Chapter X

eSubsidiarity: An Ethical Approach for living in complexity

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It is needless to insist on the significant increase of the complexity we are living in. Whereas the social order arisen with modernity encompassed –at the level of the nation-states– a reduction of social complexity through cultural normalization, the new social and political order is nowadays, as a consequence of globalization, to be intercultural, multilingual and even multi-national. We may encounter a different way of diminishing the complexity at the level of the human agency, but we have to do it in different way as modernity did. The management of information and complexity in biology provides some clues to this endeavor. As we see, living beings through its management of complexity enacts the subsidiarity principle that can equally be applied to the organization of decentralized political systems. It enables the decrease of complexity at the level of the heterarchical organized agents, while preserving the complexity at the global level. eSubsidiarity was essayed in Allende's Chile following Stafford Beer's Viable System Model and in many other human organizations. Could it become a new ethical paradigm at the information age?

1. The world we are living in

Our current world is significantly determined by the geo- political, economic and social process of globalization which poses a number of complex challenges amounting to environmental and climatic issues, inequality and poverty, peace and security concerns, depletion of basic resources, financial instabilities, cultural conflicts, etc., as the author has

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elsewhere discussed [Díaz Nafría, 2011, 2014; Díaz et al. 2014]. From a network perspective, the globalization process brings about an unprecedented increase of the complexity of the human network through the extension and multiplication of human interactions throughout the globe thanks to the development of ICT and transport technologies and facilities.

In a significant extent, the globalization is a consequence of the natural proclivity of capitalism to extend itself towards a "free, unobstructed, progressive and universal development" [Marx 1973, p. 540]. Nevertheless the globalization was actually deployed from the framework of liberal-democratic wealthy nation-states surrounded by significantly poorer countries with a narrow factual autonomy. In Marxian terms, it was the development of the productive forces within the framework of the existing productive relations—reflected and legitimized in the property relations—that leaded to the contradictions between the given productive-forces and relations [Marx 1859], ending up in the obsolescence of the productive relations and the subsequent necessity to re-express them in the existing political framework [Elster 1983, pp. 209-236]. This is what we for example see nowadays in all the continents through the endorsing of free-trade treaties, regional alliances and international institutions, legitimized by the nation-states. Thereby the productive forces, remarkably embodied in international corporations, get clearly expressed.

Still, if Marx was right, this cannot be the end of the history. As Hardt and Negri has pointed:

> "Through processes of globalization, capital not only brings together all the earth under its command but also creates, invests, and exploits social life in its entirety, ordering life according to the hierarchies of economic value. In the newly dominant forms of production that involve information, codes, knowledge, images, and affects, for example, producers increasingly require a high degree of freedom as well as open access to the common, especially in its social forms, such as communications networks, information banks, and cultural circuits. […] The content of what is produced—including ideas, images, and affects—is easily reproduced and thus tends toward being common, strongly resisting all legal and economic efforts to privatize it or bring it under public control. The transition is already in process: contemporary capitalist production by addressing its own needs is opening up the possibility of and creating the bases for a social and economic order grounded in the common." [Hardt and Negri, 2009, p.ix-x]

Is this 'commonist' horizon or Commonwealth—as Hardt and Negri like to speak—evolving from a formless network really nearby? Or shall it emerge an effective autonomous agency (a sort of historical subject) capable to take these bulk tendencies of the 'Multitude' towards its effective expression?

What we can currently observe is, on one side, the individual overwhelmed by a carpet-bombing of information but at same time striving to use the digital tools and it mediated relations to get ahead through increasing problems. On the other side, corporations, governments and international institutions strive to get advantage of the ever increasing realms of data provided by the peoples and the environment in order to make the adequate decision that keep or extend their concentrated power. Whereas the former side seem to have an ethical flavor—concerning how to carry a better life—the latter could be rather regarded as a political concern. But such bifurcation is just an optical aberration stemming from the Cristian separation—often opposition—between the realm of individual moral action and the realm of social, political agency: church vs empire in Dante, ethics and politics in Locke, nature and society in Rousseau, etc. In the context of liberalism the separation is quite crude: while the political action should stablish the space of trustworthiness and leeway for the individual, the ethics can be expressed in such space. But is this separation really meaningful in our contemporary world?

