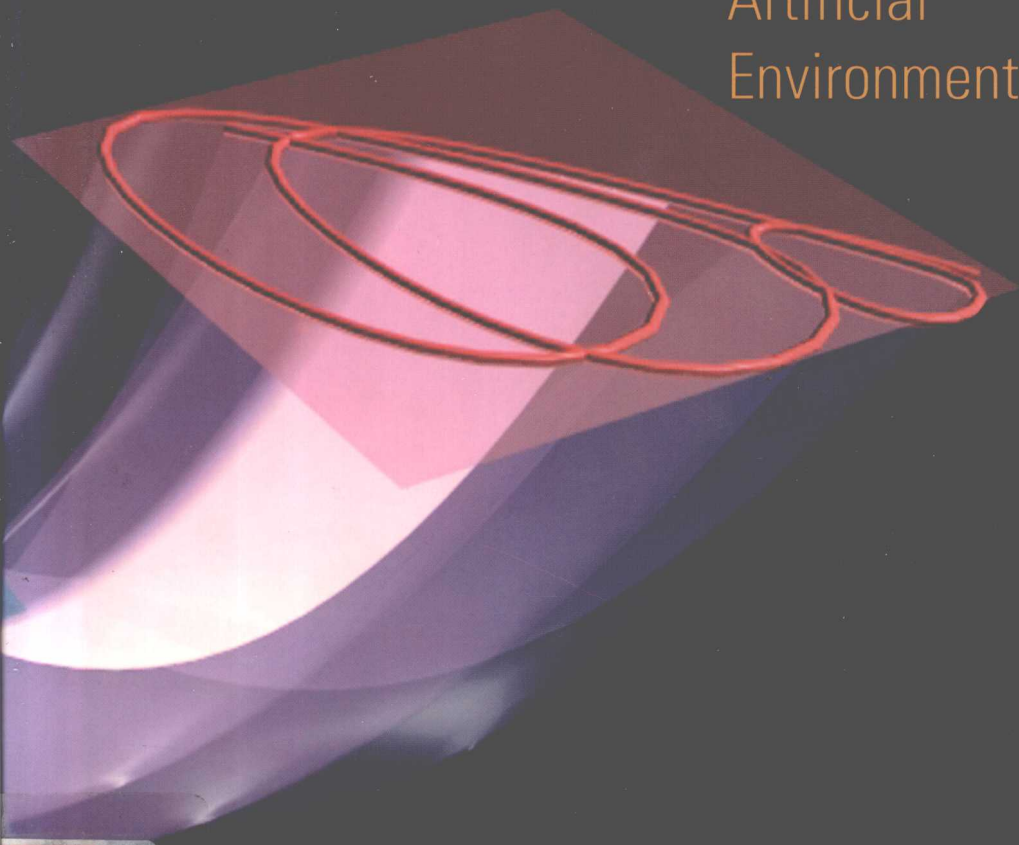


Studies of Nonlinear Phenomena in Life Science – Vol.9

CHANGING MIND

Transitions in
Natural and
Artificial
Environments



Franco F. Orsucci

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Preface

The elephant in the dark.

This is the Sufi tale, narrated by Rumi, the poet:

“The Elephant in the dark, on the reconciliation of contrarities

Some Hindus had brought an elephant for exhibition and placed it in a dark house. Crowds of people were going into that dark place to see the unknown beast. Finding that ocular inspection was impossible, each visitor felt it with his palm in the darkness.

The palm of one fell on the trunk.
‘This creature is like a water-spout,’ he said.
The hand of another lighted on the elephant’s ear.
To him the beast was evidently like a fan.
Another rubbed against its leg.
‘I found the elephant’s shape is like a pillar’, he said.
Another laid his hand on its back.
‘Certainly this elephant was like a throne’, he said.

The sensual eye is just like the palm of the hand. The palm has not the means of covering the whole of the best. The eye of the Sea is one thing and the foam another. Let the foam go, and gaze with the eye of the Sea. Day and night foam-flecks are flung from the sea: amazing! You behold the foam but not the Sea.

We are like boats dashing together; our eyes are darkened, yet we are in clear water” (Rumi, 1995).

