vertical laws, in order to play its role it should: 1) establish continuity between the successive levels (to produce uniformity); and 2) reproduce its formal horizontal relations within each level (to produce symmetry).

Continuity across the successive levels of nature mandates that 'horizontal laws' at each level be compatible with those of the prior and posterior levels. If we keep in mind that the concept of levels is no more than some form of representation of reality i.e. a useful 'model', and consequently we can make as much number of levels as we require, then we should expect that 'horizontal laws' at all levels, from the subatomic level to the human level, are compatible too.

Here the concept of the model plays a central role to resolve the problems of such a picture through the concept of domain limit. For compatibility can be easily achieved through introducing some general form of such horizontal laws that are so abstract that it can be interpreted differently at each level, in a way that is similar to the statistical models mentioned above. Hence, across the successive vertical levels, we have such formal (umbrella) laws that apply 'more qualitatively and less quantitatively' on the upper levels of existence (such as humans), and more 'quantitatively and less qualitatively' on the lower levels of existence (such as the physical).

Bridging Statements of the Model

Making such a move in which we endeavor to present 'formal' statements that can be translated into quantitative or qualitative 'laws' according to the problems at hand makes such 'formal' statements some kind of bridging statements between levels of nature. Such a set of 'formal' statements would cover the whole basic problems of reality, and hence, comprise together the bridging part of our possible non-reductive model of nature.

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However, such a situation would require formulating an overall bridging language that is independent of both the physical mathematical language and the value-laden human qualitative language. In such a language, for example, a specific 'new' term should be introduced to differentiate between, and bridge, the quantitative physical term 'attraction' and the qualitative human term 'attraction'. The same applies to the need to differentiate between the quantitative term 'disposition', the functional term 'tendency' and the human purposive term 'desire', and so on.

This move is essential, for it would alleviate the inherent equivocation that plagues our language when we indulge into inter-level discourse. For, when the elementary particle 'knows' the appropriate bath is different from the meaning when the neuron 'knows' the appropriate action to interact with other neurons, and naturally differs from the meaning of 'knowing' in human behavior. A bridging term is required, otherwise we would continuously be engaged in discussions about the existence of pan-psychism, and get stuck between the elementary particles that are endowed by a specific human psych (the teleological model) and a totally negative elementary particles (the mechanistic model), which in both positions contradict reality.

The final result is that we have one way out of the existing fragmented situation with respect to our view to nature, which is constructing a formal model of nature with a domain that spans both natural and human sciences. This model represents a bridging overall construct that is composed of bridging neutral statements that can be translated in accordance to the specific level of reality under scrutiny. However, such bridging statements are only possible if we were able to formulate some sort of a neutral bridging language that is capable of carrying the neutral meanings required for such statements.

Such a result represents a huge program that requires considerable efforts and time to be achieved. However, this is a natural consequence given the current situation which is very similar to the period in which the now failing mechanistic model has been constructed as a response to the failure of the ancient Aristotelian model. Such a process has consumed around two hundred years of efforts to formalize its basic principles as well as its necessary language, which represented at that time an advanced mathematical-logical model of nature.

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VIII. Conclusion

In this paper we addressed the problem domain limits of of models in view of the current shift of contemporary scientific thought from empathies on the theory to the concept of modeling. The question raised is whether models can span both natural and human sciences? or any model should be limited to one of the two basic fields, in the same way as our scientific theories work today.

This question is of special importance in view of the current obstacles that confront the currently prevailing mechanistic model of nature. Specifically, we question the possibility of formulating a non-mechanistic model that covers both 'natural' and human sciences without reducing either of them to physics. In other words, on the basis of taking modeling as a pragmatic tool to be used in accordance to our purposes, modeling is presented here as a tool for bridging 'natural' and human sciences.

In order to answer such a question, we first introduced the concept of 'general model of nature', which is based on three basic presuppositions, the final constituents of existence, the vertical relations between the successive levels of existence, and the horizontal relations that govern change within every level.

Using such a construct we presented the 'mechanistic model of nature' as a particular instance of such a general form of the concept of the model of nature. In the mechanistic model, the final constituents are the indivisible atoms, the vertical relation is reduction and the horizontal relation is the Newtonian mechanics. Following such characterization we presented the challenges that confronted the mechanistic model which have not been overcome yet. Specifically, the three basic presuppositions of such a model, which are the indivisible atoms, reduction and determinism are now completely refuted. This situation points out clearly to the need for an alternative model.

In the final section of this paper, in order to show that the concept of modeling can in principle close the gap between natural and human sciences, we presented in some details how to achieve such a goal. On the basis of contemporary advancement of scientific thought, especially the appearance of QM, as well as the newly admitted views in philosophy of science, such disposition, emergence and holism, we formulated the general form of such non-reductionist model. Hence, we introduced the possible three alternative presuppositions of the alternative model. Such presuppositions countenance a world that is composed of energy particulars as the final constituent endowed with specific dispositions that interact vertically in order to compose the different levels of existence, and horizontally to compose the different forms of existence at each of such levels.