Whereas the social order arisen with modernity encompassed –at the level of the nation-states– a reduction of social complexity through cultural normalization, the new social and political order is nowadays as a consequence of globalization to be intercultural, multilingual and even multi-national. National life is more and more entangled with international relations, and cannot be conceived anymore with our backs turned to nature. All this makes that the traditional context of posing ethical questions is rather different. The universality paradigm that pervaded many classical approaches in ethics is not so convincing anymore. Anthropology, ethnography, intercultural ethics has shown the fragility of such pretentious positions. Its social and political correlate is bureaucracy, whose efficiency for the organization of the industrial enterprise and the state has been a decisive factor for the extension of its power. However when this organization accumulate unsolved problems, we must then encounter a different way of diminishing the complexity at the level of the human agency.

2. The lessons learnt from biological information and complexity

Before dealing with the issue of how we should manage information in the benefit of a better life within the complexification or our current social and natural environments, let us look at how information is being used and managed in the living beings.

Before the tremendous complexity we actually find in any organism the first questions arisen concerns where all that comes from. The immediate answer provided by contemporary biology concerns genetic information as the heritable biological information coded in the nucleotide sequences of DNA and RNA. These nucleic acids, able to reproduce themselves –through replication–, contain the information which is used by a living cell to construct the proteins constituting the building blocks of the corresponding living being (be it just a cell or a multicellular organism). With these proteins, the organism built and maintain the organic structures that enact the living form.

From the molecular perspective, the basic process consists in the translation by the cell machinery of the sequence of nucleobases –on the nucleic acid strand– into the specific sequence of amino acids that make up a particular protein, where a single amino acid corresponds to a codon or triplet composed by a set of three bases (belonging to the four nucleotide sorts).[a] This offers a set of 4^3=64 different combinations that code for 20

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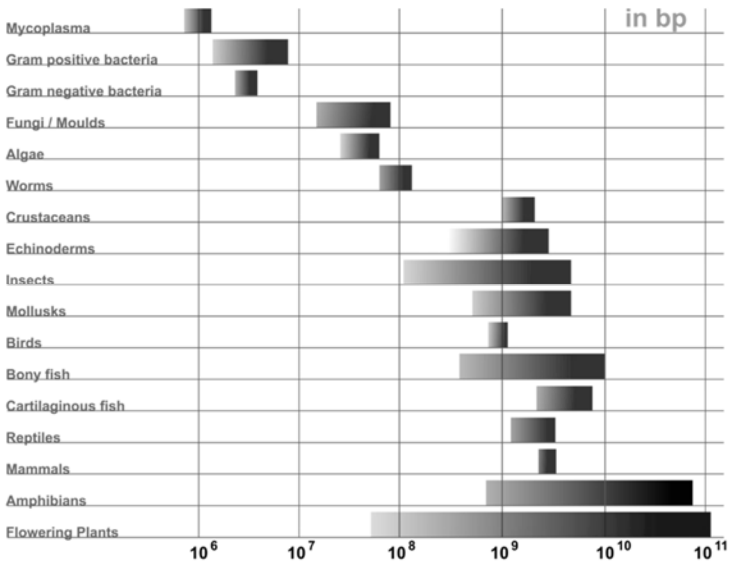
[a] In eukaryotic cells according to the central dogma of molecular biology, the specific mechanism by which proteins are constructed consists in the transcription within the nucleus of the DNA information into the mRNA –intermediary molecule– which is being used by the ribosomes in the cytoplasm as a template to construct the protein strand. After a complex "regulation of the form, proteins are integrated as structural and/or functional units in the complex network of biological functions in the cell" [Lara, 2009, p.376]. This complex regulation, not fully understood, concerns among other factors the set of nucleic acid sequences which do not code for proteins, but play a significant role for instance as

different amino acids needed for the protein synthesis together with 3 stop-codons which are also fundamental for protein construction. This represents a redundancy which is relevant to ensure the protein building processes but that states a relation to structural complexity of about: $\log_2 21$ bit/codon $\cong$ 1.5 bit/codon = 0.5 bit/base (assuming, for the sake of simplicity, a homogeneous distribution of amino acids and codons which is obviously not the case). Nevertheless not all the sequences code for proteins. If we take into account the difficulty to measure the regulatory value of the non-coding DNA together with the ongoing discussion about its actual functionality, the informational correspondence of the nucleic acids into the erection of the actual complexity of the organism is difficult to determine, but as an approximation we can hold the genome length in base-pairs (as shown in fig. 1 for different species) as about the double of the potential information held by the genetic molecules, i.e., not what is being actually expressed by genomes but what can potentially be expressed in the evolutionary process.