Rediscovering mind

We have discovered mind since prehistoric shamans, their graffiti in caves and Lucy’s first insights in African savannas. We always discover again its

amazing qualities and failures every morning, when we wake up. But we still don't really know how mind functions; if it is in the skull, everywhere or elsewhere in the body.

A few years ago John Horgan (1999) wrote a book that has had interesting titles in its different versions: *The undiscovered mind. How the human brain defies replication, medication and explanation* (US version); *How the brain defies explanation* (UK version); *The inviolate mind. A challenge for psychology and neurosciences* (Italian version). Probably there are many other versions: this book is about the fragmentation of studies on mind, and their primitive state of development.

These titles are symptoms of a persistent difficulty in considering the state of the art of mind sciences as a set of harmonic and cooperative studies. They are still divided in a myriad of disciplines and sub disciplines, often in conflict and using different technical languages. This, obviously, originates problems in sharing or translating knowledge between scholars all involved in the same challenge for knowledge.

The project of cognitive science, in its endeavour to interconnect seemingly disparate disciplines such as linguistics, anthropology, artificial intelligence, neuroscience, psychology and philosophy, has been representing the challenge in unifying all the studies on the nature of subjectivity and the research on mind structures (Gardner, 1985). It generated ambitious questions such as: *what is knowledge?*

The enterprise is crucial but not new. Classical philosophy was about this until the *Naturwissenschaften* (natural philosophy), before Cartesian and neo-Cartesian positivisms conquered the control of operations.

The Sufi tale is clear: when the object is so large and complex, and you are not able to encompass it, your perspectives can be partial and misleading. But, if you try to deal with the whole big object you should be sure that you wouldn't be devoured or crushed.

Applications

This has been even truer in the field of applicative cognitive and neuroscience. Clinical psychology, psychiatry, neurology and the human sciences were fragmenting in a myriad of small schools. The emphasis of each one in defending its vantage point was proportional to its partiality (i.e. ideology). The reason was probably embedded in the contamination of the authentic

scientific motivation with ideological and economical considerations due to partiality of results, and the lack of methodological rigour in formalization and empirical verifications.

This has been related to the lack of the appropriate mathematical and statistical tools to handle such a big beast.

Dynamical systems theory

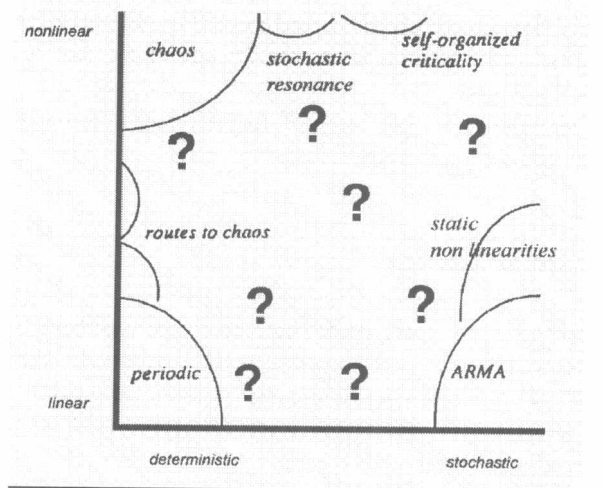
The gradual emergence of a set of formal and methodological tools called Dynamical Systems Theory, or Complexity Theory could finally make the scene different. This is called also Nonlinear Science: a marker of the shift in scientific paradigms (Kuhn, 1996) because all dynamical systems that are not linear are called nonlinear.

This name by exclusion might seem surprising. As Stanislaw Ulam remarked: "Calling a science 'nonlinear' is like calling zoology 'the study of non-human animals.'" This means that almost every system is complex, dynamical and nonlinear by nature. It is (the limit of) our approaches that make us see them as linear. Yet the distinction has been necessary in the natural sciences, which became so accustomed to linear systems, because they were more *treatable*. The discovery of the possible scientific study of dynamical behaviors unrestricted by linearity is one of the greatest scientific revolutions of all times. It is becoming even a revolution in our everyday perception of reality, as trees and lightning become "scientific objects" just as cubes and cones and even dodecahedrons.

A state of the art

In fact, the science of nonlinearity still resembles a sea of ignorance with some small islands where results are known and applicable. The important thing is that now we know that this sea exists and we can explore it. This is well represented in the sketch below that we owe to Thomas Schreiber (Kantz & Schreiber, 1997) and Francisco Varela (1991).

