The Absence of "Perfect Induction" in Science

ABSTRACT

The present paper is finalized to show that Science, even if considered in its two different Phenomenological Approaches at present known, is unable to assert that: "Thinks are like that". This is because both the two Scientific Approaches previously mentioned have not the property of "the perfect induction".
Consequently, although they can even reach an experimental confirmation of the theoretical results, and thus a "valid description" of the various phenomena of the surrounding world, such a description has not an "absolute value". In fact, it always and only has an "operative validity", that is, it exclusively and solely refers to an "experimental point of view". This means that such an "operative validity" cannot represent the basis for a logical process characterized by a "perfect induction". In addition, the Traditional Scientific Approach is also characterized by "Insoluble" Problems, "Intractable Problems", Problems with "drifts", which could generally termed as "side effects".

On the other hand, the same com-possible Scientific Approach based on the Emerging Quality of Self-Organizing Systems, also presents its "Emerging Exits". Consequently, none of the two mentioned scientific Approach has the "gift" of "the perfect induction". However, there are significant differences between the two. Differences that may "suggest" the most appropriate choice for an "operative point of view".

This conclusion will be com-proved by considering, with particular reference, both the "side effects", which are related to the traditional approach and, on the other hand, the "Emerging Exits", which specifically pertain to the new Scientific Approach based on the Emerging Quality of Self-Organizing Systems.

INTRODUCTION

In order to show the *difference* between the *origin* of "side effects" and that of "Emerging Exits", it is worth starting from the consideration of a synoptic picture that summarizes the basic characteristics of the two mentioned approaches (see Tab. 1), that will be successively analyzed and compared, in more detail, in the context of the paper.

A comparison that, as already anticipated, will lead us to affirm that, in both *the two Scientific Approaches* at present known, there is no form of "perfect induction".

FUNDAMENTAL CHARACTERISTICS OF THE TWO SCIENTIFIC APPROACHES

Traditional Scientific Approach	***"Emerging Quality"* of Self-Organizing Systems**
1) causality principle (efficient causality) 2) classical logic (necessary logic) 3) functional relationships	1') Emerging Causality 2') Generative Logic 3') Ordinal Relationships

d/dt is the corresponding formal translation $f(t)$ represents a *functional relationship*	**Development of an appropriate Language** - L. Boltzmann, A. Lotka - H. T. Odum: Emergy Algebra and M. Em-P. P. - Further developments in transient conditions - Introduction of the "Incipient" derivative $\tilde{d}/\tilde{d}t$

- Thermodynamic Principles (1st , 2nd, 3rd) **- Physical Laws (specific for each Discipline)** **Every System is a "Mechanism"** **Hypotheses** ↓ **Mathematical Formalization** ↓ **Conclusions** ↓ **Confirmation by experimental results**	**The Maximum Ordinality Principle** **- it is applicable to any Field of analysis: *non-living* Systems, *living* Systems, "*thinking*" Systems (e.g. Human Systems)** **- at *any space-time scale* and in *variable conditions*** **- it also offers a *more appropriate* description of any given System and its surrounding Habitat** **Every System is a "Self-Organizing System"**

Tab. 1 - Synoptic comparison between the fundamental characteristics of the two Scientific Approaches

Let us first consider the Traditional Approach that fundamentally characterizes Modern Science.

The Traditional Scientific Approach

Modern Science is characterized by a persistent and progressively ascendancy toward ever more general Physical Laws and Principles.

However, before any formulation of a single hypothesis or a physical theory, Modern Science (let us say, from Newton on) adopts three fundamental *pre-suppositions* (see Tab. 1): the *causality principle* (also termed as "efficient causality"), *classical logic* (also termed as "necessary logic"), and *functional relationships* (between the various parts of any System analyzed).

On the basis of such fundamental presuppositions, and only after having developed a strictly conform consequential *formal language* (that is the Traditional Differential Calculus (TDC)), Modern Science progressively ascends toward ever more general Physical Laws and Principles:

i) from Phenomenological Laws (e.g. Kepler's Laws); ii) to Physical Laws specific of each Discipline (e.g. Newton's Laws, Maxwell's Equations, etc.); iii) up to the three well-known Thermodynamic Principles.

Such a progressive development has given origin to a hierarchy of a multiplicity of *quantitative* Physical Laws and Principles, in particular as a consequence of the first basic presupposition: the *causality principle*. This Principle, in fact, has led Modern Science to introduce "different causes" in different Disciplines. The Principle of causality, in fact, tends to "sub-divide" the entire phenomenology (at present known) in different "branches", precisely because, on the basis of such a presupposition, it leads Scientists to research for the most "appropriate causes" pertaining each specific set of phenomena each time considered.

