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CHAPTER I

FOUNDATIONS OF SYSTEMS THINKING: THE *STRUCTURE-SYSTEM* PARADIGM

Sergio Barile and Marialuisa Saviano

SUMMARY: 1. Some considerations on methods and language in business management. – 2. The systems path as a bridge between reductionism and holism. – 3. Qualifying elements of systems thinking. – 4. From *structure to system*. – 5. The *structure-system* dualism.

1. SOME CONSIDERATIONS ON METHODS AND LANGUAGE IN BUSINESS MANAGEMENT

Knowledge and learning paths can be traced to two fundamental categories: the formalization path and that of heuristics[1]. The former,

[1] By formal pathway we mean a procedure which responds to an order or rational criterion by means of which a syntactic system made up of symbols underpinned by specific axioms is construed. Once the axioms are defined, the procedure aims at construing the relation between symbols (beyond their meaning). The procedure furthermore, necessitates common acknowledgement of the symbols of the language. According to Popper, a theory can be called formal if *it has no one particular interpretation albeit at the same time, it is open to accepting all the known interpretations* (Popper, 1959, 1998). The heuristic pathway is a non rigorous procedure which enables the predicting of a result that has to be validated scientifically. Polya sums up the meaning of heuristic in the expression "the art of discovery". As concerns knowledge, *criticism, which according to Popper is the only form possible of a "scientific method" is practiced by means of the subtle art of "sensum detorquere"... Lakatos called it concept-stretching, ... in line with Polya, Lakatos accepts the theory that even mathematicians proceed by "hypotheses" and apply the fallible principle of "guess and check" ... not all concept stretching is valid and to bear fruit, needs to find an appropriate "ecological niche" which is the role*

typical of the scientific environment, finds application in natural sciences, in which two approaches to learning can be identified: one applied to the *scientific* communities of physics, chemistry, mathematics etc; the other to what we would define as *technological,* engineering, biology, applied chemistry etc. The latter pathway of a heuristic kind is applied to the humanities, in particular social science. The Communities involved concern sociologists, psychologists, economists, business economists etc.

One might ask what effects the absence of a strictly formal approach could have on the development of research. The distinction between formal knowledge and a heuristic pathway is based mainly on the presence or otherwise of links of reference between previous and subsequent models. In particular, it is the formal learning path that enables a model to become a theory. In analyzing reality and insight in specific laws, the scholar can define a model of behaviour of reality in such specific hypotheses. In the event the model can be considered universal, generalizable and absolute, it would rise to a theory, justifying all the previous and emerging exceptions, thus epitomizing a predefined model.

On the contrary, the heuristic path needs no link of reference between previous and subsequent models.

The issue of the absence in social science of formal learning induces reflection on the possibility of constructing theories that closely represent the object of investigation.

Not only the lack of formalization renders the development of scientific theories in business economics problematic: the issue of methods needs to be added to that of language. According to Panati, most of the difficulties relative to the elaboration of theories and the empirical assessment of managerial and sector economic issues stems both from conceptual diversity and from diversity in the use of existing terminology (Panati and Golinelli, 1991:21). It is often the case that in our discipline the same terms are used for different

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of statements that are too metaphysical; they justify the most reckless moves, those that scandalize if examined from the perspective of "scientific rigor" accepted by the vast majority of researchers and at the same time, are "confirmed" by the success of expedients, by means of which they are conferred conceptual dignity (Giorello, 1985). It should also be noted that the different perspective – formalization versus of heuristics – can be traced to the epistemological cycle: abduction to deduction through induction (Barile, 2009).

concepts and different terms are used to express the same concept. This issue is quite crucial because if researchers are not measuring the same concept albeit using the same terminology, it will be impossible to compare the findings of their research. In this respect, consider the following reflections on the limits of language.

> *The contradiction which disconcerts modern thinking today derives from the fact that we have to use language to communicate our inner experience, which by its very nature, transcends the possibility of language* (Suzuki). *The problems of language are very serious here. We desire to speak in some way about the structure of atoms. But we cannot speak about atoms using ordinary language* (Heisenberg)[2].

Social science requires targeted methodological "treatment". It has been underlined in many cases that a shared language is lacking, which factor impacts negatively on interpretation. The lack of a linguistic heritage, widespread among researchers of the social sciences, makes it quite difficult at times, to compare the various research contributions. This often implies that the findings of a research that are apparently considered different, are in effect so merely in the language used; at the same time, research studies which are apparently convergent, in actual fact are contradictory.

The definition of language for the expression of specific phenomena places emphasis on the choice between *quantitative* and *qualitative* methods and on the need to establish whether the use of a mathematical language renders more scientific or merely, more certain a given assumption. Hence, two considerations derive:

1. quantitative approaches are not necessarily better able to describe specific phenomena; if complexity increases, the possibility is reduced of measuring to the full, all the aspects of the phenomenon, consequently, the insistence on applying methodologies implying exclusively quantitative methods could lead to the consequence that the variables measured are not the most significant;
2. the scientific community, at least relative to the above mentioned disciplines, requires a lexicon and relative semantic space

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[2] The specificity of the two reflections lies in the fact that they come from two completely different fields of research: the former Author is a scholar of Oriental Sciences, the latter is a physicist; this evidences that language is not in itself coherent, it is not able to render thinking in any of the buildings of knowledge that man to date possesses.

in common, on the basis of which, a fruitful discussion of the various points of view can be based. A common conceptual and semantic matrix would prevent considering as different, perspectives, approaches, methods, and theories that effectively are not different.

