EQS in Ambito Evolutivo
"supporto e guida" *alla Sintonia con* la Qualità

1. Introduzione

Il Simulatore EQS è in grado di descrivere l'Inter-Azione Ordinale fra due Sistemi Auto-Organizzanti, anche in Ambito "Evolutivo", con l'importante differenza che:

- il Sistema 1 è descritto in condizioni "Evolutive" già "*di per sé*", cioè a prescindere da quelle del Sistema 2
- il Sistema 2 è anch'esso descritto in termini "Evolutivi" "*di per sé*", cioè a prescindere dalle condizioni del Sistema 1
- ed il Sistema Finale viene perciò descritto come "Esito" della "*Inter-Azione Evolutiva*" dei Primi Due.

In questo caso il Modello Formale di Riferimento è quello corrispondente al "Principio di Massima Ordinalità" nella sua Formulazione più Generale, basata cioè sulla *Prima e Seconda Equazione Fondamentale*.
Tale Formulazione Generale, già presentata nella memoria di Gainesville 2018 (v. Terza Sezione), viene qui riproposta non solo per ragioni di comodità del Lettore, ma anche (e soprattutto) "*per ragioni di completezza*".
Infatti, è proprio sulla base di questa Formulazione Generale che, nel prossimo capitolo, sarà possibile illustrare, più chiaramente, il Concetto *di Sintonia con la Qualità*.

2. INTRODUCTION

The Maximum Ordinality Principle (MOP), whose verbal enunciation asserts that "*Every System tends to maximize its Ordinality, including that of its surrounding habitat*", is formulated by means of two fundamental equations, which are so *strictly related to each other*, so as to form *a Whole* (Giannantoni 2010, 2012, 2014a,b, 2016, 2017):

2.1 The First Fundamental Equation

It is formulated as follows

$$\underline{(\tilde{d}/\tilde{d}\,t)}_s^{(\tilde{m}/\tilde{n})}\{\tilde{r}\} \overset{[\rightarrow}{=} \{\tilde{0}\} \qquad (1) \qquad (\tilde{m}/\tilde{n}) \rightarrow Max \rightarrow \{\tilde{2}/\tilde{2}\} \uparrow \{\tilde{N}/\tilde{N}\} \qquad (1.1)$$

where: $\{\tilde{r}\}$ is the *Relational* Space of the System under consideration, while $(\tilde{m}/\tilde{n})$ represents its corresponding Ordinality, which reaches its *maximum* when it equals $\{\tilde{2}/\tilde{2}\} \uparrow \{\tilde{N}/\tilde{N}\}$ (as indicated in (1.1)).
In this respect it is worth noting that:

i) the underlined symbol $\underline{(\tilde{d}/\tilde{d}\,t)}_s$ explicitly indicates that the Generative *Capacity* of the System (more appropriately termed as *Generativity*), is "*internal*" to the same System, precisely because it is the one which gives origin to its Self-Organization as a Whole;

ii) the symbol " $\overset{[\rightarrow}{=}\{\tilde{0}\}$ " represents a more general version of the simple *figure* "zero", as the latter systematically appears in the traditional differential equations. In fact it now represents, at the same time:

- the specific "*origin and habitat*" *conditions* associated to the considered Ordinal Differential Equation (1);
- while the symbol " $\overset{[\rightarrow}{=}$ " indicates that the System, during its Generative Evolution, is persistently "adherent" to its "origin and habitat" conditions.

2.2 The Second Fundamental Equation

It is formulated as follows

$$(\tilde{d}/\tilde{d}\,t)^{(\tilde{2}/\tilde{2})}\{\{\tilde{r}\} \otimes (\tilde{d}/\tilde{d}\,t)^{(\tilde{2}/\tilde{2})}\{\tilde{r}\}\} \overset{[\rightarrow}{=} \{\tilde{0}\} \qquad (2),$$

and it can be considered as representing a *global* Feed-Back Process of *Ordinal Nature*, which is *internal* to the same System.