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metadata for protein synthesis or evolution [Lyre, 2003]. This uncertainty makes difficult to determine the information amount contained in the DNA [Farach et al., 1994].

Fig. 1. Genome size ranges (in base pairs) of various life forms (source: Abizar at English Wikipedia)

As we can observe in fig. 1, genome's length is not always in direct correspondence with the observed complexity of the organism. Here the role of the non-coding genome seems to play a fundamental role concerning the complexity of the regulatory process that deploys the intricate network of biological structures and functions. Indeed as we can observe, there are flowering plants which genome contains much more information that the one of humans, whose organic complexity is much higher. Concerning the latter, is worth comparing the amount of potential determinations that the human DNA can provide (of the order of 10^9 b) with the complexity of its organism. For instance, just the number of antibody molecules (from 10^8 to 10^{11}) that the human cells can synthetize seem to be over the determination ability of the DNA. Furthermore, the complexity of the nervous system comprise 10^{15} synapsis among a network of 10^{12} neurons. Therefore considering neuronal plasticity (namely the leeway to stablish synapsis), the number of determinations needed to specify the actual structure of the nervous system is significantly far beyond the reach of the genome. Thus the observed morphogenesis shows that the actual complexity of the organism must stem from a *self-determination* process in which the environment plays a fundamental role [Lyre, 2003].

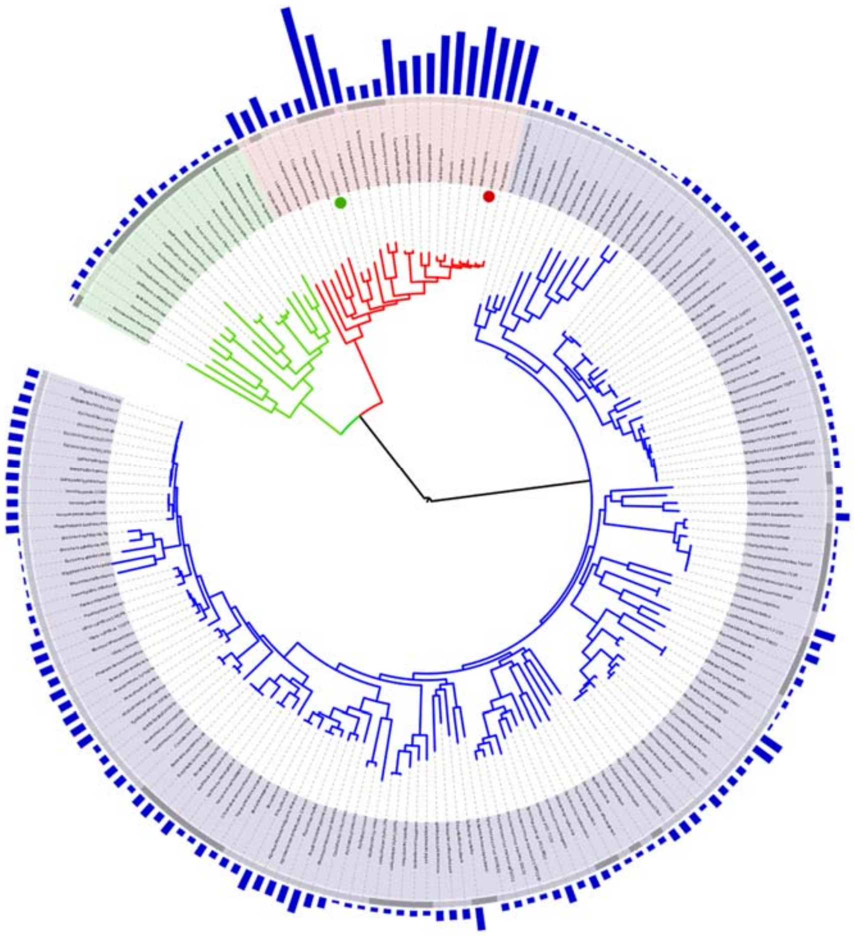

Fig. 2. A highly resolved tree of life based on complete sequence genomes. In blue: *Bacteria*; in green: *Archaea*; in red: *Eukaryota*. Green dot: *oriza sativa;* Red dot: *homo sapiens*. The surrounding blue bars correspond to the genome size for the corresponding branch (source: http://itol.embl.de/itol.cgi).