In this way, Modern Science persistently propends to show that: "*Every System is a mechanism*".

Such a conclusion, however, even when confirmed by experimental results, can be considered as being valid *only* from an *operative* point of view, but not from an *absolute point of view*. This is because "necessary logic" (adopted as a second basic presupposition) does not admit any form of "*perfect induction*".

In fact, as synthetically illustrated in Tab. 1, in the strict contest of "necessary logic":

i) after having formulated a single or more hypotheses (such as in the case of a given Theory);
ii) after having formalized them in an appropriate formal language (faithfully conform to the three above-mentioned basic presuppositions);
iii) after having drawn the consequential conclusions
iv) and after having also obtained experimental confirmations of the previous formal conclusions;
v) it is impossible, *in any case whatsoever*, to assert the *uniqueness* of the *inverse* process. That is: it is impossible to show that the hypotheses adopted are the *sole* and *unique* hypotheses capable to explain those experimental results.

This is precisely because of the *absence*, in "*necessary*" logic, of any form of *perfect induction*.

In fact, only in the presence of a *perfect induction* it would be possible to assure the *uniqueness* of the *inverse* process and, thus, to transform the adopted hypotheses into an *absolute* perspective.

This means that Modern Science, precisely because based on *necessary logic*, should always be "open" to recognize that *there always exist* many other *possible* Approaches (in principle *infinite*) capable to interpret the same experimental results.

At this stage, after having synthetically recalled the basic characteristics of Modern Science, we can consider the fundamental properties of the New Scientific Approach based on the "Emerging Quality" of Self-Organizing Systems, synthetically indicated in parallel (for a better comparison) in the right hand side of Tab. 1.

In fact, on the basis of the fundamental properties of both the Two Scientific Approaches we will able to analyze the corresponding differences between "side effects" and "Emerging Exits".

The Scientific Approach based on the "Emerging Quality" of Self-Organizing Systems

The expression "*Emerging Quality of Self-Organizing Systems*" refers to the fact that Self-Organizing Systems always show an unexpected "*excess*" with respect to their phenomenological premises. So that they usually say: "*The Whole is much more than its parts*".

Such an "excess" can be termed as *Quality* (with a capital Q) because it cannot be understood as being a simple "property" of a given phenomenon. This is because it is *never reducible* to its phenomenological premises in terms of traditional mental categories: *efficient causality, logical necessity, functional relationships*.

This evidently suggests a *radically new* gnosiological perspective, which corresponds to recognize that: "*There are processes, in Nature, which cannot be considered as being pure* "*mechanisms*".

This also leads, *in adherence*, to the adoption of "*new mental categories*"[1], *Emerging Causality*, *Generative Logic*, *Ordinal Relationships* and, correspondently, to the development of a completely *new formal language*, in order to

[1] These "*new mental categories*" can no longer be termed as "pre-suppositions", because they are not defined "a priori" (as in the case of Traditional Approach). In fact, they are chosen only "a posteriori", on the basis of the "Emerging Quality" previously recognized. "*Emerging Causality*", in fact, refers to the *capacity* of a Self-Organizing System to manifest an "irreducible excess"; "*Generative Logic*", correspondently, refers to the capacity of our mind to draw "*emerging conclusions*". That is, "conclusions" whose information content is much higher than the information content corresponding to their logical premises, although persistently "adherent" to the latter. "Ordinal Relationships", in turn, refer to particular relationships of *genetic nature*, like in the case of two "brothers". The latter in fact are termed as such not because of their "direct reciprocal relationships", but because their *direct reference* to *the same genetic principle*: their father (or their mother or both).

formulate *one sole Reference Principle*, the Maximum Ordinality Principle, so that the description of Self-Organizing Systems might result as being faithfully conform to their "Emerging Quality".

The Progressive Development of a New Formal Language

L. Boltzmann was the first who attempted at describing Self-Organizing Systems in more appropriate formal terms, by proposing the adoption of a new Thermodynamic Principle: The Principle of Maximum Exergy *Inflow* to the System (Boltzmann 1886).

Some years later, A. Lotka (1922-1945) reformulated such a Principle in the form of: The Principle of Maximum Exergy *Flow through* the System (Lotka, 1922a,b, 1945).

Both such attempts were not perfectly successful, because still based on the concept of Exergy, which is a quantity that is strictly pertaining to Classical Thermodynamics. Consequently, it re-proposes the concepts of *efficient causality*, *logical necessity*, *functional relationships*.

