Would the Big Government Approach Increasingly Fail to Lead to Good Decision? A Solution Proposal.

Abstract

Purpose – The present paper offers an innovative and original solution methodology proposal to the problem of arbitrary complex multiscale (ACM) ontological uncertainty management (OUM). Our solution is based on the postulate that society is an ACM system of purposive actors within continuous change. Present social problems are multiscale-order deficiencies, which cannot be fixed by the traditional hierarchical approach alone, by doing what we do better or more intensely, but rather by changing the way we do.

Design/methodology/approach – This paper treasures several past guidelines, from McCulloch, Wiener, Conant, Ashby and von Foerster to Bateson, Beer and Rosen's concept of a non-trivial system to arrive to an indispensable and key anticipatory learning system (ALS) component for managing unexpected perturbations by an antifragility approach as defined by Taleb. This ALS component is the key part of our new methodology called "CICT OUM" approach, based on brand new numeric system behavior awareness from computational information conservation theory (CICT).

Findings – In order to achieve an antifragility behavior, next generation system must use new CICT OUM-like approach to face the problem of multiscale OUM effectively and successfully. In this way homeostatic operating equilibria can emerge out of a self-organizing landscape of self-structuring attractor points, in a natural way.

Originality/value – Specifically, advanced wellbeing applications (AWA), high reliability organization (HRO), mission critical project (MCP) system, very low technological risk (VLTR) and crisis management (CM) system can benefit highly from our new methodology called "CICT OUM" approach and related techniques. This paper presents a relevant contribution towards a new post-Bertalanffy Extended Theory of Systems. Due to its intrinsic self-scaling properties, this system approach can be applied at any system scale: from single quantum system application development to full system governance strategic assessment policies and beyond.

Keywords: Big government, Self-organization, Post-Bertalanffy, CICT, IDB, impredicative control systems, OUM, Cybernetics, Education, Learning, Social change.

Paper type Research paper.

1 Introduction

Since the pioneering application of Cybersyn to the Chilean economy in the early 1970s (Espejo, 2014) to the recent revisiting of The Viable System Model (VSM), developed by the British operational research and management theorist Stafford Beer (Beer, 1972), there has been always a need to understand how complexity is managed in viable organizations (Espejo and Harnden 1989). Today, environmental conditions are quite different from the 1970s and they are continuously changing at an increasing rate. While the computer processing power doubles every 1.8 years and the amount of data doubles every 1.2 years, the complexity of networked systems is growing even faster, unfortunately. This is the main reason why the traditional big government approach will have to face higher and higher information overload and glut.

In past years, the term "information overload" has evolved into phrases such as "information glut" and "data smog" (Shenk, 1997). What was once a term grounded in cognitive psychology has evolved into a rich metaphor used outside the world of academia. In many ways, the advent of information technology has increased the focus on information overload: information technology may be a primary reason for information overload due to its ability to produce more information to disseminate to a wider audience than ever before and more quickly, contributing to ontological uncertainty creation in recent turbulent times.

Lane and Maxfield (2005) distinguish three kinds of uncertainty: truth uncertainty, semantic uncertainty, and ontological uncertainty, the latter of which is particularly important to deal with turbulent processes. According to them, the definition of ontological uncertainty depends upon the concept of actors' ontology or their beliefs about (1) what kinds of entities inhabit their world; (2) what kinds of interactions these entities can have among themselves; (3) how the entities and their interaction modes change as a result of these interactions.

We postulate that current societies are arbitrary complex multiscale (ACM) systems of systems of purposive actors within continuous change. Actors interact not only to select and implement policy, but also to design and change the rules under which that interaction takes place. Indeed, rules can be considered in terms of three different levels: rules as policies (such as budgetary allocations); rules as organizational forms (such as the independence of the central bank); and rules as mechanisms to change the rules themselves (such as electoral norms) (WBG, 2017). Sometimes the entity structure of actors' worlds change so rapidly that the actors cannot generate stable ontological categories valid for the time periods in which the actions they are about to undertake will continue to generate effects. In such cases, we say that the actors face "ontological uncertainty."

Ontological uncertainty, in contrast to truth or semantic uncertainty, resists the formation of propositions about relevant future consequences. The entities and relations of which such propositions would have to be composed are simply not known at the time the propositions would have to be formulated, that is, during the extended present in which action happens. For instance, in today fast-changing emerging market system technology, ontological uncertainty is an endemic situation. Sometimes, ontological uncertainty hovers around an unaware actor. Sometimes, though, market system actors are completely conscious that they are immersed in ontological uncertainty, which offers no particular help in dealing with it.

The Western fourth industrial and information technology revolution will reshape the virtual world, and the large amount of data available on the Internet will make more difficult to sift through and separate fact from fiction quickly (even with Big Data approach, unfortunately), contributing to the exponential grow of ontological uncertainty. Do not be tricked by words, this revolution will be a major cultural and social revolution than a technical one. A new age which has leading-edge technologies as its foundation is not necessarily on the extension of the current line. It is also an age full of "uncertainties." Because of its uncertainties, industry must create reform on its own initiative to lead the world. These policy recommendations are just a starting point toward the reform of economy and society. We assume that this is the main reason why the traditional big government approach will increasingly fail to lead to good decisions timely, as technology innovation, economic diversification and cultural evolution progress. From this perspective, it will be interesting to follow what is happening on the Eastern side of the world, to all the Japan's initiatives which fall under the "Society 5.0" umbrella name (Keindaren, 2016). Japan has its particular challenges and just as Industry 4.0 is the digital transformation of manufacturing, Society 5.0 aims to tackle several challenges by going far beyond just the digitalization of the economy, towards the digitalization across all levels of the Japanese society and the (digital) transformation of society itself.