Equation (2), in fact, formally asserts that the *Relational Space* of the System $\{\tilde{r}\}$, which "emerges" as a solution from the First Equation, interacts (in the form of the product $\otimes$) with *its proper Generative Capacity* $(\tilde{d}/\tilde{d}\,t)^{(\tilde{2}/\tilde{2})}\{\tilde{r}\}$, so as to originate a *comprehensive* Generative Capacity which, *at any time*, is always adherent to the origin and habitat conditions of the Second Fundamental Equation.[1]

2.3 General Explicit Solution to the two fundamental Equations understood as a Whole

Equation (1) always presents an *explicit solution* which can always be written in the following general form

$$\{\tilde{r}\} = e^{\{\tilde{\alpha}(t)\}} = e^{\left\{\begin{pmatrix}\tilde{\alpha}_{11}(t)\\ \tilde{\alpha}_{21}(t)\\ \cdots\cdots \\ \tilde{\alpha}_{N1}(t)\end{pmatrix},\begin{pmatrix}\tilde{\alpha}_{12}(t)\\ \tilde{\alpha}_{22}(t)\\ \cdots\cdots \\ \tilde{\alpha}_{N2}(t)\end{pmatrix}\begin{pmatrix}\cdots\cdots\\ \cdots\cdots\\ \cdots\cdots \\ \cdots\cdots\end{pmatrix}\begin{pmatrix}\tilde{\alpha}_{1N}(t)\\ \tilde{\alpha}_{2N}(t)\\ \cdots\cdots \\ \tilde{\alpha}_{NN}(t)\end{pmatrix}\right\}} \tag{3}$$

where the *Relational* Space $\{\tilde{r}\} = e^{\{\tilde{\alpha}(t)\}}$ depends on the Nature of the System analyzed, while the corresponding structure of each term of the Ordinal Matrix depends on the Specific Generativity $(\underline{\tilde{d}/\tilde{d}\,t})_s$.

For example, if the *Relational* Space of the System is characterized by the three topological coordinates $\{\tilde{\sigma}, \tilde{\varphi}, \tilde{\vartheta}\}$, which are always considered as *the exit of a Generative Process*, we have that

$$\{\tilde{r}\}_s = e^{\tilde{\alpha}(t)} = e^{\{\tilde{\sigma}\circledR\tilde{i}\oplus\tilde{\varphi}\circledR\tilde{j}\oplus\tilde{\vartheta}\circledR\tilde{k}\}} \qquad (3.1),$$

because, on the basis of a generalized form of De Moivre representation, it is always possible to write

$$\{\tilde{r}\}_s = \{\tilde{\rho}\circledR\tilde{i}\circledR e^{\tilde{\varphi}\circledR\tilde{j}}\circledR e^{\tilde{\vartheta}\circledR\tilde{k}}\} = \{e^{\tilde{\sigma}\circledR\tilde{i}}\circledR e^{\tilde{\varphi}\circledR\tilde{j}}\circledR e^{\tilde{\vartheta}\circledR\tilde{k}}\} = e^{\{\tilde{\sigma}\circledR\tilde{i}\oplus\tilde{\varphi}\circledR\tilde{j}\oplus\tilde{\vartheta}\circledR\tilde{k}\}} = e^{\tilde{\alpha}(t)} \qquad (3.2).$$

Equation (3) thus describes the *Generative Evolution* of the System as the exit of an Ordinal Cooperation of *N* Co-Productions and their associated *N* Inter-actions. At the same time, when the Process has reached its Maximum Ordinality, each term $\tilde{\alpha}_{ij}(t)$ of the Ordinal Matrix (as we will see later on) is represented by a binary-duet Relationship $\{\tilde{\alpha}_{ij}(t)\}^{\{\tilde{2}/\tilde{2}\}}$, although in the Ordinal Matrix (3) it is represented as $\tilde{\alpha}_{ij}(t)$ only for the sake of notation simplicity.
At the same time, the adoption of the brackets "{ }" in Eq. (3) is explicitly finalized to remind us that the Ordinal Matrix represents a mathematical concept understood as a *Whole*.
In fact, all the elements of the Ordinal Matrix (in Eq. (3)) satisfy the following "Ordinal Relationships"

$$\{\tilde{\alpha}_{i,j+1}(t)\}^{\{\tilde{2}/\tilde{2}\}} \oplus \{\tilde{\lambda}_{i,j+1}(t)\}^{\{\tilde{2}/\tilde{2}\}}\} \overset{*}{=} (\sqrt[N-1]{\{\tilde{1}\}})_j \circledR \{\tilde{\alpha}_{12}(t)\}^{\{\tilde{2}/\tilde{2}\}} \oplus \{\tilde{\lambda}_{12}(t)\}^{\{\tilde{2}/\tilde{2}\}}\} \tag{4}$$