In our view, having placed the focus on the issue, we converge on a theory, explicated within a workshop approach, based on the use of the concept "system" relative to the defining of problem solving pathways.

2. THE SYSTEMS PATH AS A BRIDGE BETWEEN REDUCTIONISM AND HOLISM

Many researchers of business management disciplines use the term *system* to qualify features and concepts relative to enterprise; however, often the meaning attributed is not always univocal. In many cases, analogies and metaphorical uses are intended (Tagliagambe and Usai, 1994), with the aim of applying a new perspective to business studies, overcoming traditional approaches based on the analysis of the components of which a firm is made up. Many Authors suggest an attentive transposition of the *systems* concepts in firm organization. However, the full comprehension of their contributions implies interdisciplinary knowledge and often, familiarity with mathematical tools; this prevents their research from becoming widespread and widely used (Ceccanti, 1996).

In the different disciplinary fields, what is generally acknowledged relative to systems thinking and the validity of its use can be summed up as follows:

In the systems approach attention should be focused strictly on the whole as opposed to the parts making up the whole.

Accepting this construct means the need for knowledge that enables the understanding of the whole (holism) without necessarily resorting to an analysis of the parts. A feeling of insufficiency emerges relative to the traditional analytical approach (*reductionism*), which is accompanied, at least as far as some scholars of business studies are concerned, by a concealed flicker of hope and faith in the possibility of an alternative methodology compared to that commonly used in practice. Scholars and researchers of business studies are going through a complicated period: the needing to resort to subdividing, separating, considering individually the articulations of a structure or the phases of a process evidences a limited explicatory efficacy in the light of the growing complexity of the object analyzed. Consequently, while increasingly more specialist, slotted and articulated strands of research are in bud, the links of which are not always justified by various scientific theories inspired and underpinned by widely diverging premises, more and more risky and improbable becomes the re-composition of the whole into an organic development of knowledge of the dynamics of enterprise.

Acknowledging and adopting the systems approach concur in an effective paradigmatic revolution with respect to the analytic-mechanistic approach.

> As defined by Kuhn, a "*paradigm is what the members of a scientific community share, and, conversely, a scientific community consists of men who share a paradigm.*" (Khun, 1996:176)

In the mechanistic-reductionist approach the object is investigated as though it were isolated from the context; proceedings continue with the search for causal and linear, mono-directional relations to explain cause and effect. The outcome in some cases is that solutions are often inadequate if not totally unsuitable for the changed relational context. In this respect, in the context of systems thinking, a significant contribution comes from Watzlawick with his theory of change, the basic assumption of which is that originally problems do not exist, only situations, in other words, events that the system has to face, which become real problems only when the system is incapable of dealing with them effectively, transforming them into opportunities for change in an evolutionary sense. Consequently, problems originate from the persisting of an approach that is inadequate (Watzlawick *et. al*, 1974).

The search for cause-effect relations between events, on the basis of traditional perspectives implies the assumption of a temporal stance which tends to reconstruct an historical-chronological order distinguishing causes as past events, from effects observed in the present. As will be clarified later, a key to overcoming the deterministic approach lies in the acknowledgement of a conception of time that goes beyond the historic-chronological perspective of events. In the systems approach not only past events – the causes determining the problem – take on relevance, but also the present factors that encourage the persevering of the condition observed, impeding the system from self-regulating and creating new balance. Moreover, from the perspective based on the concept of *syntropy*, future events also become relevant (Barile, 2009)[3]. The temporal dimension of the analysis is synchronic considering that something at a precise moment (present), becomes relevant even if it is the result of a previous historical seriation.

The methodology takes on a systems logic when it acknowledges the principle of interdependency characterizing the working of systems which renders circular the cause-effect relations between events. According to the principle of interdependence, every relationship of influence between the variables is always mutual, for which a variation in the state of a component of the system tends to reflect on the others as a whole, which in turn, tends to reflect on the components and on the outside, the changes occurring within.

For instance, the Healthcare system and more precisely, consolidated practice on the part of physicians, showing that where treatment is based on symptoms, the approach used can be qualified as mechanical as opposed to systemic. Considering the case when the symptoms of a throat infection are manifest, the doctor's intervention will be focused on prescribing the right medicine to fight bacteria (in some cases the virus) to eliminate the cause of the infection. Certainly, we would be quite surprised if the doctor were to approach the illness from a systems perspective, i.e. *analyzing the patient's general state of health including at the same time*, *a check- up relative to his/her mental health in order to posit the conditions for underpinning a systemic reaction activating a homeostatic process*. *In other words, in an attempt to lay the conditions for enabling the human body system to regain a balanced order, at the same time, treating the patient's emotional stress and leaving the elimination of the foreign body as part of the body's regenerated immune system.* The metaphor illustrates the meaning of the relation between the parts and the whole in terms of the system. The focus of treatment is shifted onto the system rather than onto the symptoms; thus, moving the attention from the parts to the whole represents a *therapeutic pathway to the system as a whole,* but a *preventive pathway with respect to the symptoms*. In the systems approach, the methodological, technical and instrumental distinction between treatment and prevention is clearly quite blurred.