Present planetary problems are multiscale-order deficiencies from the past, obsolete, Western reductionist worldview. They cannot be fixed by the usual, traditional, hierarchical approach alone, by doing what we do better or more intensely, but rather by changing the way we do. Too often, governments fail to adopt pro-growth or pro-poor policies. And even more often, when adopted, these policies fail to achieve their intended goals. In the process of designing and implementing policy, who is, and who is not, included at the bargaining table can determine whether policy makers deliver effective solutions. That process, which we call governance, underlies every aspect of how countries develop and how their institutions function. We need to find different solutions. Putting governance front and center of the development debate is therefore essential for promoting sustained economic growth and encouraging more equitable and peaceful societies. To be effective, policies must enhance commitment, coordination, and cooperation.

In real democracy, holistic governance requires the co-production of values between policy-makers and citizens to make visible political and expert guidance and people's interests and concerns. Transparency of communications between citizens and policy-makers is far more than making information available: it is building up effective co-organisational systems. From this perspective, next generation system need a new key fundamental component: a subsystem able to face the problem of multiscale ontological uncertainty management (OUM) effectively. To achieve this result and to design better, antifragile system (Taleb and Douady, 2013), we need a new understanding first. For this reason, Section 2 is devoted to analysing social communication complexity and purposive actors propositional fallacies. The final aim of present paper is to offer an innovative and original, fundamental solution methodology proposal to OUM problem.

2 Social Communication Complexity and Purposive Actors Propositional Fallacies

Quite often, from an individual perspective, external events seem to be an entirely random series of happenings. But looked at over a long period of time, and tracking the branching changes in the planet that follow from it, all the chaos does produce a form of identifiable order. Patterns will appear from the chaos. And this, in its essence, is chaos theory: finding order in the chaos (Wheatley, 2008). Chaos theory falls into that category of scientific ideas that few actually understand but many have heard of, due to its expansive, epic-sounding principles and thoughts. Inherent to the theory is the idea that extremely small, weak changes produce enormous effects, but ones that can only be described fully in retrospect. Accurate prediction is somewhat impossible.

In other words, attempts to optimize hierarchical systems in the traditional top-down way will be less and less effective, and cannot be done in real time (Fiorini, 2016a). In fact, current human made application and system can be quite fragile to unexpected perturbation because Statistics by itself can fool you, unfortunately (Taleb and Douady, 2015). From this perspective, present most advanced "intelligent system" is a "deficient system", a fragile system, because its algorithms are still based on statistical "intelligence" or statistical knowledge only. They are lacking a fundamental property and key system component. We need more resilient and antifragility application to be ready for next generation systems. What Nassim Taleb has identified and calls "antifragility" is that category of things that not only gain from chaos but need it in order to survive and flourish, and proposes that things be built in an antifragility manner (Taleb and Douady, 2013). The antifragility is beyond the resilient. In turn, the resilient is beyond the robust. The robust fails when perturbations are out of its preprogramed range. The resilient resists shocks and stays the same; the antifragile gets better and better.

The logical answer is to add and use distributed (self-) control, i.e. bottom-up self-regulating systems. Advanced Cybernetics (i.e. extended system theory) and complexity theory tell us that it is actually feasible to create resilient, social and economic order by means of self-organization, self-regulation, and self-governance. "Governing the Commons" is a major theoretical contribution to the study of collective action and institutional design. It describes in clear language the problems arising from common pool resource (CPR) management and presents an uncompromising critique of existing approaches (Ostrom, 1990). Complexity science offers a way of going beyond the limits of reductionism, because it understands that much of the world is not machine-like and comprehensible through a cataloguing of its parts. It consists instead of mostly organic and holistic systems that are difficult to comprehend by traditional scientific analysis (Lewin, 1993). Nevertheless, to achieve reliable self-organization, self-regulation in a competitive arbitrary-scalable system reference framework, we need application resilience and antifragility at system level first.

In fact, decision theory, based on a "fixed universe" or a model of possible outcomes, ignores and minimizes the effect of events that are "outside model". Deep epistemic limitations reside in some parts of the areas covered in decision making. Unfortunately, the "probabilistic veil" can be quite opaque, and misplaced precision leads to incompleteness, ambiguity and confusion. In fact, as the experiences in the latest fifty years have shown, unpredictable changes can be very disorienting at enterprise level. These major changes, usually discontinuities referred to as fractures in the environment rather than trends, will largely determine the long-term future of organization. They need to be handled, as opportunities, as positively as possible (Taleb, 2015). In a continuously changing operational environment, even if operational parameters cannot be closely pre-defined at system planning and design level, we need to be able to plan and to design antifragile, self-organizing, self-regulating and self-adapting system quite easily anyway.

"Every Good Regulator of a System Must be a Model of that System" (Conant and Ashby, 1971). Therefore, we need system able to manage multiscale ontological uncertainty effectively. We need anticipatory learning system (ALS) as a fundamental key system component. In fact, to behave realistically, system must guarantee both Logical Aperture (to survive and grow) and Logical Closure (to learn and prosper), both fed by environmental "noise" (better… from what human beings call "noise") (Fiorini, 2014b).

Current scientific computational and simulation classic systemic tools, and most sophisticated instrumentation system (developed under the positivist reductionist paradigm and the "continuum hypothesis", CH for short) are still totally unable to capture and to discriminate so called "random noise" (RN) from any combinatorically optimized encoded message, called "deterministic noise" (DN) by computational information conservation theory (CICT) (Fiorini, 2014a). This is the information double-bind (IDB) dilemma in current science, and nobody in the traditional scientific arena likes to talk about it seriously (Fiorini, 2016a).

Therefore, high levels of cognitive ambiguity still emphasize this major IDB problem in most current, advanced research laboratory and instrumentation system, just at the inner core of human knowledge extraction by experimentation in science (Fiorini, 2016a). This is the main reason why traditional computational resources and systems have still to learn a lot from human brain-inspired computation and reasoning. How does it come that scientists 1.0 (statisticians) are still in business without having worked out a definitive solution to the problem of the logical relationship between experience and knowledge extraction? It is a problem to solve clearly and reliably, before taking any quantum leap to more competitive and convenient, at first sight, post-human cybernetic approach in science and technology. Our means of new knowledge at personal level is reason, the use of observation and logic to learn and prosper. This strong link cannot be based on statistics only. We need a definitive, antifragile solution to the problem of the logical relationship between human experience and reliable knowledge extraction. As a matter of fact, in logic, the needs of the healthy individual are what give rise to the need and possibility of value judgments to begin with, and there can be no divide between acting logically and acting human. We need to extend our systemic tools to solve this IDB dilemma first, to open a new era of effective, real cognitive machine intelligence (Wang et al., 2016).