A really *new formal language* only appears with H. T. Odum (1994a,b), with the genial introduction of the concept of Emergy (*Em*), defined as the product of Exergy (*Ex*) by Transformity (*Tr*)

$$Em = Ex \cdot Tr \qquad (1).$$

Equation (1) clearly shows that Emergy is *still* based on "Exergy". However:
i) *Quality Factor Tr* "*Transforms*" *Ex* into a *new physical quantity*: Emergy;
ii) The latter in fact is not defined in "functional terms", but only by "*assignation Rules*" (Brown and Herendeen, 1996);
iii) This is precisely because *Tr* is expressed by means of a *non-conservative Algebra*;
iv) Thus the output "excess" of the three Fundamental Process (Co-Production, Inter-Action, Feed-Back) is always understood as being "irreducible" to its specific inputs in *mere functional terms*.

This means that Emergy is able to represent the "Emerging Quality" of Self-Organizing *Processes*. Consequently, the general enunciation of the *Maximum Emergy-Power Principle* (Odum 1994a,b,c) can *equally be referred*, at a phenomenological level, to the *corresponding maximization tendency* of the "Emerging Quality" on behalf of *Self-Organizing Systems*.

The Maximum Emergy-Power Principle, however, had not a corresponding formulation under *variable conditions*. On the other hand, such a formulation could not be given in terms of the Traditional Differential Calculus, because traditional derivatives, as a consequence of their conceptual basic presuppositions (see Tab. 1), are not properly apt to represent the "generative" behaviour of "Self-Organizing Systems".

This is why a new concept of derivative was introduced, that is the "*Incipient Derivative*", defined as

$$\left(\frac{\tilde{d}}{\tilde{d}\,t}\right)^{\tilde{q}} f(t) = \underset{\tilde{\Delta}t:0\to 0^{+}}{\tilde{Lim}} \circ \left(\frac{\tilde{\delta}-1}{\tilde{\Delta}\,t}\right)^{\tilde{q}} \circ f(t) \qquad \text{for} \quad \tilde{q} = \tilde{m}/\tilde{n} \qquad (2).$$

A definition which clearly shows that the "*Incipient Derivative*" is not an "operator", like the traditional derivative (d/dt), but it could be termed as a "*generator*", because it describes a Process *in its same act of being born* (Giannantoni 2001a,b, 2002, 2004a,b, 2006, 2008a, 2010a).

On this basis, the Mathematical Formulation of the Maximum Emergy-Power Principle was preliminarily given in (Giannantoni 2001b). Afterwards, and in a more articulated form, in a specific book co-financed by the Center for Environmental Policy (Giannantoni 2002).

During the successive eight years (2002-2010), such a mathematical formulation was applied to several Disciplines, such as *Classical Mechanics*, *Quantum Mechanics*, *General Relativity*, *Chemistry*, *Biology*, *Economics and the corresponding results were reunited in two books* (titled: *"Lightness of Quality"* (Giannantoni 2007) *and "Ascendency of Quality*" (Giannantoni 2008b)).

At the end of this wide range of applications, it was possible to give a more general formulation of the Maximum Emergy-Power Principle in the form of the "*Maximum Ordinality Principle*" (Giannantoni 2010a), whose verbal enunciation asserts that: "*Every System tends to maximize its Ordinality, included that of the surrounding habitat*".

For the sake of completeness, the corresponding mathematical formulation will be recalled in the next section.

Mathematical Formulation of the Maximum Ordinality Principle (M.O.P.)

The mathematical formulation of the M.O.P. can be expressed as follows (Giannantoni 2010a):

$$(\tilde{d}/\tilde{d}\,t)^{(\tilde{m}/\tilde{n})}\{\tilde{r}\}_s = 0 \qquad (4) \qquad\qquad (\tilde{m}/\tilde{n}) \to Max \to \{\tilde{2}/\tilde{2}\} \uparrow \{\tilde{N}/\tilde{N}\} \qquad (4.1)$$

where: $(\tilde{d}/\tilde{d}\,t)$ is the symbol of the *incipient derivative*, which represent the *Generativity* of the System; $\{\tilde{r}\}_s$ is the proper Space of the System; $(\tilde{m}/\tilde{n})$ is the Ordinality of the System under consideration, that reaches its *maximum* when it equals $\{\tilde{2}/\tilde{2}\} \uparrow \{\tilde{N}/\tilde{N}\}$ (as indicated in Eq. (4.1)).