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[3] Consider that the discussion of the influence of future events on the phenomenal reality, better known as anticipated potentials, is not covered in this work.

Thus, the drive is towards overcoming the limits of the analytical-mechanistic approach on the one hand and the tensions towards an approach that is capable of grasping the entirety, i.e. the global character of the object under investigation, and on the other, the trend towards adopting a systems thinking approach, conceived as a *bridge* between a reductionist and a holistic vision of the phenomenon. In this sense, the systems approach is suggested as a methodological solution for reconciling reductionism and holism, in that the vision of the parts is not abandoned, but a re-composing of the whole is achieved, taking into account the principle of interdependence. Thinking in a systems way means above all, being aware of the interdependence characterizing phenomena in their internal relations and with the outside.

3. ELEMENTS OF QUALIFICATION OF SYSTEMS THINKING

At this point, the logical categories which are fundamental for the study and dissemination of any issue centred on *systems thinking* have to be defined.

Taking the shared view that an *aggregate*[4] of elements clearly do not qualify *sic et simpliciter* any system and when studying systems as such, the following question needs investigating:

How does an aggregate of elements relative to which it is possible to identify functional relations, enable the emerging through dynamic interaction of a new autonomous entity that can be defined as system?

To clarify the process requires the introduction of further concepts: *structure* which, in its turn, necessitates the definition of *set*[5].

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[4] In Italian effectively defined as "accolta", a group of entities characterized by the absence of any principle of aggregation. For the use of the term "accolta" see Zappa, 1956:36.

[5] The definitions of concepts and terms proposed in what follows derives from relevant literature of a different disciplinary nature. See References for the sources.

Set
Any collection of entities (*elements*) in which a link of uniformity can be identified expressing a logic of aggregation.

The shift from the concept of aggregate to that of set is identified through some characteristics of the elements and the relative link of uniformity.

In business organizations the set is defined typically by productive factors: work and capital, to which respectively, human and technical elements both tangible and intangible, can be traced.

Structure
A *set* in which the elements are qualified as *components* recognized as having the capacity to contribute to perform specific *functions* (necessary to carrying out specific *roles* in the context of an emerging *system*). The *components* can be put in *relation* respecting specific constraints (*rules*)[6].

The shift from the concept of set to that of structure entails specifying the functions carried out by the elements as components and distinguishing the links between them, taking into account, the constraints and regulations in order to designate the relations composing the parts into the whole.

In corporate organizations the structure is defined by the whole of the human and technical components placed on various levels, in relation to reaching potential aims.

It is evident that the previous definition implies the existence of two consequential concepts:

Logical structure
The *set* of logical *components* described plays a specific *function* respecting established *rules* and with the capacity to link up with other *components*.

Actual structure
Set of physical, concrete *components*, with a known function provided with a connecting mechanism or linker device predisposed for linking up other *components*.

[6] On the difference between function and role, and constraints and rules, see the contribution of Barile and Di Nauta, Chapter VIII.

To clarify the terms *logical component* and *physical component*, consider the following example.

> Consider an entity which is capable of receiving as input two figures and exporting their sum onto a decipherable device (visual, sound, touch); such an entity can be qualified as *logical component*.
> For the logical component, several *physical components* can be identified as equivalent: an electronic calculator, a calculator (electronic or mechanical as the case may be), an abacus, a slide rule, or even a cardboard box in which a person provided with pencil and paper and capable of doings sums, is hidden.

To clarify the shift from the concept of logical structure to that of actual structure we have to consider the process of concretization of the structure, initially defined on the basis of logical schema, designing the set of relations between physical components identified on the basis of their capacity to contribute to the carrying out of specific functions and linking themselves up to the other components.

Distinguishing then in the context of the structure, between internal and external components, a further conceptual category is qualified – the *extended structure.*

> ***Extended structure***
> The extended structure includes the set of external components and defines the entire set of resources usable by the corporate government for the activating the system.

In corporate organizations the logical structure is defined on the basis of an organization plan for the processes necessary for the functioning of the system.

The actual structure as such is the outcome of the concretizing of such a plan. This implies the need to introduce a further concept: the organizational design**.**

> ***Organizational plan/design***
> Plan or design by virtue of which the planned processes and activities are defined by means of a series of relations between the components are identified.

Clearly, the organizational design has to be drafted indicating *who does what, how and when* guiding the subsequent characterization of the logical structure, to be further specified in a specific actual structure. The selection of the processes to activate in order to enable the emerging of the system will be supported by the progressive modelling of the organizational scheme, which from a *draft organizational plan* will evolve to a *definite organizational design.*

In this context, it is fundamental to bear in mind that *a specific logical structure can be concretized in many actual structures*.

The organizational plan (draft) and the organizational design (definite) become in this sense, the expression of the capacity of the decision maker to make the most appropriate decisions. And it is on the basis of the organizational design scheme that the governing body extracts from the extended structure a *specific structure* the activation of which, will put the system in place.

It is at this stage that a definition of system can be devised as emerges from the matrix below.