In evolutionary terms, we can say that the process in which living beings co-evolve, adapting to their environments (in turn, composed by a complex network of living beings and other natural elements), is condensed in the nucleic acid memory of the genome. This memory provides the elementary determinations that enables that a new cell (a zygote in eukaryotic organisms if sexual reproduction takes place) diachronically reconstructs the structures supporting the phenotype of the individual living being. However, at each step it is the existing cell with its particular structural and functional apparatus together with the given environment what constitute the substrate upon which new determinations in the morphogenesis process take place epigenetically.

Figure 2 shows a highly resolved tree of life in which the evolutionary paths are shown from a common trunk, together with the genome sizes of the species. Again we can observe here that there is not a direct correspondence between the evolutionary determinations which are needed for the morphogenesis and the hereditary memory of the genome. In other words life develops between the determinations provided by the genomic instructions and the fundamental leeway and constraints offered by the environment, particularly defined by other evolving living beings. As elsewhere discussed, this chaotic situation of conflict and co-evolution, in which the morphogenetic processes take place, can be fruitfully visualized in terms of Thom's logoi dynamics [Zimmermann & Díaz, 2012]. In Haeckel's 1874 representation of vertebrate embryonic development, shown in fig.3, we can observe how the epigenetic process can evolve from a common or similar origin into different directions. The higher the complexity of the evolving form, the wider the corresponding cone. For the case of humans, this concerns the leeway of their nervous system.

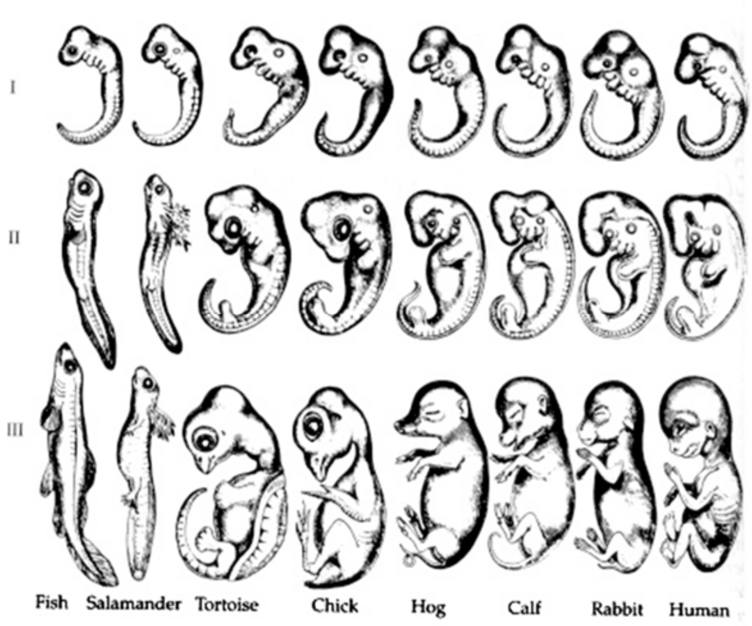

Fig. 3. Haeckel's 1874 version of vertebrate embryonic development. The top row shows an early stage common to all groups, the second row shows a middle stage of development, and the bottom row shows a late stage embryo. (Adapted from [Gilbert, 1997]).

From the physiological perspective, we can focus—following Beer [1981]—on the organization of the human organism as being mainly composed by three interacting parts: (i) the muscles and organs, (ii) the nervous system and (iii) the external environment. The first is being concerned with the primary activities, the basic work and interaction with the environment and is being regarded as the set of *operational units*; the second ensures that the operational units (muscles and organs) work in an integrated, harmonic manner and can therefore be regarded as a *metasystem* (with respect to the system of operation units); and finally the *environment* refers to the parts of the outside world directly relevant to the organism, namely in direct interaction with the organism—be it immediately or in the foreseen future. (See fig. 4).