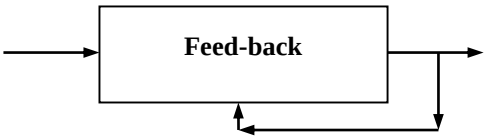
Under such conditions, the explicit Solution to Eq. (4) is structured in the following form

$$\{\tilde{r}\} = e^{\{\tilde{\alpha}(t)\}^{(\tilde{N},\tilde{N})}} = e^{\left\{\begin{pmatrix}\tilde{\alpha}_{11}(t)\\ \tilde{\alpha}_{21}(t)\\ \cdots\cdots\\ \tilde{\alpha}_{N1}(t)\end{pmatrix},\begin{pmatrix}\tilde{\alpha}_{12}(t)\\ \tilde{\alpha}_{22}(t)\\ \cdots\cdots\\ \tilde{\alpha}_{N2}(t)\end{pmatrix}\begin{pmatrix}\cdots\cdots\\ \cdots\cdots\\ \cdots\cdots\\ \cdots\cdots\end{pmatrix}\begin{pmatrix}\tilde{\alpha}_{1N}(t)\\ \tilde{\alpha}_{2N}(t)\\ \cdots\cdots\\ \tilde{\alpha}_{NN}(t)\end{pmatrix}\right\}} \qquad (4.2)$$

which exactly represents the Structural Organization of the System as generated by a joint *cooperation* of *N Co-Productions* and *N Inter-Actions*, all understood as Generative Processes. This is because:

i) each term $\tilde{\alpha}_{ij}(t)$ of the Ordinal Matrix in Eq. (4.2) represents a couple of elements that originates from a Generative Process of Ordinality $\{\tilde{2}/\tilde{2}\}$, that is as a joint cooperation between a Co-Production and an Inter-Action Process, both of Generative Nature;
ii) at the same time, each "column" of the same Ordinal Matrix represents the extension of the concept of a "Binary" Relationship to *N* elements. Each "column", in fact, represents the "emerging" output of a Generative Co-Production Process of Ordinality $1/\tilde{N}$;
iii) while the *N* columns of the same Ordinal Matrix, considered all together as one sole entity, represent the "emerging" output of a Generative Inter-Action Process of Ordinality $\tilde{N}$;
iv) the System Generation Process, however, becomes complete only when, in addition, the System is considered as being generated by a *global* Feed-Back Process of Ordinal Nature (see Fig. 2).

Its associated formal output, in fact, represented by Eq. (5), formally asserts that the *proper Space* $\{\tilde{r}\}$ of the System



$$(\tilde{d}/\tilde{d}t)^{(\tilde{2}/\tilde{2})}\{\{\tilde{r}\}\otimes(\tilde{d}/\tilde{d}t)^{(\tilde{2}/\tilde{2})}\{\tilde{r}\}\} = 0 \qquad (5).$$

Fig. 2 – Feed-Back between the System and its specific Generativity

is coupled with its *specific Generativity*, so as to originate a *comprehensive* Generative Capacity which, *at any time*, is always *in equilibrium* (including its initial conditions).[2]

As a consequence of this "global" Feed-Back Process, all the elements $\tilde{\alpha}_{ii}(t)$ are equal to zero, whereas all the other elements $\tilde{\alpha}_{ij}(t)$ satisfy the following Relationships

$$\{\tilde{\alpha}_{ij}(t)\}^{\{\{\tilde{2}/\tilde{2}\}\uparrow\{\tilde{2}\uparrow\}\}} \overset{*}{=} \{\tilde{\alpha}_{ji}(t)\}^{\{\{\tilde{2}/\tilde{2}\}\uparrow\{\tilde{2}\uparrow\}\}} \qquad (6),$$

which represent an *intensive form of Ordinal Symmetry*, characterized by the *absence* of any form of *internal priority* in any couple considered. A concept which is much more profound than the traditional concept of symmetry (this is also the reason for the adoption of the symbol "$\overset{*}{=}$", which indicates an assignation condition).

These properties are the basis of the *real novelty* of the M.O.P., which resides in its *Solutions*. The latter, in fact, not only are *always explicit* but, for their particular structure (see Eq. 7)), they can also be termed as *Harmony Relationships*:

$$\{\tilde{\alpha}_{1,j+1}(t)\oplus\tilde{\lambda}_{1,j+1}\} \overset{*}{=} (\sqrt[N-1]{\{\tilde{1}\}})_j \circledR \{\tilde{\alpha}_{12}(t)\oplus\tilde{\lambda}_{12}\} \quad \text{for } j = 1,2,3,\ldots \text{ N -1} \qquad (7).$$

This is because: i) all couples $\tilde{\alpha}_{1,j+1}(t)$ can be obtained by assuming one *sole* and *arbitrary* reference couple $\tilde{\alpha}_{12}(t)$, together with *N-1* Correlating Factors $\tilde{\lambda}_{1,j+1}$ which are related to the *Habitat* conditions;

ii) whereas the *N-1* Ordinal Roots $(\sqrt[N-1]{\{\tilde{1}\}})_j$ of Unity $\{\tilde{1}\}$ (whose specific sequence depends on the reference couple adopted) transform *Explicit Solution* (7) into an "*Emerging Solution* ". That is, a Solution "whose *information content* is *much higher* than the information content corresponding to the initial formulation of the problem" (Giannantoni 2012).