System
A *structure* addressed to achieving a goal.
The goal is reached through the *interaction* of the components in a series of relations (*processes*) respecting the rules.

To clarify the three conceptual levels illustrated, consider the following example.

Consider a room in which the following elements are put together:
a CPU, a keyboard, a mass-storage, a video card, a DVD-RW unit case and a set of connecting cables, a monitor, a mouse, a multimedia software, a printer, a video card, a power supply set, etc. all of which can be considered a *mass* of technical and informative tools.
The setting up of the cards in their place, the connecting up of the screen and printer by means of the cables, the uploading of the software applications all lead to the definition of *structure* (in this case physical), denominated "computer". Although not obvious, it should be noted that any actual structure is always the "concretization" of an equivalent logical structure. In our example, it is clear that rather than referring to a specific brand of screen, we find a logical component described as a component enabling the collecting and processing of data on the basis of an alpha-numeric standard. If we reflect on the fact that the use of the described actual structure to write a letter implies *interaction* between the components to obtain a *system* of digital writing, its use for calculating transforms the actual structure into a *system* of calculus. Further, in the same way we can have a system of accounting, graphics, management production and so on. Obviously in more general terms, in each of the previous cases, we have concretized a data processing system.

In defining structure and system we have used the terms *relation* and *interaction* with great emphasis. With reference to the structure, we have specified that it can be conceived as an environment in which the components are in *relation*; as regard the system, we have pointed out that the components *interact*. Consider the following analogy.

> At this moment the Authors of this study and the reader can be envisaged as components of a system tending towards the broadening of knowledge relative to systems thinking. Undoubtedly, they are in relation by means of the manuscript produced at the moment in which it is read. This relationship exists independently of the system considered, as it defines the structure of which they are a part: the authors can write, the reader can read and the social context enables the procuring of the text. This means that an author can write nonsense and the reader read it without deducing anything, but it also means that the former can concentrate on trying to write sensibly and the latter can read them receiving ulterior elements for consideration and reflection: in this case, they are interacting, having finalized the relation, of which they are able structurally speaking, towards a systemic interaction.

It can be affirmed consequently that:

> The concept of ***relation*** (structural) has a static nature and can be qualified as objective, requires an environment of reference and it is not dependent on what emerges from activating the relation itself.

> The concept of ***interaction*** (systemic) requires a context, has a dynamic nature and depends on the observer and what is observed from the observer's specific perspective of the investigation of reality.

> For example, the School System envisages that a teacher and a student enter into contact during school hours; this "relation" can be defined as "classroom" in the sense that by activating the "classroom" it is possible to give lessons. The "classroom" relationship produces from the point of view of Student A cultural growth, from the point of view of Student B a boring waste of time, from the point of view of the Teacher an opportunity for testing ideas etc. The observation of the structure defined by the classroom relation, therefore, is not sufficient *per se* to interpret the system implemented: a university lectures in a cinema defines a structure that does not enable an observer on the outside to interpret as a "lecture hall" that relation between an individual speaking over a microphone and the young people sitting in the cinema listening, at least unless the observer is fully aware of the interaction.

4. FROM *STRUCTURE TO SYSTEM*

Saraceno defines firm structure as the network of inter-relations between the parts of which the system is made up (Saraceno, 1973:125). In this definition, as in the general definitions of a firm as a system, two perspectives are implicitly summed up integrating the descriptive and functional representation of the organizations (*structural dimension*) and the interaction of forces or tendencies that govern the development of processes, subject to constant evolution in relation to changing needs imposed by the context (*systemic dimension*).

As it will be illustrated in more detail hereafter, it would be opportune to highlight that the statics of the structural perspective, defining a 'physical state' or how 'something is made' of a general entity, is not sufficient to explain 'how it behaves' in the effective development of its systemic dynamics.

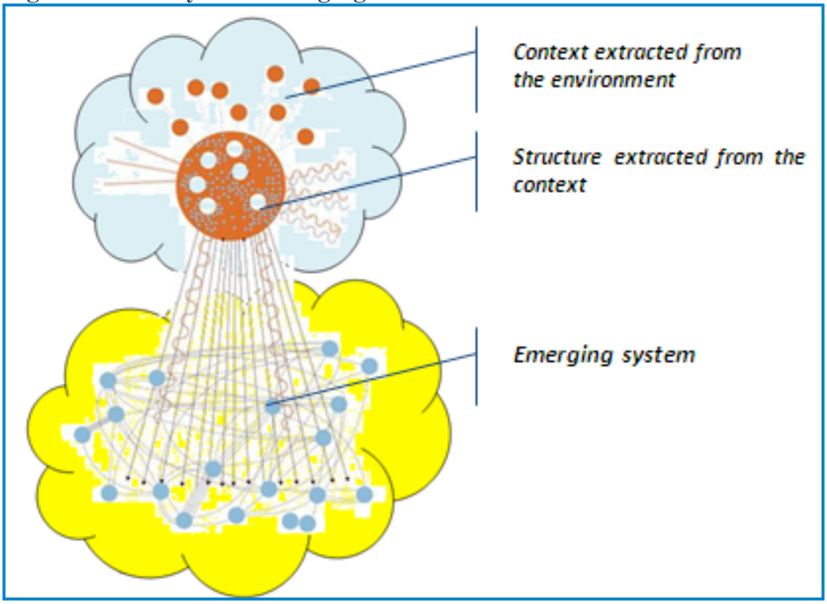
The system *emerges* from the structure as much in a governed as uncontrolled way. This means that even in the presence of regulating the way of interacting realized by the decision maker of the planned system, much interaction and relative properties will be *emergent*, in other words, they will be activated regardless of the organization defined on the part of the decision maker (Fig. 1).