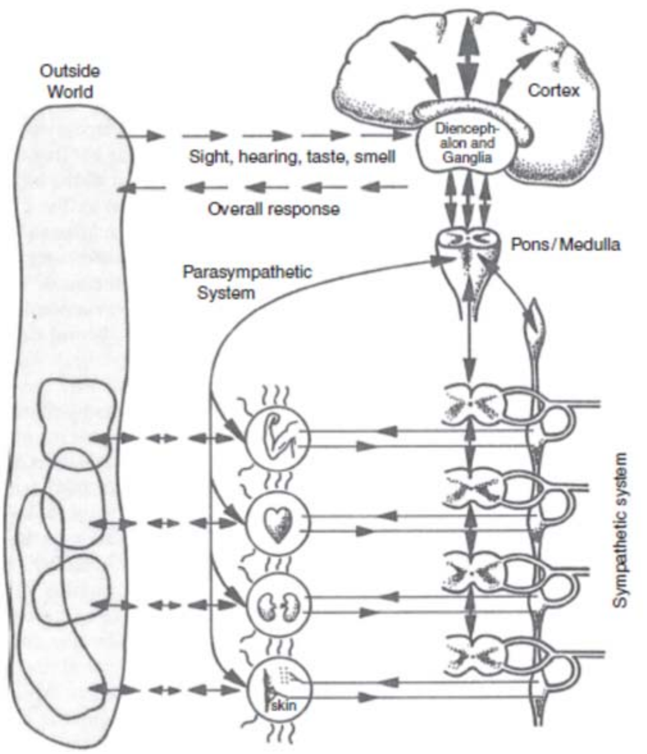

Fig. 4. The human organism is basically regarded as being composed by: (i) *operational units* (muscles and organs) inscribed by circles; (ii) the nervous system which in turn is composed by: the sympathetic system, the base brain, the diencephalon and ganglia and the cortex; (iii) the environment (Source: [Beer, 1981, p. 131]).

Though the three parts are dynamic, there is a balance among them whenever the organism in a sane situation. This means the three parts shall be constantly adapting upon each other: (i) according to the physical interactions and the metabolic activities, as well as the constant exchange with the nervous system: the muscles and organs will evolve in a way or another; (ii) according to the sensing interactions with the outer and inner environments, the neuromuscular coordination needed for the usual mobility, the mental activity performed to regulate the organism and its activities, the nutrients provided by the organs, etc conforms the constant development of the nervous system (as argued above and elsewhere [Díaz & Zimmermann, 2013a, 2013b]; and (iii) the environment is similarly evolving according to the activities of the organism (for instance, some living beings run away, some others cooperate, and others play against).

Of particular relevance for the management of information and complexity in the human organism, it is the articulation of the nervous system as proposed by Beer [1981] represented in fig. 4. He distinguishes four systems in tight connection with the operational units which constitute what he calls system 1, namely: System 2) the sympathetic nervous system which stabilizes and coordinates the activity of muscles and organs through resolution of conflicts; Sytem 3) the base brain, including pons and medulla, which enables internal regulation and optimization; System 4) composed by the diencephalon and ganglia, linked to the outer senses and committed to the forward planning; and System 5) the cortex which regards the higher brain functions performing self-identity, ultimate decision-making, and axiological orientation. If we now consider the information management, the first lesson learnt show us that most information actually circulates at the level of system 1, particularly if we consider therein the afferent-efferent pathways closed by the interneurons in the spinal cord. Second, the existence of other pathways through the sympathetic trunk shows the possibility of regulation through information exchange with the higher nervous system, but in most of the cases this embraces just system 2 for the short-term coordination of organ activity, or system 3 if longer term coordination is required. Indeed a very small fraction of regulatory information reaches system 5 as proven by the fact that the bandwidth of conscious awareness is in the range of 100 b/s or less while, in contrast, the bandwidth of the information managed in the retina is of about $6x10^6$ b/s [Anderson, 2005, Norretranders, 1998].

This reduction of information flow from the lower to the higher regulatory bodies corresponds to distributed and autonomous management of operational complexity and the concentration of the mostly relevant with respect to the dynamics of the whole. Thereby, if one is grabbing a flower most of the information flow to regulate the complex coordination of muscle fibers will be circulated at the lowest level, in which the corresponding network of synapsis have ‘learnt’ how to do it, but if in the movement one is acutely pricked by a thorn, the information of the pain stimulus will circulate all the way up as to make—all the way down—the whole body to escape from the danger.

All in all, the biological management of information show us that a proper hierarchical architecture (or rather heterarchical as we have just seen) of autonomous agency oriented to the resolution of issues at the lowest level and the coordination of actions among the parts enable a dramatic alleviation of information flow and the coping with a maximal complexity. Furthermore, the meaning of the information flow is fundamentally dependent of the environment.