To get stronger solution to advanced multiscale biophysical scientific modelling problems, like complex social, quantum cognitive, neuroscience understanding, living organism modelling, etc., we have EVEN to look for convenient arbitrary multi-scaling, bottom-up modelling (from discrete to continuum, under the "discreteness hypothesis", DH for short) approach to start from first, and NOT the other way around (top-down, from continuum to discrete, CH) ONLY, as usually done!

Society is, without any doubt, a complex system and the idea to use the knowledge from the analysis of physical complex systems in the analysis of societal problems is tempting. Indeed, the notions of, nonlinearity, interactions, impredicativity, self-organization, stability and chaos, unpredictability, sensitivity to initial conditions, bifurcation, etc., are phenomena which also characterize social systems.

However, not everything is easy because physical and computational measures of complexity exist in abundance. These can provide a starting point for creating social complexity metrics, but they need refinement and continuous updating for the simple reason that society is an aggregation of purposive actors in continuous change. To harness complexity, we must take a generative perspective and see social outcomes as produced by purposive actors responding to personal anticipation, incentives, information, cultural norms, psychological predispositions, etc. In other words, as Robert Rosen said, in his book "Life, Itself", that "The Machine Metaphor of Descartes is not just a little bit wrong, it is entirely wrong and must be discarded" (Rosen, 1991). As a matter of fact, purposive actors are centered on their wellbeing dynamic equilibrium or balance that can be affected by life events or challenges continuously. Personal wellbeing state is stable when they have abundant resources needed to meet and manage their life's challenges (Fiorini et al., 2016).

One of the fundamental preconditions is to speak in the common language. It is not the problem of cultures only (Leung et al., 2007), it is also a problem of scientific communities (Kagan, 2009; Snow, 1969) and new societal education (Mulder, 2015; UNE, 1997). For instance, educational curricula in human-computer interaction (HCI) need to be broad and nimble. To address the first requirement, HCI focuses on people and technology to drive human-centered technology innovation. At the same time, students need to develop methods and skills to understand current users, to investigate non-use, and to imagine future users quickly (Churchill et al., 2016).

Even in mere terminology, avoiding representation uncertainty and ambiguities is mandatory to achieve and keep high quality result and service. The proper use of term and multidimensional conceptual clarity are fundamental to create and boost outstanding performance. As an example, for high quality clinical and telepractice results in healthcare informatics research and technology, understanding the difference between "well-being" and "wellbeing" is mandatory (Fiorini et al., 2016). In order to move up in the value chain (or Lancasterian evolution tree, or wellbeing of society) it is also important to build up the knowledge corpus domestically and with domestic resources first (Kitt, 2016).

When ambiguities and uncertainty cannot be avoided, then reliable OUM system is needed and becomes a must to achieve system antifragility. There are surprising similarities in many fields of human activities and much can be learned from these. For instance, Puu discussed bifurcations that are likely to govern the evolution of culture and technology. More specifically, by defining culture as art plus science, he discusses the evolution of social and material products (Puu, 2015).

Another fundamental problem is causality, because the usual observations always reveal superficial reasons only; they cannot reveal deep, concealed reasons (Fiorini, 2016b; Wang et al., 2016). Forcing societies to fit in a box without understanding deep reasons may lead to serious consequences like we witness in many world affairs today. Multidisciplinarity, interdisciplinarity and transdisciplinarity are really ways the society, together with scientists and scholars, must move on (De Giacomo and Fiorini, 2017; Nicolescu, 2008).

Furthermore, according to Swiss clinical psychologist Jean Piaget, human adults normally know how to use properly classical propositional logic. Piaget also held that the integration of algebraic composition and relational ordering in formal logic is realized via the mathematical Klein four-group structure (Inhelder and Piaget, 1955). In the last fifty years, many experiments made by psychologists of reasoning have often shown most adults commit logical fallacies in propositional inferences. These experimental psychologists have so concluded, relying on many empirical evidences, that Piaget's claim about adults' competence in propositional logic was wrong and much too rationalist. But, doing so, they forgot Piaget's rigorous and important analysis of the Klein four-group structure at work in logical competence. In other words, according to experimental psychologists, Piaget was overestimating the logical capacities of average human adults in the use of classical propositional logical connectives.

As a matter of fact, English speaking people tend to treat conditionals as equivalences and inclusive disjunctions as being exclusive (Robert and Brisson, 2016). The Klein four-group structure generates squares of opposition (SOO), and an important component of human rationality resides in the diagram of the SOO, as formal articulations of logical dependence between connectives (Beziau and Payette, 2012). But the formal rationality provided by the SOO is not spontaneous and therefore, should not be easy to learn for adults. Metaphors encompass often our everyday communication and can also be used in explaining the behavior of complex social systems. Such an approach, developed initially by English anthropologist and social scientist Gregory Bateson, is advocated by De Giacomo and Fiorini (2017), and Wheatley (2006) for management and leadership. They do not enter into the technical details of chaos theory and complexity in terms of physical systems, but recommend using these ideas convincingly to the management of social systems and also for educational purposes.

To gain the predicative proficiency provided by the formal rationality of the SOO is the main reason why we need reliable and effective training tools to achieve full propositional logic proficiency in decision making, like the elementary pragmatic model (EPM) (De Giacomo and Fiorini, 2017), based on the CICT elementary dichotomy structuring process, briefly presented in next section.