This is precisely the reason why the Maximum Ordinality Principle is *potentially able* to describe the "*Emerging Quality*" of all "Self-Organizing Systems".

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[2] The symbol $\otimes$ represents a generalized form of the "vector" product between *spinors* (Giannantoni 2010a).

"Side Effects" and "Emerging Exits"

In order to prove our *thesis*, clearly expressed in the title of the paper, we will now develop our considerations concerning the absence of a "Perfect Induction" by considering, as a preliminary step, two distinct fundamental concepts: "Side Effects" and "Emerging Solutions". Where the first one is specific to the Traditional Scientific Approach, while the second one is strictly pertaining to the Approach based on the "Emerging Quality" of Self-Organizing Systems.

"Side Effects" in the traditional Scientific Approach

The synthetic expression "side effects" refers to those problems whose solutions (when available) present some "experimental discrepancies" with respect to the corresponding experimental results. Consequently, they cannot be considered as having a valid confirmation from an experimental point of view.
The "experimental discrepancies" of such problems can be synthetically termed as being "side effects", simply because they are a direct consequence of the basic presuppositions of the Traditional Scientific Approach.
More specifically, the "side effects" can be classified in three distinct categories, because directly referable to: "Insoluble Problems", "Intractable Problems", and "Problems with Drift".
In addition, it is worth mentioning another typology of problems, that is those Problems which "seem" to present a valid experimental confirmation of the corresponding theoretical solutions, but such a confirmation is only "apparent", as it will be shown later on.

The list of the main problems pertaining to the three mentioned typologies of "side effects" will be here simply recalled in a rapid sequence, because they have already been analyzed in all deeper details in (Giannatoni 2014a,b, 2016, 2018, 2019, 2020a).

"Insoluble" Problems

These Problems are termed as such because they do not present an *explicit solution in formal terms*, precisely because they are formulated in terms of TDC (Traditional Differential Calculus).
Let us recall the most famous among them:

i) The Three-Body Problem, demonstrated as being intrinsically insoluble by H. Poincaré (1889);

ii) The distribution of the Planets in the Solar System
Such distribution is at present only approximately described by the semi-empirical Bode Law (with the exception of Neptune and Pluto). Up to now, in fact, there is no physical reason able to explain such a topological distribution, that is: the fact that the ratio between the successive mean distances between the Sun and the various Planets (including the "asteroid belt") are approximately "constant", within 15% (always with the exception of Pluto);

iii) The angular distribution of planetary orbital planes with respect to the Ecliptic
This is another example in which there is no satisfactory physical explanation of such a distribution. The main reason fundamentally depends on the fact that, in the absence of an explicit solution to the "Three-body Problem", it is impossible to evaluate the exact influence between the reciprocal orbits of the Planets. The various angles, in fact, are distributed in a cone of a rather large width (20°), which reduces to 10° if the extreme Planets (Mercury and Pluto) are "excluded" (this is why the latter are usually considered as being rather "anomalous");

iv) The angular velocities of the Stars in Galaxies.
The Stars in Galaxies, in fact, present an unexpected non-Keplerian distribution of velocities. A general trend that results as being unforeseeable, and also inexplicable, on the basis of both Classical Mechanics and General Relativity. This fact has led Scientists to suppose the presence of a "non-visible" matter (thus denominated "dark") that could potentially explain such an unexpected behaviour;

v) The Three-good two-factor Problem in Economics, which, as is a well-known, represents an "insoluble" problem very similar to the "Three-body Problem" in Classical Mechanics (Giannantoni 2011b).

"Intractable" Problems

In this section we will simply recall the most known "intractable" Problem, 2015. This is the "Protein Folding" in Biology (Giannantoni 2015).
In fact, it is one of the dynamic problems considered as being maximally intractable, because it usually requires about 10.000 years even if the model is run on the most updated computers (10 Petaflop).
In addition, even in the case of solutions obtainable in reasonable computation time (in the case of very small proteins), they always present a "drift" (see next section) between the foreseen theoretical behaviour of the system analyzed and the corresponding experimental results. A drift which becomes much more marked as the order of the system increases. (Giannantoni 2010b, 2011a).