3. Reconciling ethics, politics and nature: eSubsidiarity

Democracy since its Greek roots is conceived as linked to both equality and liberty [Aristotle, 2004, VI, 2][b]. Equality with respect to the capacity to decide upon available common options; liberty with respect to the self-determination or autonomy of the community members, who should not depend on some authority in order to make really free choices. Equality thus concerns the right to participate equally (social value), but it also entails that a minimal satisfaction of needs is provided as to ensure real autonomy (material value). Therefore concerning material equity democracy admits a certain degree of inequality, but this is strictly bounded by the need to guaranty autonomy [Post, 2003]. As it has been proven, though democratization can be achieved under inequality conditions, in the long term, it undermines the consolidation of democracy [Houle, 2009] and moreover, it is correlated to the decrease of democratic political engagement [Solt, 2008]. This relation has even been stated by the OECD in the report concerning public engagement: "Decision-making is founded on broad participation and equality of citizens" [2009: 146].

In historical perspective, it can be observed that despite the constantly growing global inequality since the 18th century (measured for instance through the Gini coefficient), the localized reduction of inequality has often been associated to democratic processes, as in Western Europe, where the strengthening of social security systems improved the autonomy

[b] In Aristotle these principles are aligned with the ethical virtues which in turn stem from the very human nature.

of the citizens during the decades following World War II [Milanovic, 2009]. But since the 1980s, we observe within these countries a heterogeneous increase of national inequality, as well as between EU countries. Again, this provides an additional clue to the EU democratic deficits.

To this respect, it is remarkable to recall that, it was in the context of the dramatically increasing inequality, observed in the industrialized areas of the 19th century Europe, that the principle of *subsidiarity* was developed and incorporated into the socio-political agenda [von Nell-Breuning, 1990]. Although the concept is historically rooted in the Calvinistic understanding of community, it was the arisen contradiction between work and capital that made evident the undermined autonomy of the many and subsequently the inability to accomplish the principles of democratic liberalism. Hence, it progressively became a fundamental principle of democratic liberalism, a pillar of the Catholic Church social doctrine, and it is now one of the foundations of the EU who has coded the principle in the following terms: “Under the principle of subsidiarity, in areas which do not fall within its exclusive competence, the Union shall act only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member States, either at central level or at regional and local level, but can rather, by reason of the scale or effects of the proposed action, be better achieved at Union level.” [EU, 2008: art.5]. Internationally the principle has been coded as a foundation of decentralization and co-responsibility [UNDP, 1997] and it has been even devised as a core concept for the organization of complex systems (for instance, in the field of neuropsychology and cybernetics), and this is in fact what underlays the aforementioned organization of organisms devised by Stafford Beer in his search of the principles of sustainable organizations.

Hitherto, this understanding of subsidiarity requires moving beyond the *negative* account of subsidiarity (as it has been extensively done in the EU in order to prevent action of public bodies) and developing instead a *positive* strive by public institutions to act where no other closer instrument is actually acting as to ensure fundamental rights, in particular those enabling the development of real democracy.

As we can see in Stafford Beer's *Designing Freedom* [1974] his positions clearly stands for a reconciliation of ethical and political action superseding the limitations of both the liberal ethics and the bureaucratic organization of economic and political life. As we saw, he learned the lesson of how to deal with complexity from biology, deriving the fundamental and necessary structure that any *viable system*—able to constantly adapt to its environment—should hold [Beer, 1981]. The success of this architecture was shown in several organizations, but the most astonishing experiment is undoubtedly its implementation at the level of Chile's state by Allende's government of Popular Unity through the utilization of very simple but effective electronic means. Nevertheless, though this was the target of the Cybersyn project, the implementation just achieved the management of the nationalized economic companies between 1972 and 1973. Such economic control proved its strengths against the "soft" power supporting Allende's opposition and organizing two massive transport strikes, but it brutally collapsed under the bombs of the hard power in the other black 9/11 of 1973 [Church 1975, Atina 2008, Rivière 2010].

The case is of significant interest because it addresses at a time the question of individual life (ethics) and the questions of social life (politics) and it has been extensively documented, in particular since the last book of Medina [2008, 2012; Beer, 1975, 1981]. Nevertheless, despite Allende's strong concern of furthering radical democracy in an efficient way, it must be born in mind its direct connection to nation-state political-economy and how the leeway of the latter has significantly changed since as we argued at the beginning, but the scalability of the organizational core model of subsidiarity is capable to address the additional complexification that should be address in order to handle e-Subsidiarity at a global scale [Díaz, 2011; Díaz et al., 2015].