Emergence can be traced to (Pessa, 2002; Minati *et al*., 2006):

- the process of forming new collective entities (e.g. flocks, swarms, automobile traffic or superconductivity) established by the *coherent* behaviour of interacting elements;

- a process that can be considered dependent on the observer (not so much *relative to*, but in which the observer is an *integral part* of the process), taking into account that: collective properties emerge on a higher level of description (i.e. more abstract, requiring *another* cognitive model with respect to that in use for the elements); collective properties are detected as new and unexpected by the observer in reference to the cognitive model adopted, adequate for detecting the conditions of coherence.

Figure 1 – The system emerging from the structure



Source: www.asvsa.com.

The *structure*, in terms of a composition of correlated elements, is characterized by the following conceptual elements:

- a physical boundary defining what is proper to the structure and what is extraneous to it;
- components to which a specific function has been attributed;
- a set of stable links between the components.

Such specifications, evidently, are not useful in identifying features that can be traced to the behavioural dynamics of the structure, in respect of which not so much the links and their sequential succession are important, but above all, the relations between the components from which interaction is activated.

The *system* perspective emphasizes the following elements:

- while the concept of boundary exists and is justified in structural terms, in a systems perspective, it has little sense; contact with a system implies participation to the system itself; a system is absorbent; when it exists, it is conceived as total;

- a system is made up of components which are often different, referred to a common project, deliberated by an individual decision maker or group, pursuing a single aim: that of survival;
- links, in the sense of physical bond between the mass of components present in an environment; the focus is shifted onto the relations, considered as rules for favouring the interaction between components. The putting in place of relations produces the effect of interaction between the components that lead to the emersion of a potential system from the structure. The whole cycle is shown in Fig. 2.

Figure 2 – From individuals to system

Source: www.asvsa.com.

The *Viable System Approach* (***VSA***), re-examining topics and studies typical of business management, has formalized the fact that the *structure* or *systems* perspective cannot and should not be considered in a dichotomic or alternative way but rather should be interpreted in terms of composite representations characterized by integrated and blended structural and systems elements (Golinelli, 2000, 2002, 2005, 2008, 2010, 2011; Barile, 2000, 2006, 2008, 2009).

5. The *Structure-System* Paradigm

The concepts presented thus far represent the essential elements that characterize the logical distinction between *structure and system*[7]. Such dualism as will be evidenced, has a remarkable explicatory value to better describe the nature and the behaviour of both natural and social systems.

We are all aware of the fact that with respect to the eternal process of reality making, our perception is limited both from a *spatial and temporal* point of view. We are not able to grasp *everything* in space and in time; only partial and limited observation relative to specific places and defined moments is possible for us. The coveted holistic vision thus becomes a tending towards the reconstruction of everything which, as stated previously, becomes difficult if not impossible using an analytical approach. In other words, recomposing uniqueness, by means of the sum of the single parts, becomes at the least, sketchy when attempting to grasp the dynamics of the numerous and often unpredictable interactions that characterize the phenomena observed, or in other words, when using a systems approach.

The often desired reconciliation between reductionism and holism, based on the systems approach, poses however no few problems on the practical level of potential implementation. Taking into account the prevalent context of application of the systems approach – engineering, electronics, informatics – a use of an instrumental kind, rather than methodological prevails; in other disciplinary contexts – mainly socio-economic – acceptance remains

[7] The distinction *structure-system* is described as "dichotomy" when a reductionist representation is proposed that focuses on the parts making up the whole. "Dichotomy" is, in effect, "a division into two especially mutually exclusive or contradictory groups or entities" (www.merriam-webster.com) or, more precisely, a logical division of a concept in two new concepts that cover the entire extension. In this sense, the dichotomy expresses the structural view of the dualistic link between structure and system, where "dualism" is defined as "presence [...] of two fundamental principles either aspiring to a single aim or in contrast", evidences the underpinning of the conception "upon an essential duality of principles" (*Our translation* from Istituto della Enciclopedia Italiana, Il *Vocabolario Treccani*, 1997, vol. II, p. 87 e p. 201). Consequently, dualism expresses the systemic view of interaction between the two concepts. It is interesting to note how the *structure-system dualism* being used to explain itself, offers a significant example of the concept of *recursion*.

very limited and even in those cases where the approach is used, it seems still clearly overbalanced towards the reductionist logic, strongly centred on the vision of reality of a materialistic-object type. A more significant approach towards a holistic vision would require a concrete effort of focusing on the process or in other words, on the *dynamics* of interaction between the parts in the whole and the limiting of attention addressed to the components and the links between them.