for j=1,2,3,….N -1

where the additional terms $\{\tilde{\lambda}_{i,j}(t)\}^{\{\tilde{2}/\tilde{2}\}}$ explicitly account for the associated habitat conditions.
Eqs. (4) can also be termed as "Harmony Relationships" precisely because they show that all the elements $\{\tilde{\alpha}_{i,j+1}(t)\}^{\{\tilde{2}/\tilde{2}\}} \oplus \{\tilde{\lambda}_{i,j+1}(t)\}^{\{\tilde{2}/\tilde{2}\}}\}$ of the Ordinal Matrix can be obtained by means of *one sole* arbitrary couple $\{\tilde{\alpha}_{12}(t)\}^{\{\tilde{2}/\tilde{2}\}} \oplus \{\tilde{\lambda}_{12}(t)\}^{\{\tilde{2}/\tilde{2}\}}\}$, assumed as reference, and the N-1 Ordinal Roots $(\sqrt[N-1]{\{\tilde{1}\}})_j$ of Unity $\{\tilde{1}\}$.

[1] The symbol $\otimes$ represents a generalized form of the "vector" product expressed in terms of *spinors* (see Giannantoni 2010a).

Consequently, if each element of the Ordinal Matrix (in Eq. (3)) is expressed in terms of the reference couple $\{\tilde{\alpha}_{12}(t)\}^{\{\tilde{2}/\tilde{2}\}} \oplus \{\tilde{\lambda}_{12}(t)\}^{\{\tilde{2}/\tilde{2}\}}\}$, the solution to Eq. (1) assumes the form

$$\{\tilde{r}\} = e^{\{\tilde{\alpha}(t)\}} = e^{\{\tilde{\alpha}_{12}(t)\oplus\tilde{\lambda}_{12}(t)\}\circ\left\{\begin{pmatrix}(\sqrt[N-1]{\{\tilde{1}\}})_{11}\\(\sqrt[N-1]{\{\tilde{1}\}})_{21}\\\dots\dots\dots\\(\sqrt[N-1]{\{\tilde{1}\}})_{N1}\end{pmatrix},\begin{pmatrix}(\sqrt[N-1]{\{\tilde{1}\}})_{12}\\(\sqrt[N-1]{\{\tilde{1}\}})_{22}\\\dots\dots\dots\\(\sqrt[N-1]{\{\tilde{1}\}})_{N2}\end{pmatrix}\begin{pmatrix}\dots\dots\\\dots\dots\\\dots\dots\\\dots\dots\end{pmatrix}\begin{pmatrix}(\sqrt[N-1]{\{\tilde{1}\}})_{1N}\\(\sqrt[N-1]{\{\tilde{1}\}})_{2N}\\\dots\dots\dots\\(\sqrt[N-1]{\{\tilde{1}\}})_{NN}\end{pmatrix}\right\}} \qquad (5)$$

where, always for the sake of simplicity, the term $\{\tilde{\alpha}_{12}(t) \oplus \tilde{\lambda}_{12}(t)\}$ stands for $\{\tilde{\alpha}_{12}(t)\}^{\{\tilde{2}/\tilde{2}\}} \oplus \{\tilde{\lambda}_{12}(t)\}^{\{\tilde{2}/\tilde{2}\}}\}$
.
The same Ordinal Matrix, in addition, may be represented in a synthetic form by means one sole symbol, when adopting the following synthetic notation

$$\{(\sqrt[N-1]{\{\tilde{1}\}})_{ij}\}^{\uparrow\{\tilde{N}/\tilde{N}\}} \qquad (6),$$

where the arrow "↑" explicitly reminds us that the Ordinality $\{\tilde{N}/\tilde{N}\}$ has always to be considered as being a particular form of *Over-Ordinality*.
In this way the explicit solution to Eq. (1) can more synthetically be expressed as follows

$$\{\tilde{r}\} = e^{\{\tilde{\alpha}(t)\}} = e^{\{\tilde{\alpha}_{12}(t)\oplus\tilde{\lambda}_{12}(t)\}\circ(\sqrt[N-1]{\{\tilde{1}\}})^{\uparrow\{\tilde{N}/\tilde{N}\}}} \qquad (7).$$