3 Communication and the CICT Elementary Dichotomy Structuring Process

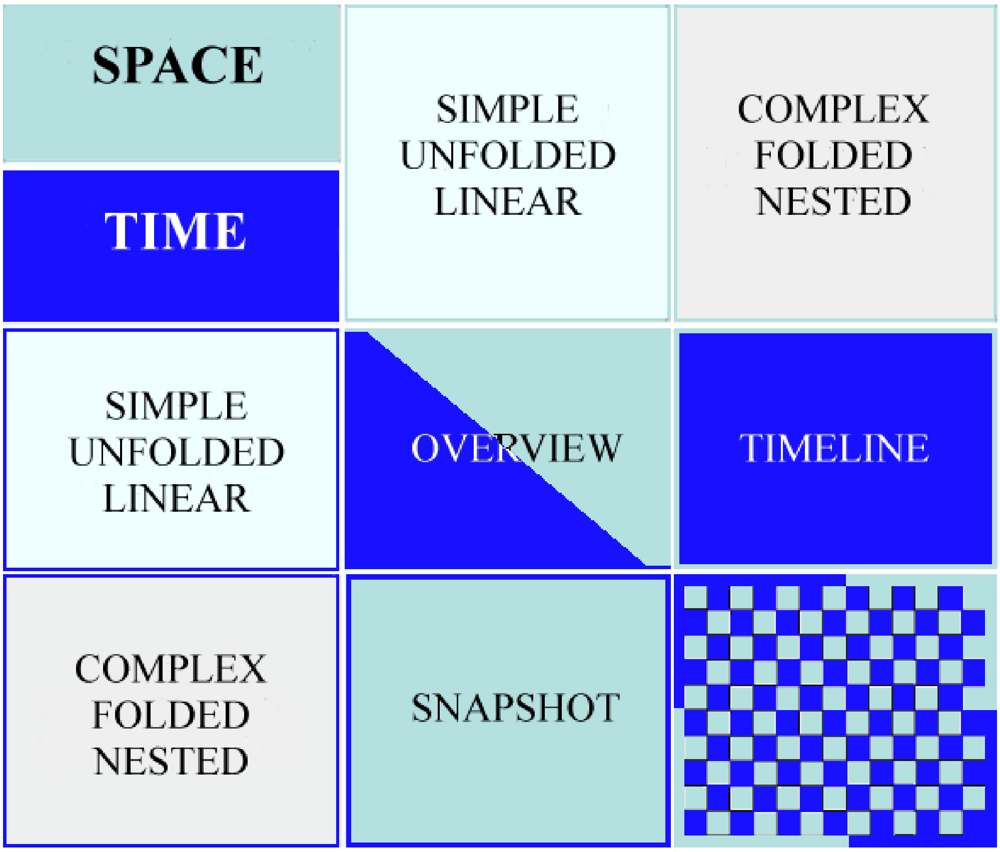
Mankind's best conceivable worldview (Weltanschauung) is at most a representation, a partial picture of the real world, an interpretation centered on man. We inevitably see the universe from a human point of view and communicate in terms shaped by the exigencies of human life in a natural uncertain environment. What is difficult is processing the highly conditioned sensory information that comes in through the lens of an eye, through the eardrum, or through the full skin. In fact, at each instant, human being receives an enormous volumes of data, and we have a finite number of brain cells to manage all the data we receive quickly enough.

According to traditional theories, brain researchers estimate that the human mind takes in 11 million pieces (tokens) of information per second through our five senses but is able to be consciously aware of only 40 of them (Koch et al., 2006; Wilson, 2004; Zimmermann, 1986). So our neurointerfaces and our brain have to filter to the extreme. To better clarify the computational paradigm, we can refer the following principle: "Animals and humans use their finite brains to comprehend and adapt to an infinitely complex environment" (Freeman and Kozma, 2009). We are constantly reconstructing the world's essential and superficial characteristics. This is the outcome of the on-going evolution of our relationships in a world full of surprises and challenges related to deeper characteristics (Espejo, 2011).

Spacetime (ST) invariant physical quantities can be related to the variables employed by a specific interacting observer to get a representation and an interpretation of the world within which a human being is immersed. In fact, original "spacetime" (a transdisciplinary concept), usually by classic operative interpretation, is split into two separated additive subcomponents "space" and "time." In that forced operative split, original information is lost or dissipated to an unaware interactor (Fiorini, 2015a).

This constrained operational splitting may represent an advantage by a formal (rational) representation perspective (i.e., ease of representation and understanding), but its major drawback is an original information precision loss, if the observer is unaware of or unable to compensate for it partially. Today, in fact, a partial compensation is possible, taking into consideration the folding and unfolding properties offered by the CICT "OpeRational" representation (Fiorini and Laguteta, 2013). According to CICT, the full information content of any symbolic representation emerges from the capturing of two fundamental coupled components: the linear component (unfolded, structured, technical) and the nonlinear one (folded, structured or unstructured, non-technical). Referring to the transdisciplinary concept (Nicolescu, 1996), we see that for full information conservation any transdisciplinary concept emerges from two pair of fundamental coupled parts (Figure 1).

Figure 1. The Four Quadrants of The Space-Time Split (STS)



Taking into consideration the folding and unfolding properties of CICT "OpeRational" representations for the Space-Time Split (STS) (Fiorini, 2015a), by a common language perspective, one can conceive a better operative understanding of usual terms, with added possibility of information conservation as shown in "The Four Quadrants of The Space-Time Split" (Figure 1), through a narrative point of view. Here, the term "Timeline" (first quadrant, top right) is considered the combination of a major, unfolded linear time representation, framed by the related, folded minor space representation. The term "Overview" (second quadrant, top left) is interpreted as the combined representation of major linear space and major linear time representations, with minor, complementary folded time and space components. The term "Snapshot" (third quadrant, bottom left) can be assumed as the combination of a major linear space representation, framed by minor folded time representation. The forth quadrant (bottom right) represents the combination of major folded space and time components, framed by the combination of minor linear space and time components. In can be interpreted as the simple (bidimensional), but realistic representation of the usual information experienced by a living organism.