Such an alternative model necessitated two basic moves. First, constructing formal (or umbrella) general laws of nature that are void of meaning, and that acquires meaning only when applied to a specific level of existence. The second move is that we would be in need of a new 'neutral' language with respect to the different levels of nature in order to avoid ambivalence in describing reality, by using 'human' language to describe and define other non-human levels of nature.

References

Abuzaid, Samir. 2008, "Science and Conditions of Renaissance – the New scientific Conceptions and the Scientific Grounding of the Arabic Renaissance", Madbouli Bookstore, Cairo. (in Arabic)

Barnes, Jonathan. 2000, "Aristotle -A Very Short Introduction", Oxford University Press.

Bird, Alexandr. 2004, "the Dispositionalist Conception of Laws", Foundations of Science 152: 1–18.

Cartwright, Nancy. 2002, " What Makes a Capacity a Disposition?", in Reiss, Julian (ed.) " Causality: Metaphysics and Methods – Technical Report 10/03", Centre for Philosophy of Natural and Social Science, London School of Economics.

Chalmers, David. 2003, "Consciousness and its Place in Nature", in Stich, Stephen and Warfield, Ted A. (eds.), The Blackwell Guide to Philosophy of Mind , Blackwell, P. 102 – 142.

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Cooper, David. 1996, "World Philosophies – An Historical Introduction", Blackwell.

Couch, Mark B. 2011, "Mechanisms and constitutive relevance", Synthese, V. 183, Pp. 375-388.

Craver, Carl and Bechtel, William. 2006, "Mechanism", in Sarkar, Sahotra and Pfeifer, Jessica (eds.), the Philosophy of Science – An Encychlopedia, Routledge, p. 469-477.

Donato Rodríguez, Xavier and Zamora Bonilla, Jesu´s. 2009, "Credibility, Idealisation, and Model Building: An Inferential Approach", Erkenntnis, 70:101-118.

Fodor, Jerry. 1974, "Special Sciences (or: the Disunity of Science as a Working Hypothesis), Synthese, V. 28, 97-115.

Frigg, Roman and Hartmann, Stephan. 2006, "Scientific Models", in Sarkar, Sahotra and Pfeifer, Jessica (eds.), the Philosophy of Science – An Encychlopedia, Routledge.

Garson, Justin. 2006, "Emergence", in Sarkar, Sahotra and Pfeifer, Jessica (eds.), the Philosophy of Science – An Encychlopedia, Routledge, p. 230-235.

Gaukroger, Stephen. 2006, "The Emergence of a Scientific Culture - Science and the Shaping of Modernity, 1210–1685", Clarendon Press, Oxford.

Giere, Ronald. 2004, “How Models Are Used to Represent Reality”, Philosophy of Science,V.71, Supplement, S742-752.

Harré, Rom. 2001 , "Dispositions and Powers", in Newton-Smith, W. H. (ed.) A Companion to the Philosophy of Science, Blackwell, Pp. 97-101 .

Hookway, Christopher. 2001, "Holism", ", in Newton-Smith, W. H. (ed.) A Companion to the Philosophy of Science, Blackwell, P. 162 – 164.

Koltko-Rivera, Mark E. 2004, "The Psychology of Worldviews", Review of General Psychology, Vol. 8, No. 1, Pp. 3-58.

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ISSN: 1737-6432

Psillos, Stathis. 2007, "Philosophy of Science A–Z", Edinburgh University Press.

Psillos, Stathis. 2007, "Philosophy of Science A–Z", Edinburgh University Press.

Psillos, Stathis. 2011, "Living with the abstract: realism and models", Synthese, V. 180, Pp. 3–17.

Roberts ,John T. 2006, "Determinism", in Sarkar, Sahotra and Pfeifer, Jessica (eds.), the Philosophy of Science – An Encychlopedia, Routledge, p. 197-208.

Sarkar, Sahotra. 2008, "Reduction", in Stathis, Psillos and Martin, Curd (eds.) The Routledg Companion to Philosophy of Science, Pp. 425-434.

Seager, William. 2001, "Supervenience and Determination", in Newton-Smith, W. H. (ed.) A Companion to the Philosophy of Science, Blackwell, P. 480-482.

Silberstein, Michael. 2002, "Reduction, Emergence and Explanation", in Machamer, Peter and Silberstein, Michael (eds.), The Blackwell Guide to the Philosophy of Science, Blackwell, P. 80-107.

Stapp, Henry P. 2007, " Mindful Universe - Quantum Mechanics and the Participating Observer", Springer.

Taylor, John. 2003, "Hidden Unity in natural Laws", Cambridge University Press.

Wimsatt, William C. and Sarkar, Sahotra. 2006, "Reductionism", in Sarkar, Sahotra and Pfeifer, Jessica (eds.), the Philosophy of Science – An Encychlopedia, Routledge, p. 696-703.
Zaman, Frederick. 2001,"A Physico-social Theory Of Weberian Ideal-types: The Newtonian Deconstruction Of Classical Sociology", Theory & Science, V.2, Issue.2.