The following proposal epitomizes a matrix qualifying systems thinking, that becomes *viable* systems thinking, grounding its validity on a paradigmatic basis contemplating a dual perspective – static and dynamic – of observing reality: the *structure-system* paradigm. In the definitions provided of concepts of *relation* and *structure* on the one hand and of *interaction* and of *system* on the other, a fundamental characteristic has been identified that consists in envisaging that every phenomenon can be interpreted from both a static and dynamic perspective. In relation to these two perspectives, two ways of investigating phenomena can be traced to the *structure* (*how the phenomenon can be described*) and to the *system* (*how the dynamics of the observed phenomenon evolve*).

The investigation of the structure, availing in methodological terms of the contribution of the analytical approach, offers accurate and detailed descriptions of the components included in the phenomena observed. The comprehension of the phenomenon and its behaviour requires, on the contrary, an ulterior effort of enquiry aimed at grasping its dynamics.

In effect, the structural analysis, up to the micro details observable, provides descriptions that the more precise and articulated they are, the more they seem to distance themselves from the vision of the global behaviour of the phenomenon. The systems interpretation on the contrary, produces representations of the events which are certainly more concise but also much more explicative of their real behaviour. The systems approach, in this sense, evidences, compared to the analytical approach, its s*ynthetic* nature[8].

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[8] Jove, in this respect, clarifies that the meaning of "synthetic" here, is not that attributed by common practice i.e. a synonym of essential, summarizing, but rather that deriving from Greek etymology, of the term "synthesis", which means "putting together", joining the parts of a whole; in this sense it is opposed to "analysis", which means the destructuring of a whole into its component parts.

Thus, the distinction between *structure* and *system* represents a foundational premise of the systems approach. A distinction rich in significant shades of meaning to represent, analyze and understand organizations. A perspective that also explains many terminological distinctions, which, in some cases, might seem synonyms. Examples are shown is in Tab. 1.

Table 1 – "Structure-system" dichotomies[9]

Our wills and fates do so contrary run
That our devices still are overthrown;
Our thoughts are ours, their ends none of our own.
William Shakespeare, *Hamlet*, Act III Scene II, 183-209.

Structure	***System***	***Structure***	***System***
Analytic	*Synthetic*	*Management*	*Governance*
Being	*Becoming*	*Material*	*Energy*
Brain	*Mind*	*Nothing*	*All*
Cause	*Effect*	*Objective*	*Subjective*
Firm	*Enterprise*	*One*	*Many*
Complication	*Complexity*	*Organization*	*Process*
Consonance	*Resonance*	*Parts*	*Whole*
Chronos	*Kairos*	*Personality*	*Character*
Date	*Information*	*Position*	*Movement*
Desire	*Passion*	*Power*	*Act*
Efficiency	*Effectiveness*	*Project*	*Operation*
Emotion	*Feeling*	*Reductionism*	*Holism*
Enemy	*Adversary*	*Relation*	*Interaction*
Environment	*Context*	*Space*	*Time*
Experience	*Impression*	*Statics*	*Dynamics*
Foreword	*Result*	*Strategy*	*Tactics*
Function	*Role*	*Theory*	*Practice*
Genius	*Talent*	*Thoughts*	*Outcomes*
Genotype	*Phenotype*	*Velocity*	*Acceleration*
Enlightenment	*Romanticism*	*Wills*	*Fates*
This space is left for readers' suggestions.			

[9] *For the reader: scan the table of dichotomies three times and then reflect on it. Should you identify other dichotomies, please make your suggestions on the website*: www.asvsa.com.

From a methodological point of view, it is possible to acknowledge full validity to both the structure and systems based approaches in the context of the specific aims of the investigation but the distinction between them is relevant as the result of the analysis are quite different in that the two perspectives evidence features of the phenomenon that are absolutely different.

Awareness of the (pro tempore) permanent nature of the structure and the evolving nature of the system is also fundamental.

The concepts of permanence and evolution herald the *time* variable which renders necessary a more detailed analysis to clarify in what way this variable can contribute to the distinction between the *analytical-structural* and *synthetic-systems* perspectives.

At first sight, one is led to consider that in the structural analysis time "stands still" at a precise moment. In this sense reference is usually made to the structural representation as a "photograph" of the phenomenon that describes its components and relations and the interpretation of its dynamics, realized by means of confronting the variations in its structure over time, or in other words, interpreting the different states (Golinelli, 2010), the diverse photographs, remaining in some way, anchored to the structural approach.

At the same time, although the succession of several frames of a given structure, if viewed in sequence (as happens for a film at the cinema), produces a general idea of the system as a whole, a basic enquiry emerges which can be summed up as follows:

How does time become an explicable variable of the relation between the concept of structure and the concept of system? How can the shift from a structural to a systems approach be explained and linked? Do different time scales exist as concerns the structure and the system? And in this framework, where is the concept of space collocated?

In order to respond to the first query, let's consider the following dialogue.

On space and time...[10]

MS: ***I feel that when reflecting on the relationship between space and time, the relation between structure and system is also envisaged. How can the two concepts contribute to reciprocal comprehension*?**

SB: What is space is also time; there is no radical difference between the two concepts. Structure and system: one approaches space and the other approaches time as idealized representation of the two concepts. Structure, conceived as physical extension, emphasizes space to the detriment of time. The system, conceived as a sequence of actions, exalts time to the detriment of space. The systemic process is the unfolding over time of what is initially condensed in the structure. In contrast, structure can be interpreted as the synthesis in space of what we call time.