In other words by CICT, to capture the full information content of any elementary symbolic representation, it is necessary to conceive a "quadratic support space" at least, to express its associated, linear, unfolded component. Of course, we can apply our dichotomizing process in a recursive way to achieve any representation accuracy we like. According to our methodology, as an operative example, we can use previous understanding to the representation of human experience by a narrative point of view, to be used effectively in human knowledge structuring and computer science modelling and simulation.

We can start to divide human experience into two interacting concepts or parts, "Application" and "Domain," in the sense that experience is always gained when an Application is developed to act within a specified Domain, and a Domain is always investigated by a developed Application. In terms of ultimate truth, a dichotomy of this sort has little meaning, but it is quite legitimate when one is operating within the classic mode used to discover or to create a world of "immediate appearance" by narration. In turn, both Domain and Application can be thought to be in "simple mode" (SM, linearly structured, technical, unfolded, etc.) or in "complex mode" (CM, non-linearly structured or unstructured, non-technical, folded, etc.) Description, as defined in Fiorini (1994).

The SM Application or Domain represents the world primarily in terms of "immediate appearance" (superficial reasons), whereas a CM Application or Domain sees it primarily as "underlying process" in itself (deep, concealed reasons). CM is primarily inspirational, imaginative, creative, intuitive: feeling, belief rather than facts predominate initially. By this perspective, "Art" when it is opposed to "Science 1.0" is "feeling transmission" rather than "data transmission". It does not proceed by data, reason or by laws. It proceeds by feeling, intuition and aesthetic resonance. The SM, by contrast, proceeds by data, logic, reason and by laws, which are themselves underlying forms of rational thought and behavior. Therefore, we can assume, for now, to talk about human experience by referring to SM and CM, Application and Domain, according to the "Four-Quadrant Scheme" (FQS) of Figure 2.

SM is straightforward, unadorned, unemotional, analytic, economical and carefully proportioned. Its purpose is not to inspire emotionally, but to bring order out of chaos and make the "unknowns known". It is not an aesthetically free and natural style. It is "esthetically restrained". Everything is under control. Its value is measured in terms of the skill with which this control is maintained. From the CM point of view the SM often appears predictable, dull, awkward, limited and ugly. Everything is in terms of pieces and parts and components and relationships. Nothing is figured out until it's run through the computer a dozen times. Everything's got to be measured and proved. Within SM, however, CM has some appearances of its own. Irrational, erratic, unpredictable, untrustworthy, sometime frivolous, etc. By now, these battle lines should sound a little familiar. This is the source of current trouble between these two cultures, created and structured by the past reductionist approaches.

Human being and present academic researcher tend to think and feel exclusively in one mode or the other and in so doing tend to misunderstand and underestimate what the other mode is all about. But no one is willing to give up the truth as he/she sees it, and as far as we know. In today‘s society, quite a few individuals have been developing any real reconciliation of these truths or modes, which is mandatory to arrive at the new "Science 2.0" worldview. There is no social, formal and shared point at which these visions of reality are unified at present. But if you can keep hold of the most obvious observation about SM Application or Domain, some other things can be noticed that do not, at first, appear and which can help to understand a convenient unification point.

Figure 2. Four-Quadrant Scheme (FQS) for Application and Domain (see text).

APPLICATION **DOMAIN**	SIMPLE STRUCTURED TECHNICAL	COMPLEX UNSTRUCTURED NON-TECHNICAL
SIMPLE STRUCTURED TECHNICAL	(known knowns)	(known unknowns)
COMPLEX UNSTRUCTURED NON-TECHNICAL	(unknown knowns)	(unknown unknowns)

The first is that in traditional Science 1.0 approach, apart from recent disciplines like risk analysis and computer security areas, any interacting observer is missing. Any classic SM Application or Domain description doesn't take into consideration any observer. Even an operator is a kind of personalityless robot whose performance of a function on a device is completely mechanical. There are no real subjects in this description. The only objects exist that exist are independent of any observer. This is the current Newton‘s Paradise of Science 1.0!

The second is that to standard Science 1.0, dichotomy is a simple cut-and-split process only. As a matter of fact, we have seen that there is an arbitrary knife moving here. There is an intellectual scalpel so swift and so sharp you sometimes do not even see it moving. You get the illusion that everything is there and that anything is being named as it exists. But they can be named quite differently and organized quite differently, depending on how the knife moves. It is important to see this knife for what it is and not to be fooled into thinking that anything is the way it is, just because the knife happened to cut it up that way. It is important to concentrate in the knife itself. As a matter of fact, one of the most highly developed skills in contemporary Western civilization is dissection: the split-up of problems into their smallest possible components. We are good at it. So good, we often forget to put the pieces back together again (Toffler, 1984).

The third is that the words "good" and "bad" and all their synonyms are completely absent. No value judgments have been expressed anywhere, only sterilized facts.

The fourth is that anything under CM is almost impossible to understand directly without experiencing it, unless you already know how it works. The immediate surface impressions that are essential for primary understanding are gone. Nevertheless, the masterful ability to use this knife effectively can result in arbitrary, creative solutions to the SM and CM split (De Giacomo and Fiorini, 2017). For now, you have to be aware that even the special use of the term SM and CM is an example of this arbitrary knife-manship. In order to master and to model this arbitrary knife-manship effectively, we need a reliable OUM system modelling architecture.