Preface



A state of the art in complexity theory (Varela, 1991; Kantz, 1997)

These small islands of knowledge called *chaos*, *SOC* or *stochastic resonance* are like candles in a total darkness: we can finally have intuitions of the elephant's whole shape. Or at least knowing that we are dealing with that big elephant, and not with some bizarre furniture.

Theory

The book includes some maps deriving from a personal route through cognitive science: philosophy, medicine, psychiatry, linguistics, psychoanalysis, and nonlinear dynamics: past and current studies.

The land to discover, in a collective project, is *a general theory of mind and its applications (i.e. change)*:

- 1) mind multilayered structures;
- 2) mind couplings;
- 3) modelling;
- 4) transitions in natural and artificial environments.

Bonds

The object of knowledge is where there are no objects: in the bridges of relationships. This means tracing the sketch of a *biophysical theory of human relations*. As we know that “perfection is the enemy of excellence”, the difficulty of the enterprise will be an additional source of passion for further explorations.

The following is another sketch that the painter, architect and sculptor Gianlorenzo Bernini made for a *Pietà*, in a quasi topological and dynamical presentation of a coevolving interaction. It confirms that in a complicated field, as mind sciences obviously are, artists can often reach the metaphorical knowledge that scientists are trying to grasp in other formal ways (Verhulst, 1994). Art and metaphors sometimes will help us, because their icons have the power to encompass, in a single form, huge amounts of data.



Sketch for a sculpture of a *Pietà* by Gianlorenzo Bernini, intuitive presentation of a coevolving interaction

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Chapter 1: E-Mergence

The Golden Chain:
Zeus was anxious to know
How shall all things be one,
yet each distinct?
Callimachus

1.1 E-Mergence

Following some instructions that Ludwig Wittgenstein (1967) has offered about knowledge games, we try first to draw the lines in the field and recall the rules of the game we are going to play. Most of the game will be played in the field defined by two conceptual basic poles in system dynamics: *emergence* and merging, or *fusion*. While the first one is more frequently cited and discussed, the second one is often neglected. It seems quite strange, because it is so difficult to define and understand the first without the second and vice-versa. We can say more: they form a dynamic couple. If we start from their etymologies and semantic fields in natural language, we can easily see why (Merriam-Webster, 1998).

Merge – etymology: Latin *mergere*; akin to Sanskrit *majjati* ('he dives').

Transitive senses:

- Archaic, to plunge or engulf in something, immerse;
- to cause to combine, unite, or coalesce;
- to blend gradually by stages that blur distinctions;

Intransitive senses:

- to become combined into one;
- to blend or come together without abrupt change;

Mergence \ noun

Synonyms: mix, amalgamate, blend, compound, fuse, interblend, interfuse, intermingle, meld, mingle.

Emerge – etymology: Latin *emergere*, from *ex* + *mergere* to plunge.

Senses (intransitive):

- to become manifest
- to rise from or as if from an enveloping fluid out into view
- to rise from an obscure or inferior position or condition
- to come into being through evolution

Synonyms: appear, loom, show.

Related Words: derive, originate, spring, stem; arise, materialize, rise; come (forth), come out, emanate, flow, issue (forth); proceed.

Idioms: appear on the horizon, come on the scene, come out in the open, come to light, make its appearance.

Contrasted Words: disappear, fade, fade (out); evaporate; dissolve.

From a first comparison we find an interesting thing, it seems that emerge is a semantic evolution (see Sanskrit and Latin) from merge.

We could say that the dialectics

$$M \leftrightarrow E$$

represents a dynamic relation between some whole and its part(s).

For example, following the Sanskrit original etymology, if I dive in the sea I become part of it, for an observer, but during my swimming I emerge and I can be differentiated from it. And, also, I am not caused by the sea; I just have a dynamic relation with it. The simplicity or complexity of an object and its consistency depends from the perspective and resolution the object is considered.

Ernest Nagel (Nagel, 1961) cites Mill's System of Logic (1843) as the *locus classicus* on the notion of emergence. For Mill, the key to the distinction between emergent and non-emergent properties centers on a distinction regarding two different ways in which conjoint causes can produce an effect: Non-emergent properties are effects that are mere summations of the effects of each of the causal conjuncts, whereas emergent properties are effects that are not sums of the effects of each causal conjunct.