MS: ***Shall we try with a metaphor*?**

SB: Let's say that space is a ball of string and time is the ball of string unraveled, the string itself. If you interpret a phenomenon as a process, you perceive the logical thread that links all the activities together in the different moments. If, instead, you annul the sequence of activities, you huddle them together, then the progression of time has no meaning and gives way to space, the ball of string.

MS: ***There is no distinction then between space and time*?**

SB: That's true, physicists proved it and many sages in the past had the same intuition. The concept of *aion* normally refers to eternity in classical literature, constituting an accurate representation of an unchanging space-time dimension.

MS: ***Can you give an example*?**

SB: All this finds in the physical science sit exemplification: the dichotomy between corpuscle and wave. A fundamental research in physics concerns the unified theory of electromagnetic and gravitational forces. Physicists find difficulty in understanding why when they look at tiny objects, they notice that the electrons and the atoms behave in a specific way: for example, the electron jumps to predefined energy levels, the so-called quantum orbits. Imagining the representation of this phenomenon through a kind of deeply ploughed field, the electrons according to quantum theory, can only place themselves within the furrows in the ground and not in the space between one furrow and another.

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[10] MS: Marialuisa Saviano; SB: Sergio Barile.

Physicists ask themselves why on a macro component level for example, between a planet and its satellite, this does not happen. It is worthy of note that gravity follows a path.

MS: ***How come then*?**
SB: This might be a false problem .
It could depend on the point of observation; the position of a satellite encircling the Earth, like the Moon, to an observer (enormous in relation to the Earth as Man is to the electron) characterized by a reduction in time and an expansion in space, the observer would be perceived from a quantum perspective and would see from a quantum perspective the arrangement of stars and planets; he would not perceive the shift, it would be instantaneous for him; he would see the whole nucleus; he would know only that there was a satellite, the Moon, which it were struck, it would not move on a little further but would go into another orbit and would be tied to its capacity for flight and its mass.
In the same way, we have no idea of the velocity and mass of an electron and its capacity for escape compared to the atom.
Having assisted during the course of millions of years, to the fragmenting of something that was encircling the Earth, our enormous observer would have the same sensation that we have when we oblige, through input of energy, the electron to arrange itself in a specific position around the atom: this electron too will begin to orbit in a fixed orbit. We see these orbits as fixed but we do not have the capacity to grasp their infinitesimal distances in the same way the large being in the example would not be able to perceive our kilometric distances...

MS: ***... we're talking about the recursion between macro and micro*!**
SB: Yes, the theory is grounded in macro and micro terms, i.e. the recursion of levels. What an observer can perceive does not render comparable the two: on the level of the Sun and the Moon he would live in dilated time; at the level of electron he would live in compressed time. Returning to the classics, it is the concept of *kairos* that does justice to such a representation. The present time is not the same for observers at the micro and at the macro levels. However, there is a relative time span for these observers, this is *kairos*. If we assume that the ball is aion, and chronos the string, kairos is that part of the string which is the object of attention as much on the part of a mite that lives in it as on the part of someone working with it. It is certain that the time each one actually lives cannot be compared. These are among the most important concepts that the systems theory helps to clarify.

MS: ***and...as regards business economics*?**

SB: Imagine the recursive progression between strategy and tactics. In the bible, it says the God created the world in seven days. According to the viable system paradigm, from the structural point of view, God may well have created the world in seven days; what however, has required millions of years is the *system*, in other words the ball of wool has become a skein.

MS: ***... the unquestionable explicatory power of the metaphor*! *But ... I was asking about business economics...***

SB: The same is true for businesses. Let's consider the process of strategic planning and the resultant operative plan articulated in objectives and fundamental lines over twelve months. On the basis of this plan, the person responsible organizes an articulation of the activities for each month and, in his turn, delegates to others under him responsibility for a three month period; these others, in their turn, even divide the plan into decades. As you can see, the time dimension varies on the basis of the various levels; for each person responsible, time flows at a different rate: one level for those of the three-month period, another level for those of the months, yet another for those of the decades. Each person experiences their own temporal dimension in terms of strategic planning and is anchored to their own context of reality in a subjective manner. Inevitably, by comparing the temporal dimensions time lags will emerge. Each person will experience *chronos* time and in the moment in which on one level a specific time is read on another level a *kairos* time is generated.

For the ancient Greeks there were at least three ways to indicate time: *aion*, *chronos* and *kairos*. It was Plato, in *Timeo*, who noted the distinction between two types of time: *aion* and *chronos*. The former is defined as present time the latter as future time in the dynamic sense of flow. Albeit having different meanings from time immemorial[11], the Greek term *aion* has usually been translated as "eternity"; but the concept of eternity also lends itself to a dual

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[11] On the polisemy of the term *aion* see Degani, 2001. It is of interest that in Homer, having no temporal value *aion* indicated life, as a "vital force", believing that staying alive depended on the presence in the life of the vital force. In the literature after Homer, *aion* is still considered a time span depending in conceptual terms on *chronos* which enfolds it. Only later was the relationship inverted with *aion* becoming eternal and *chronos* time deriving from it.

interpretation: as the incommensurable extension of time or rather, as a-temporal.