4 Ontological Uncertainty Management (OUM) Model Architecture

Following neurophysiological findings by Joseph LeDoux (LeDoux, 1998; 2002; 2015), differently from the past, we focus on ontological uncertainty (Lane and Maxfield, 2005) as an emergent phenomenon from a complex system (see Section 1 Introduction). Then, our dynamic ontological perspective can be thought as an emergent, natural operating point from, at least, a dichotomy of two fundamental coupled irreducible and complementary ideal asymptotic concepts:

a) reliable predictability, and

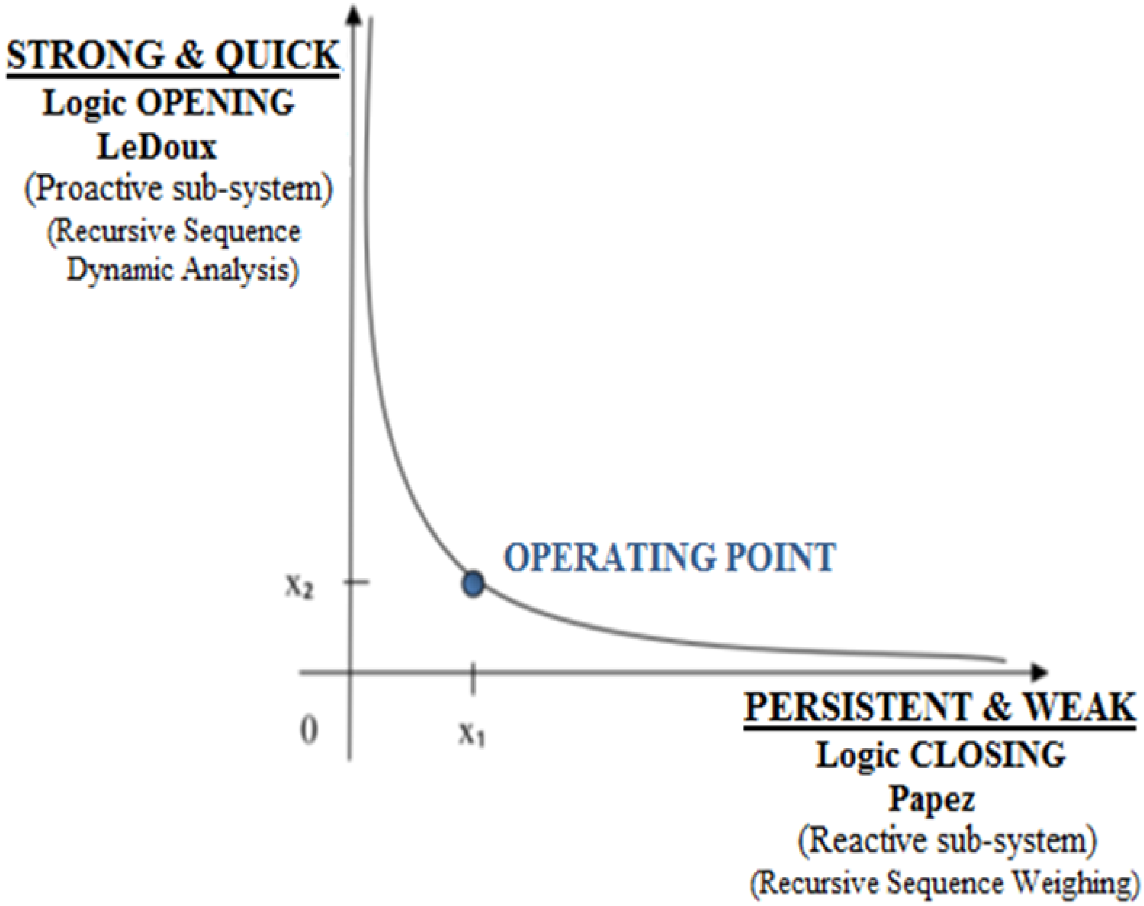
b) reliable unpredictability.

From Top-Down (TD) management perspective, the reliable predictability concept can be referred to traditional system reactive approach (lag subsystem, closed logic, to learn and prosper) and operative management techniques. Then, the reliable unpredictability concept can be associated to system proactive approach (lead subsystem, open logic, to survive and grow) and strategic management techniques.

As discussed in previous sections, to achieve our final goal, the overall system must be provided with smart sensing interface which allow reliable real-time interaction with its environment (Fiorini, 2016a). To behave realistically, the system must guarantee both Logical Aperture (to survive and grow) and Logical Closure (to learn and prosper), both fed by environmental "noise" (better… from what human beings call "noise") (Fiorini, 2014b.)

According to previous considerations, at brain level, it is possible to refer to the LeDoux circuit ("low road", Logical Aperture) for emotional behavior (i.e. fear, emotional intelligence, etc.) and to the Papez circuit ("high road", Logical Closure) for structured behavior (i.e. rational thinking, knowledge extraction, etc., as from Figure 3. Emotional Intelligence (EI) and Emotional Creativity (EC) (Goleman, 1995) coexist at the same time with Rational Thinking in human mind, sharing the same input environment information (Gunderson and Holling, 2002). Then, an operating point can emerge as a transdisciplinary reality level from the interaction of two complementary irreducible, asymptotic ideal coupled subsystems with their common environment (Figure 3).

Figure 3. Operating Point can emerge as a new Transdisciplinary Reality Level (TRL), based on Two Complementary Irreducible Management Subsystems interacting with their common environment (Gunderson and Holling, 2002).



The major added value of present work is provided by the author's fresh approach to ontological uncertainty management (OUM) modelling and by the new idea of system articulated interaction, defined by inner and outer system information resonant aggregation (Fiorini, 2016a). It can allow both quick and raw system response (to survive and grow) and slow and accurate information unfolding for future response strategic organization (to learn and prosper), by coherently formatted operating point (Fiorini, 2015b). Thus, new advanced systemic information application can successfully and reliably manage a higher system complexity than at present, with a minimum of design constraints specification and less system final operative environment knowledge at design level.

The author has already applied this new impredicative, post-Bertalanffy systemic framework on smaller scale problems, effectively and successfully. That is the case for both electroencephalography (EEG) data and event related potentials (ERP) preprocessing disambiguation and consolidation (Fiorini, 2015b; 2016a), and clinical psychiatry and psychology telepractice (subject and operator interaction reliable profiling and psychometrics) (De Giacomo et al., 2015; Fiorini et al., 2015).

