CHANGING MIND

Transitions in
Natural and
Artificial
Environments

STUDIES OF NONLINEAR PHENOMENA IN LIFE SCIENCES

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Transitions in
Natural and
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Environments

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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).

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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