Problems with "drift"

Such an expression synthetically refers to the fact that there are problems in which there is a "disagreement" (thus synthetically termed as "drift") between the foreseen behaviour of the System, modelled on the basis of the traditional Physical Laws and Principles, with respect to the corresponding experimental results.
Let us recall the most known among them.

i) Precessions of Planets

The associated "drift" is strictly related to the fact that General Relativity is not able to solve the "Three (or more)-body Problem", precisely because of its intrinsic "functional" approach.
In addition, when the "Three-body Problem" is faced in numerical terms (in the context of General Relativity), the solutions proposed by Sundman (1912) and Wang (1990s) become even more "intractable" than in Classical Mechanics. Consequently, Processions of Planets, which are basically problems characterized by a "drift", also become, at the same time, "Intractable" Problems, when faced in the context of the entire Solar System;

ii) Intrinsic Instability of Smart Grids

It is well-known that, when a Smart Grid reaches the number of about 100.000 plants (or more), it may present some forms of instability. The latter are generally associated to a distortion "drift" (with respect to a perfect sinusoidal trend of its physical parameters) which tends to amplify even under normal exercise conditions, as a consequence of the different currents produced by its *N* generators. A "drift" that, in addition, becomes even more marked in the case of a cyber attack;

iii) The "Unexplained" Sea Level Rise Over The Period 1900-2000

Global sea level has been rising at a rate of around 1.8 mm per year (i.e. 18 cm/century). This rate is still increasing. Measurements from satellite altimetry indicated a mean rate of 3.1 mm/year in the period 1993-2003 (IPCC, 2007). More recent data indicate a value of 3.2 mm/year (WMO, 2013).

Such a physical trend represents an "enigma". In fact: "Two processes are involved: an increase of the mass of water in the oceans (the eustatic component), largely derived from the melting of ice on land, and an increase of the volume of the ocean without change in mass (the steric component), largely caused by the thermal expansion of ocean water." (Meier & Wahr, 2002, p. 1).

The eustatic contribution of 6 cm attributed to IPCC leads to a residual rise to be explained of 12 cm to the end of the century, which cannot be accounted for by steric expansion only (ib.). On the other hand, other potential effects do not seem to be able to explain such a difference, because they only give marginal contributions. Consequently, they are insufficient to account for the observed "drift" of 12 cm;

iv) The intrinsic "drift" of Classical Thermodynamics

For the sake of brevity, we will synthetically refer to the "drift" of the (so-called) "Energy Conservation Principle".

Such an aspect, in fact, is strictly related to the "insolvability" of the "Three-body Problem", which led H. Poincaré to assert that: "The conservation of Energy is a limitation imposed on the *freedom* of complex systems" (Poincaré, 1952, p. 133).

Absence of Perfect Induction even in the case of Problems characterized by a "valid" experimental confirmation

It is evident that in all the cases previously considered, in which there is not a valid experimental confirmation of the theoretical results, we cannot speak about a "perfect induction", mainly because of the absence of a solid starting base for such an assertion.
What's more, we cannot assert the presence of a "perfect induction" even in the case of a valid experimental confirmation of the theoretical results. This is because of two "correlative" reasons, both strictly depending on the presupposition of the Scientific Approach adopted:
i) The first one has already been pointed out. In fact, it is directly related to the adoption of a "necessary" logic, which, as already shown, does not admit any form of "perfect induction" (see the comments to Fig. 1);
ii) The second one, vice versa, is directly related to the fact that, even when "they assert that there is a valid experimental confirmation of the theoretical results", such an assertion is always "apparent", as a consequence of a "masked drift" between *theoretical results* and their *experimental confirmation*. This "masked drift" is substantially due to the fact that, "measurement methods and experimental instrumentations" are both always conceived *in perfect adherence* to the same theoretical scientific approach adopted. In this sense, we could also speak about a sort of a "*hidden tautology*".

Absence of "perfect induction" in the Approach based on the "Emerging Quality" of Self-Organizing Systems

In this respect it is possible to distinguish three different cases:
i) Interaction between two known Systems;
ii) Interaction between two Systems where the second one, understood as Habitat of the first one, has an unknown Ordinality;

iii) The evolution of a Self-Organizing System with respect to which it is unknown the presence (or not) of a corresponding Habitat.

i) Interaction between two known Systems

A meaningful example of this case is represented by the so-called Exon-Skipping Process. This is an example of Ordinal Inter-Action between two distinct biological compounds, finalized to improve the production of an efficient Dystrophin in children who suffer from such a severe pathology, as a consequence of a genetic mis-folded Dystrophin.
The Inter-Action Process can be described as follows:
- on the one hand there is a selected inefficient Exon (that is one out of the 80 parts in which Dystrophin is usually subdivided) and,
- on the other hand, an artificial biological compound termed as AON (Antisense Oligo-Nucleotide), able to "isolate" (or better, to "skip") the considered inefficient Exon pertaining to the mis-folded Dystrophin.