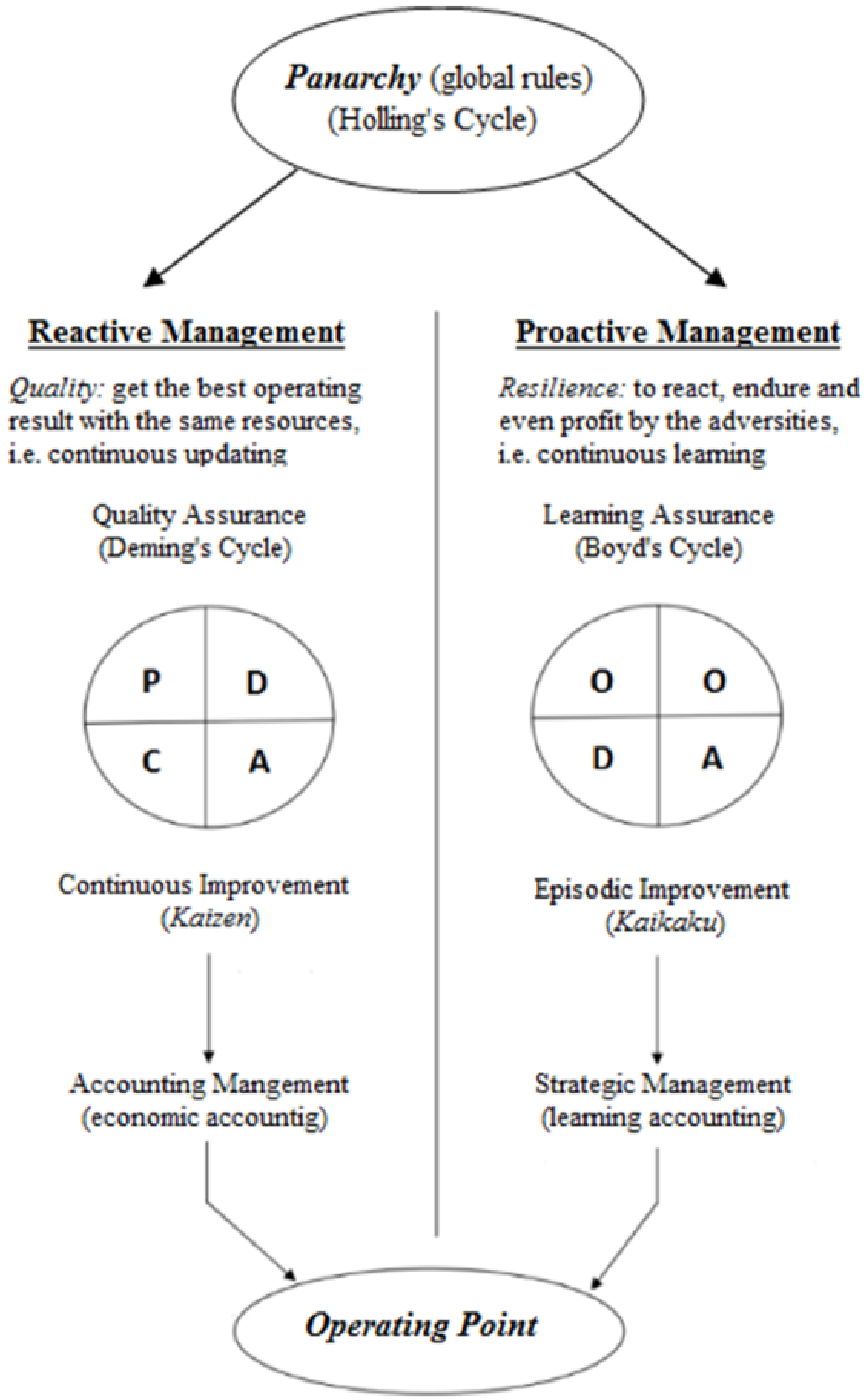
Specifically, in the case of EEG, traditional data processing and pattern recognition in a cognitive task application (spoken sentence comprehension), using usual ERP preprocessing, can offer shallow interpretation of experimental data. A deeper interpretation can be achieved by present methodology, implemented for that application, by the CICT and VEDA analysis tool (Collini and Cesario, 2012). In that case, brainstem function can be much better exploited for system modelling. In fact, in that case, the overall response result emerges from the coherent composition of five different subsystem outputs, which start to coherently cooperate to one another immediately upon input stimuli onset (Fiorini, 2015b). CICT coherent representation precision then lead to more experimental information clarity, conservation and result repeatability.

Our basic assumption is that natural living organism does perturb its environment, but ordinarily only up to the level it is perturbed in turn by its own environment both to survive and grow, no more (Gunderson and Holling, 2002). Therefore our approach can become a standard methodology to design system behavior even on higher scales, theoretically. In fact, due to its intrinsic self-scaling properties, this system approach can be applied at any system scale: from single quantum system application development to full system governance strategic assessment policies and beyond (Fiorini and Santacroce, 2013). It is even possible to use the same nonlinear, logic approach to guess a convenient basic architecture for Anticipatory Learning System (ALS) (Fiorini and Santacroce, 2013), to get realistic modeling of natural behavior, to be used in High Reliable Organization (HRO) application development.

As a matter of fact, the key operational concepts and our methodology, discussed in previous sections, can be conveniently and successfully extended to many other advanced Business and HRO application areas, with no performance or economic penalty, to develop more and more competitive application. For instance, at a higher level of abstraction, environmental noise input information to be aggregated into system internal status information can provide a structured homeostatic synthetic operating point as a reference for further inquiry (Fiorini, 2018). Then, system interaction by internal and external information resonant aggregation can allow both quick and raw response (Open Logic response, to survive and grow) and slow and accurate information for future response strategic organization (Closed Logic response, to learn to adapt and prosper), by coherently formatted operating point information (Fiorini, 2016a.)