Following (Lalande, 1962) the term emergence was used mainly to designate the fact that one thing comes from another *without a simple relation of cause and effect between the twos: in these terms it would imply self-organization and/or a different activity of the observer.*

Lloyd Morgan (1922) wrote: "The emergence of a new quality from any level of existence means that, at that level, there comes into being a certain *constellation* or collocation of the motions belonging to that level, and possessing the quality appropriate to it; and this collocation possesses *a new quality distinctive of the higher complex*. The quality and the constellation to which it belongs are at once new, and expressible without residue in terms of *the process proper to the level from which they emerge; just as mind is a new*

quality distinct from life, with its own peculiar methods of behaviour...not merely vital, but also vital." (Morgan, 1923) (Italics are mine).

1.1.1 *The emerging mind*

A system exhibits emergent properties when those properties are more than the sum of its parts' properties. We could posit that mental properties emerge from certain complex sets of physical properties, for instance, physical properties of human brains. Thus mental events are not identical to any brain events but instead emerge from them. *After the current studies on neural plasticity we can also say that brain emerges from mind, because it is moulded by mental events. As in the Moebius band, container and content in the mind-brain relationship can be reversed in their reciprocal function depending from the perspective of the observer.* That is, an increase of knowledge about the way certain effects are obtained may reveal that certain effects are decomposable into the effects contributed by subcomponents of that system.

We have to consider both the whole (decomposable), its parts (fusible), an observer function. There is also a possibility that the observer is observed by the whole, in this way becoming a whole object, and/or mirrored.

We may recall the book written by the Sufi Persian mystic Farid al-Din Attar, called "The Conference of the Birds", which inspired also a theatre play by Peter Brook. This story is about thousands of birds that set out to find a King for their Kingdom. They cross 7 valleys, and each valley has a different name and significance. Some birds give up, some die, some decide to return, and many make excuses. Finally, 30 birds make it and when they reach the end they realize that the King or Simurgh they came to look for is merely a mirror. In Farsi (the Persian language), *si* means 30 and *murgh* means bird, so... Attar the author, very cleverly named the King "Simurgh". Therefore, 30 birds meet 30 birds and realize that we are all part of a whole... so, God is in us and we are in God, we are not separate from God. This is a very basic Sufi belief. As a word of explanation, the Sufi ideal is to worship the divine by loving it. Thus the devotee's relation to God is depicted as that of lover and beloved. It is a consuming and transformative love; an embracing so intense that all distinctions of *self* and *other* disappear before it. (.....)

In the study of complex systems, the idea of emergence is used to indicate the arising of patterns, structures, or properties that do not seem

adequately explained by referring only to the system's pre-existing components and their interaction. Emergence becomes of increasing importance as an explanatory construct when the system is characterized by the following features:

- when the organization of the system, i.e., its global order, appears to be more salient and of a different kind than the components alone;
- when the components can be replaced without an accompanying decommissioning of the whole system;
- when the new global patterns or properties are radically novel with respect to the pre-existing components;
- thus, the emergent patterns seem to be unpredictable and non-deducible from the components as well as irreducible to those components.

1.1.2 Pre-Socratic shamans

Since the Pre-Socratics, the basic problem of natural philosophy has been to discover how order and form arise from turbulent and disordered states of mind and matter (as we will see, the distinction between the twos for them is often fuzzy).

It is the problem of *origin* and *primary causes of order and organization: how did it originate, what were its causes, and what does it really mean?*

The start of these studies is immersed in the shining mist of prehistoric Shamans' culture, and their followers in Asia and Europe. In classical times shamanistic practice and ideology extended across the steppes into the northern territories of the Indo-European tribes, from China and India to Persia and Greece (Cornford, 1957). The history of Chinese and Indian philosophy, growing from the shamanistic-animistic cultures, goes in parallel with the Western paths. The same roots are the core of the *Urgeist*, the primal spirit of creation in civilizations.

Mircea Eliade (1968), in his classic study on shamanism, includes between the shaman powers the following masteries: flying, going underground, power dance, ecstasies, revelations, talking with animals, managing weather, healing, and knowledge of plants. These powers are metaphorically duplicated in their knowledge of the world. Shamanism became a recognized public institution in Western and Eastern societies and