Both Exons and AONs are made up of the four fundamental Bases (Adenine, Cytosine, Guanine, Tymine). However, while any Exon is constituted by 180-200 Bases, any AON, vice versa, is made up of 20-30 Bases.
If a generic Inter-Action (Exon-AON) is modeled in the light of the M. O. P., we have that the Ordinality (n1)/(n1) of the Exon (where n1 ranges from 180 to 200) and the Ordinality (n2)/(n2) of the AON (where n2 ranges from 20 to 30), give origin to a new Self-Organizing System of Ordinality (n1+n2)/(n1+n2).
This Process is widely described in **(**www.ordinality.org**)**, where it is also shown the possibility of adopting a *Unique* Method for skipping any Exon, in Duchene Muscular Dystrophy (DMD), according to the three usually adopted methodologies: first generation AONs, Morpholinos, second generation AONs.
In each case, the Method leads to recognize the optimal Antisense and its corresponding Exon Skipping Efficiency for the methodology each time considered.
This means that, in the case of three different Efficiencies, these will manifest a "hierarchy" between them, which however is not always the same, because the "hierarchy" varies according to the specific Exon to be skipped.
The corresponding results can be obtained in less than 2 seconds, on a simple PC (Giannantoni 2013). It then becomes very easy to recognize the reason why some AONs are potentially more efficient than others. An aspect that, apart from the associated benefits when adopted in a therapy, can lead to a significant acceleration in the research of the most appropriate AONs, by also saving time and costs associated to a reduced number of preliminary experimental tests ("in vitro" and "in vivo").
However, even if the M.O.P. shows such a wide operative validity, it is always presents some "Emerging Exits", which are related to very "marginal discrepancies" in some topological parameters. Such "marginal discrepancies", in fact, even if they do not alter the operative validity of the M.O.P, they have to be considered as being corresponding "Emerging Exits", because they reveal that, *for a more appropriate Ordinal description*, the Inter-Action between Exon and AON should better be considered in a *wider context*, for instance, that corresponding to the entire Dystrophin.

ii) Interaction between two Self-Organizing Systems in which the second one (understood as Habitat of the first one) has an unknown Ordinality

An important example is that of the Solar System, when the latter is considered in Inter-Action with the remaining part of the Universe.
In such a case the Solar System, made up of 11 bodies (if we include the asteroid belt too), has an Ordinality (11)/(11), while the remain part of the Universe has an unknown Ordinality.

Under such conditions, the remaining part of the Universe can be accounted for by means the "correlation factors" $\tilde{\lambda}_{ij}$ that appear in the Ordinal Matrix (2), as well as in the Harmony Relationships (3) and (4). These in fact precisely represent that "Extra" which leads us to the explicit solution to the problem.
In this way the general solution obtained for the entire Solar System (Giannantoni 2014a, Giannantoni & Rossi, 2014b) enables us to give a satisfactory answer to some other related problems, such as those previously mentioned in the previous paragraph pertaining to "Insoluble Problems". Nonetheless, it is always possible to recognize the presence, in the corresponding solutions, of some "Emerging Exits", clearly revealed by "slight discrepancies" in some experimental values. In fact, even if such "values" are adherently obtained by means of *measurement methods and related instrumentation, always of Ordinal Nature*, they manifest that the Ordinality of the remain part of the Universe (and its related "Emerging Quality") can *never be completely reduced*, and so totally accounted for by means of the specific "correlation factors" $\tilde{\lambda}_{ij}$ previously adopted.

This then suggests that, in order to get a marginal improvement (although always reduced) of the above mentioned "slight discrepancies", the Solar System should better be modeled (at least) in the context of our Galaxy. Such an increasing effort of modeling, however, is not properly justified, because the solution previously obtained is already sufficient and adequate for an operative point of view, obviously, always of *Ordinal Nature*.

iii) The evolution of a Self-Organizing System with respect to which it is completely unknown whether it has a corresponding Habitat or not

This is the case when we want to model the evolution of our Universe as a Self-Organizing System. There are in fact two different possibilities:

- we may assume (as a preliminary hypothesis) that our Universe has a corresponding Habitat, simply because it is considered as being only *one* of a wide multiplicity of Universes. This case is not very different from the problem already illustrated in the previous case ii), although reformulated in different terms;
- alternatively, we may assume that our Universe is *unique and unrepeatable*, because it has to be considered as being a *Whole*.