To arrive at an operative architecture with our general framework for complex society and big government OUM approach, we have still to specify which coupled reliable predictability and reliable unpredictability subsystems we wish to use. For closed logic Reactive Management system, it is possible to choose from different documented operational alternatives offered by literature, like Deming's PDCA Cycle (Ohno, 2012), Discovery-Driven Planning (McGrath, and MacMillan, 1995; 2009), etc. For open logic Proactive Management system, we can refer to Boyd OODA Cycle (1987) (Osinga, 2006), Theory-Focused Planning (Govindarajan and Trimble, 2004), and many others. As a simple example, PDCA's cycle (Reactive Management) and OODA's cycle (Proactive Management) can be selected to represent two coupled, complementary irreducible sub-systems for advanced integrated operative-strategic management. Then, our final, general operative reference architecture looks like in Figure 4.

Figure 4. Final Architecture for Effective General Systemic Governance Framework



5 Conclusion and Summary

In order to provide reliable anticipatory knowledge, system must produce predictions ahead of the predicted phenomena as fast as possible. Then, they have to be verified by a reality level comparison, to be validated and accepted, to be remembered as learned reliable prediction. This validation cycle (emulation) allows system tuning and adaptation to its environment automatically and continuously. Current traditional formal systems are unable to capture enough information to model natural system realistically. They cannot represent and describe real system emergent properties effectively. Our OUM methodology allows to propose an extended Five Order Cybernetics Framework (Figure 5), which acknowledges just the complex system's emergent properties. Emergence entails a greater complexity that reduces traditional system "know-ability" and predictability. It also implies that a system will "immerge" into its environment, of which it is part. Immergence means "submergence" or "disappearance in, or as if in a liquid". If the system is determined by its contact with its context, then the reverse applies also.

The proposed fourth order cybernetic (Figure 5) deals with the system and its context simultaneously (multiscale interactivity), where relational complexity and system anticipatory ability are singular hallmarks of life (Rosen, 1985). The basic principles involved are already intuitively implied in First, Second and Third Order Cybernetic levels, but now they are shown unfolded and more explicitly. So, in this way, it is possible to achieve an ideal, cybernetic, conceptual and evolutive categorization schema by the proposed following five orders (1 + 4) framework, to offer a new reliable conceptualization for Social, Biomedical and general complex multiscale system applications:

1) Zero Order Cybernetics (Clausius): ideal, closed system, totally isolated open-loop system.

2) First Order Cybernetics (Wiener): "Self-steering" is assumed to be isolated from the act of observation and negative feedback functions as part of a mechanical process to maintain homeostasis.

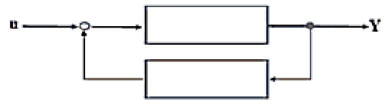
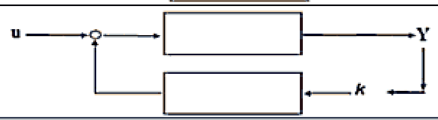
3) Second Order Cybernetics (von Foerster): the process of "self-steering" is now understood to be affected by observer/s, but the related mathematical modeling is insufficiently complex to encourage new values emerge. Nevertheless, it is understood that Positive and Negative Feedback can lead to morphogenesis intuitively.

4) Third Order Cybernetics (Bateson, Beer, Ashby): the process is understood as an interaction that can affect/be affected by many observers, but it does not address what this means for the "social response-ability" of the single participant observer. Articulated values emerge.

5) Fourth Order Cybernetics (Rosen): multiple realities emerge by the freedom of choice of the creative observer that determines the outcome for both the system and the observer. This puts demands on the self-awareness of the observer, and response-ability for/in action.

The major added value of this methodology is provided by our new idea of system interaction, defined as inner and outer system information resonant aggregation. It can allow both quick and raw system response (Reactive Management, to grow and survive) and slow and accurate information unfolding for future response strategic organization (Proactive Management, to adapt and prosper), by coherently formatted operating point (Fiorini and Santacroce, 2013). From this perspective, current most advanced embedded "intelligent system" is a "deficient system", a fragile system, because its algorithms are still based on statistical "intelligence" or statistical knowledge only, and they are lacking a fundamental key system component. We need resilient and antifragility application to be ready for next generation systems.

Figure 5. Five Order Cybernetics Framework Main Graphical Components

BIOMEDICAL CYBERNETIC ORDER	INTERACTION STYLE	GRAPHIC SYMBOL
Zero	Pure Spectator	
First	Ergodic Observer	
Second	Pulsed Egocentric Interactor	
Third	Iterated Egocentric Interactor	
Fourth	Recursive Interactor	

Now, according to previous discussion, it is possible, at systemic level, to envisage a post-Bertalanffy Systemic Framework able to deal with problems of different complexity, in a generalized way, when interdisciplinary consists, for instance, of a disciplinary reformulation of problems, like from biological to chemical, from clinical research to healthcare, etc., and transdisciplinary is related to the study of such reformulations and their properties. According to our humble knowledge, for the first time, thanks to our methodology, Social, Biological and Biomedical Engineering ideal system categorization levels, from an operational perspective, can be matched exactly to practical system modelling interaction styles, with no paradigmatic operational ambiguity and information loss, as shown in Figure 5 (specifically, our innovative system interaction modality, called "Recursive Interactor", corresponds to fourth order biomedical cybernetics) (Fiorini, 2016a). Now, even new social and advanced health and wellbeing information application can successfully and reliably manage higher system complexity than contemporary ones, with a minimum of design specification and less system final operative environment knowledge at design level.

Specifically, advanced wellbeing applications (AWA), high reliability organization (HRO), mission critical project (MCP) system, very low technological risk (VLTR) and crisis management (CM) system can benefit highly from our new methodology called "CICT OUM" approach and related techniques. The present paper offers an innovative solution proposal to complex society big government modelling and management approach, to be discussed. It is a relevant contribution towards a new post-Bertalanffy Extended Theory of Systems to show how homeostatic operating equilibria can emerge out of a self-organizing landscape of self-structuring attractor points, in a natural way.

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