Consequently, if such a solution is now introduced into the Global Feed-Back Process represented by Equation (2), it transforms the latter into a typical Riccati's Equation of Ordinal Nature, whose explicit solution is given by

$$\{\tilde{r}\} = e^{\{\tilde{\alpha}(t)\}} = e^{\{\tilde{B}(t)\}\circ(\sqrt[N-1]{\{\tilde{1}\}})^{\uparrow\{\tilde{N}/\tilde{N}\}}} \qquad (8),$$

where

$$\tilde{B}(t) = \left\{\begin{pmatrix}\oplus\,\tilde{A}(t)\\\Theta\,\tilde{A}(t)\end{pmatrix},\begin{pmatrix}\Theta\,\tilde{A}(t)\\\oplus\,\tilde{A}(t)\end{pmatrix}\right\} \qquad (9)$$

and

$$\tilde{A}(t) = \{\{\tilde{\alpha}_{12}(0)\}^{\{\tilde{2}/\tilde{2}\}} \oplus \{\tilde{\lambda}_{12}(0)\}^{\{\tilde{2}/\tilde{2}\}}\} \circ (\sqrt[N-1]{\{\tilde{1}\}})^{\uparrow\{\tilde{N}/\tilde{N}\}}\}^{(\tilde{2}/\tilde{2})} \oplus \ln(\tilde{c}_1 \oplus \{\tilde{c}_2, t\}) \qquad (10),$$

in which the term $\ln(\tilde{c}_1 \oplus \{\tilde{c}_2, t\})$ accounts for the *origin and habitat conditions* of the Feed-Back Equation and, at the same time, also represents an *Over-Ordinality* contribution specifically due to the same Feed-Back Process.
Equation (8) then represents the Explicit "Emerging Solution" to the Maximum Ordinality Principle, formulated in two "Incipient" Differential Equations ((1) and (2)), considered as being a Whole.

2.4 General Validity of the Explicit Solution (8)

Equation (8), considered with the associated Eqs. (9) and (10), has a *general validity* because, at the same time, it is *valid* for *non-living* Systems, *Living* Systems and *Human* Systems too.
What's more, the same fact that solution (8) is *always an explicit solution* represents a very general property that evidently has a huge relevance from an *operative* point of view.
In addition, Solution (8) introduces some further fundamental novelties of *gnoseological nature* (as we will see later on), which will enable us to clearly illustrate the concept already anticipated in (Giannantoni 2016), that is: "The "Emerging Quality" of Self-Organizing Systems, when modeled according to the Maximum Ordinality Principle (MOP), offers a *Radically New Perspective to Modern Science*".

3. Il Modello Formale di EQS in Ambito "Evolutivo"

La soluzione generale del PdMO appena esposta consente (come mostreremo in questo capitolo, e ancor più chiaramente nel capitolo successivo) di adottare come Modello Formale di EQS, in ambito Evolutivo, "esattamente" lo stesso Modello di quello precedentemente presentato, e che viene qui riproposto per ragioni di chiarezza espositiva, con l'importante *differenza* però che il valore t_0 che compare nel Modello EQS pseudo-statico è ora da intendersi sostituito dalla variabile ("evolutiva") temporale t :

a) $\rho_{1j}(t_0) = A \cdot e^{S_l(t_0)}$ (3.9) con $S_l(t_0) = \psi_1 \cdot E_l \cdot [B_l \cdot \Sigma_0 - C_l \cdot (\Phi_0 + \Theta_0)]$ (3.9.1)

b) $$\theta_{1j}(t_0) = \psi_1 \cdot E_l \cdot [B_l \cdot \Theta_0 - C_l \cdot \Sigma_0 + C_l(\Phi_0 - \Theta_0)] \quad (3.10)$$

c) $$\varphi_{1j}(t_0) = \lambda \cdot \frac{\vartheta_{1j}(t_0)}{\rho_{1j}(t_0)}) \quad (3.11)$$

in cui:

$E_l = \dfrac{\varepsilon_1 + 4\pi \cdot l}{N-1}$ (3.12) $B_l = \cos(\sqrt{2} \cdot \psi_l)$ (3.13) $C_l = D_l = \dfrac{1}{\sqrt{2}} \sin(\sqrt{2} \cdot \psi_l)$ (3.14)

con $$\psi_l = \psi_2 \cdot \frac{\varepsilon_2 + 2\pi \cdot l}{N-1} \quad (3.15),$$

in cui però, come anticipato, l'istante di riferimento (pseudo-statico) t_0 è ora sostituito dal generico istante t .
La descrizione in Ambito Evolutivo è allora resa possibile perché, accanto alle grandezze precedentemente descritte, il Simulatore EQS richiede ora, in aderenza alla Soluzione generale del PdMO, altri quattro valori di altrettante grandezze di Input. E precisamente:
- un arbitrario valore dell'Intervallo temporale (o "passo temporale") Δt secondo cui si intende operare l'Analisi
- ed i valori delle Derivate "Incipienti" $\mathring{\Sigma}_0, \mathring{\Phi}_0, \mathring{\Theta}_0$, secondo cui "evolvono" le corrispondenti coordinate $\Sigma_0(t), \Phi_0(t), \Theta_0(t)$ sulla base delle relazioni:

$$\Sigma_0(t) = \Sigma_0(t_0) + \mathring{\Sigma}_0(t_0) \cdot k \cdot \Delta t \quad (3.16)$$

$$\Phi_0(t) = \Phi_0(t_0) + \mathring{\Phi}_0(t_0) \cdot k \cdot \Delta t \quad (3.17)$$

$$\Theta_0(t) = \Theta_0(t_0) + \mathring{\Theta}_0(t_0) \cdot k \cdot \Delta t \quad (3.18)$$

ove k indica, di volta in volta, il numero di "passi temporali" Δt considerati.

Inoltre, il Modello assume che le grandezze $\{\tilde{\lambda}_{i,j+1}(t)\}^{\{\tilde{2}/\tilde{2}\}}$ siano "sottintese", ovvero già "incluse" nelle grandezze $\{\tilde{\alpha}_{i,j+1}(t)\}^{\{\tilde{2}/\tilde{2}\}}$, in quanto intese come esito di una precedente evoluzione.
In tal modo, e cioè sulla base delle 4 nuove variabili di Input precedentemente illustrate, il Modello di EQS Evolutivo diviene perfettamente aderente al PdMO, nelle sue due Equazioni Fondamentali.

4. Output di EQS in Ambito "Evolutivo"

Anche in questo caso, l'Output di EQS fornirà:
- i valori dei Lavori Virtuali corrispondenti ai tre Sistemi considerati, e cioè $L_1(t)$, $L_2(t)$, $L_3(t)$, valutati ad ogni istante t prefissato
- e, in particolare, il Valore dell'Indicatore Fondamentale $\delta L_r(t)$, definito, correlativamente, anch'esso in condizioni variabili, come il rapporto

$$\delta L_r(t) = \{L_3(t) - (L_1(t) + L_2(t)\}/(L_1(t) + L_2(t)) \quad (2).$$

Rapporto che, anche in questo caso, rappresenta l'*Eccedenza Generativa*, *nel Tempo*, del composto finale, rappresentata da $(L_3(t))$, rispetto a quella dei due Composti Inter-Agenti, rappresentata dalla somma dei Lavori Virtuali $(L_1(t)+L_2(t))$, quando la predetta differenza viene riferita a quest'ultima somma.

Anche in questo caso, perciò, l'Indicatore $\delta L_r(t)$ può ritenersi l'Indicatore Fondamentale, proprio perché esprime (e rappresenta), ad ogni istante t considerato, l'*Eccedenza Generativa* che il Sistema Finale manifesta in relazione ai due Sistemi iniziali di cui è "*Esito Generativo*" *per Inter-Azione "Evolutiva".*

Sulla base di tale Indicatore Fondamentale, infatti, diviene allora possibile seguire l' "Evoluzione" temporale dell'*Eccedenza Generativa* del Sistema Finale, in particolare come *Tendenza* verso un Massimo del suo valore.

E, come è facile intuire, è proprio questo l'Ambito Formale a cui riferirsi per introdurre, e poi riconoscere, il significato più proprio del Concetto di *Sintonia con la Qualità*. Aspetto Fenomenologico a cui, proprio per la su Rilevanza, verrà interamente dedicato il successivo capitolo.

2.5 REFERENCES

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www.ordinality.org: author's website that presents a general framework about the MOP, by starting from the Mathematical Formulation of Odum's Maximum Em-Power Principle up to the Mathematical Formulation of the MOP, together with some Ostensive Examples mentioned in this paper.