Plato, in particular, refers to eternity as the ideal model of creation opposing the temporal aspect of the world created by the demiurge. *Chronos* time is in movement through past, present and future, while *aion* time is immobile, eternal and unlimited; even though, and this is systemically relevant, the former is the image of the latter, reproducing its cyclical dimension. It is in the *aion* and *chronos* that the gap between metaphysical and earthly dimension is reflected. Here is that if aion is a point (ball of string) then chronos is a line (string). Thus in the relation between the ball of string and the string, the unfolding of chronos time from aion time is read (aion for the ancient Scholars is the father of chronos).

The extra-temporal dimension is created with Aristotele, who maintains that which is eternal not being contained in and measured by time, but extended for all time, is in effect, out of time. The *chronos* time dimension is lost in the sky beyond which, *aion* time as it is, is eternal in the same way that the same incessant circular motion of the sky is eternal. An idea common both to Plato and Aristotle is that of time as the order of the future.

The image of the sky, with the ordered motion of the stars leads us into the perceptive dimension of space, of what we see and represent through observation. Or in other words, the structure, that in the light of the conception of time described above, we are able to see in a different way, grasping the reality of compressed time, in the awareness that we are not on the contrary, given to perceive:

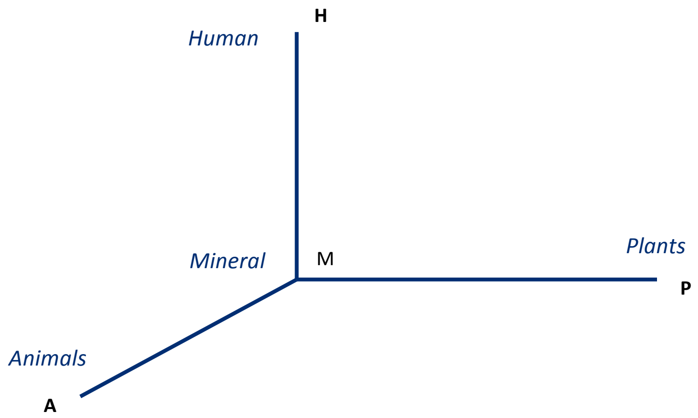
the order of reality in which space and time blend in the irreproducible and indefinable uniqueness of hic et nunc.

According to Jewish and Christian tradition, time was created with the world and starting from the beginning of creation, it develops towards a future that will have a limit; time, having a beginning and an end, is represented by a line. Thus a linear vision of time can be shared and consequently, of history, with a before and after, which in eternity does not exist by virtue of the fact that it exists at the same moment.

All this enables us to understand that what appears as an inexplicable leap escapes our human perception and orients us towards the construction of models that succeed in incorporating the essence of reality albeit within the limits of our reasoning.

In concluding these reflections, as an ulterior contribution to the comprehension of the foundations of the dichotomies *structure-system*, *permanent-evolutive*, *aion-chronos* time, the position of Korzybski is illuminating[12]. As *living* beings we are immersed in a reality that dominates and survives us, but as *viable* beings we are distinguished, compared to the other categories of life, by the capacity to think and act and to understand the nature of things, sensing what is beyond our perceptions. The following may help to clarify this idea:

The different categories of life can be represented by means of three coordinates referring to life. Minerals with their inorganic status would be the zero (0) dimension of "life", i.e. the inanimate class, in the diagram represented by M. Plants with their "autonomous" growth represented by a unidimensional line MP. Animals with their "autonomous" capacity to grow and act in space represented by the bidimensional plane PAM. Finally, humans with their "autonomous" capacity to grow, act in space and in time, represented by the tridimensional region MAPH.



Source: Korzybski, 1978:121.

The dimension of the life force which differentiates men from other living categories is given by the capacity to move not only in

[12] Korzybski a Polish chemist, lived in the period late 1800s and early 1900s. He was complex, non-conformist and extremely critical of paradigms imposed by the official culture. He had a poliedric personality ranging from protesting, eclectic and at times revolutionary, at others, a calm observer of events. He created and was Director of the Institute of General Semantics which is currently in Englewood, New-Jersey, U.S.A.

space but also in time. This suggestive modality of representation has among other things, the merit of marking and acknowledging the limits of man, his potential for "moving in time", evident expression of his *capacity to think* on the basis of an emotional not only experiential memory, besides the capacity for a*ction*.

Social systems based on man and his organizations, are "time linkers", a time in which past, present and future cannot be understood separately in isolation, they are indissolubly blended together as in a *unique whole*: the *aion* time dimension. According to Korzybski, during the same period, the social sciences evolve on the basis of a law of arithmetical progression, as opposed to natural and technological sciences that conform to geometrical laws (Korzybski, 1978:343).

Even taking into account evident limits in Korzybski's insights, some possible conclusions can be shared.

In a holistic vision, space and time unite in a single whole evading our perception, stimulating us to think that our way of representing temporal reality, the distinction between before and after, here and there, past, present and future, could be the result of our perceptive limits. Immersed as we are in our subjective perceptive dimension, our cognition of time is varied and variable; this renders fundamental the sharing of method and language along the pathways towards knowledge.

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