In this second case, even if in the total absence of the "correlation factors" $\tilde{\lambda}_{ij}$, we might always expect the presence of some "Emerging Exits". In fact, if we can (at least potentially) estimate the most appropriate Ordinality of the Entire System, this does not mean that the Ordinality so obtained precisely represents the "Emerging Quality" of the Entire Universe understood as a Whole.
This is because "Quality" is always understood as being "Emerging" (or better, as being "Over-Emerging"), and thus it does not "reduce", by itself, to the concept of Ordinality. On the other hand, such an assertion is perfectly conform to the proper meaning of Maximum Ordinality Principle, which adopts the concept of "Ordinality" as a "*cipher*" of the "Irreducible Concept" of "Quality".

CONCLUSIONS

On the basis of the previous exposition, we can *openly conclude* that in Science there is no form of "Perfect Induction". This is because:
- on the one hand, the Traditional Scientific Approach is based on a "necessary" logic, which does not admit, by itself, any form of "perfect induction" (see the comments to Fig. 1). In addition, even when it asserts that there is a valid experimental confirmation of the theoretical results, such an assertion is always characterized by a "masked drift" between *theoretical results* and their *experimental confirmation*;
- on the other hand, the Approach based on the "Emerging Quality" of Self-Organizing Systems is unable to reach a perfect description of a Self-Organizing System through the Maximum Ordinality Principle. This is because the corresponding concept of Ordinality is only a representative "*cipher*" of the "Over-Emerging Quality" of the System.
Nonetheless, the previous aspects do not prevent both the Approaches to get (at least in principle) a *valid operative description* of the various Systems *from an experimental point of view*.
However, the fundamental difference is that:
- while the Traditional Approach has to take into account that, even in that case of a "satisfactory" experimental confirmation of the theoretical results, there are always some "slight hidden discrepancies", which can be considered as being an additional form of "side effects" due to a "masked (tautological) drift";
- The Ordinal Approach, vice versa, even if it is more appropriate to describe the various phenomena of the surrounding world (in fact, it is able to solve the majority of the scientific problems characterized by "side effects"), it is always "subjected" to interpret the corresponding "slight experimental discrepancies" as being "*Emerging Exits*". The latter in fact suggest a more advanced description of the considered System, possibly *at a higher level of Ordinality*, for a better representation (always as "cipher") of its "Irreducible" Emerging Quality.

A Possible "Rebound"

Nonetheless, the previous conclusions can suggest a possible "rebound". In particular, with specific reference to the Ordinal Approach, in which the concept of "Quality" is never achieved in its "fullness". In fact, it is only represented in terms of Ordinality, where the latter is understood as a "cipher" of Quality. Consequently, Quality is always recognized as being "not less than" the level of Ordinality each time achieved.
In such a phenomenological perspective and, in particular, in the previous considered case of the Universe as a Whole (as mentioned above), the concept of Ordinality understood as a "cipher" suggests that there will always be some "Emerging Exits". In such a case, in fact, "Emerging Exits" cannot properly suggest a description characterized by a higher level of Ordinality, because the latter is precisely evaluated on the basis of a finite (although extremely high) number of physical entities.
Consequently, the "Emerging Exits" might more properly *suggest the adoption of a different* (and *more general*) *concept of* "*Generativity*", as pertaining to the various Processes each time under consideration.
In other words, the adoption of a concept of "*Generativity*" of *Different Nature*, which is not adequately represented by the Incipient Derivative of order *n* which appears in the mathematical formulation of the M.O.P. (although differentiated in the case of non-living Systems, Living Systems and "Conscious" Systems (Giannantoni 2018)).

Perspectives of Research for a "Generativity" of Different Nature

In spite of the absence of a "perfect induction", the conclusion of the previous section may always suggest the research for a *New Scientific Approach* characterized by a different (and more general) concept of "*Generativity*".
Nonetheless, it is also possible to continue to adopt the Approach based on the "Emerging Quality" of Self-Organizing Systems, because of its wider experimental validity and, contemporaneously, to research for a new and more adequate Concept of "Generativity", on the basis of other Disciplines and Perspectives, even completely different from the research of a New Possible Scientific Approach.
Among other possibilities, it is worth mentioning a possible Perspective based on "Faith".
In this context, in fact, the *phenomenological Generativity* that appears in the M.O.P. can be seen as the "reflex" (always at a phenomenological level) of a "Gift" of God, as Creator of the Universe. A "Gift" which, in its "essence", cannot clearly be "reduced" to a simple description in terms of the sole phenomenological nature, as it appears in the M.O.P.

Even in this case, however, the consequential description does not achieve the "perfect induction".
The sole difference consists in the proposal (among several other possibilities) of an "*Extra*" with respect the known Scientific Approaches. An "Extra" that could represent a form of *Over-Ordinality* and, correlatively, as a "reflexed" form of *a higher level of Quality*, which, nonetheless, is always recognized as "not less than".

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