4. Study case: Cybersyn project, democratically seizing the state

The project CyberSyn was initiated in 1971 by the invitation by the National Company Corfo to Stanford Beer, who enthusiastically accepted. The objective of the project—directed by Fernando Flores, Beer and Raúl

Espejo—was the implementation—at the national level– of the scientific approaches derived by Beer of organization and management to cope in real time with economic crisis by means of a coordination of actions under the monitoring of the information from all the related national companies. To dissipate any Orwellian interpretation, it is worth highlighting Allende's insistent claim to ensure that the system behave in a "decentralising, worker-participative, and antibureaucratic manner" [Medina 2008].

The CyberSyn team integrated by scientists of different disciplines deployed a well-organized information network—though based upon very limited technological resources—as a back bone of the economic system at national scale. Figure 5 shows the "Viable System Model" (VSM) the project aimed at implementing. The VSM allegedly structures the organization of any viable system, i.e. any organized system that combines the survival demands in a changing environment. As observed above for the human physiology, it consists of 3 different parts that incubate the management and dynamics of the processes at: (a) the environment of the organism; (b) the operations area, (c) the metasystem. As illustrated, the system is integrated by the following subsystems: activity, information, internal management, environmental monitoring and global management; and there are five control and information levels.

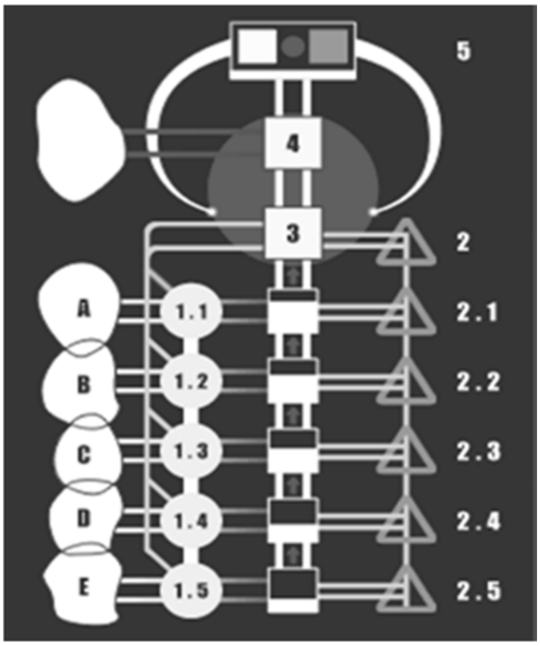

Fig. 5. Schema of CyberSyn's Viable System Model. The clouds on the left represent environments (A-E operational, global at the top); 1: operational units; 2: coordination; 3: current internal management; 4: environmental and future monitoring; 5: political decisions of the organization aimed at balancing global necessities (OR-AM 2006).

Although the systems could not be fully implemented, in October 1972, the CyberSyn team faced the truck strike—supported by the CIA and the US 40 Committee [Church 1975]. CyberSyn endeavored organizing the 200 loyal truckers (against 40.000 in strike) to warrant the most essential transports. The survival to this crisis made the project respectful. Furthermore, Flores was appointed as Economic Minister. Pitifully, as said above and before the project could be fully developed, the bombs and guns of the hard power finished the experiment in the 9/11 of 1973, and Flores spent three years in the concentration camps of Pinochet's Chile [Rivière 2010].

The probe that, from the viewpoint of procurement of freedom and appropriate individual and social life—in the sense of being able to cope with its issues—, the CyberSyn project was a clear example of it, is based upon the following facts: (i) the political, social and economic stability was dramatically threatened during the period of development of the project, (ii) it enabled the circumvention of extreme harms, and (iii) it was posed as a provision of freedom [Medina 2008].

The Cybersyn approach was committed, on one side, to guarantee the satisfaction of basic needs to enable self-determination of the members and the equality among parts (in our case, this can be translated into the necessary autonomy of the university community members and bodies involved); on the other, to bring off that relevant issues reaches the level in which they can be most efficiently addressed, thus enabling the peoples to participate in the decision-making at different levels.

In order to address the problems linked to the globalization context initialed posed, three additional features has to be added to the model (elsewhere discussed by the author [Díaz 2011]): a) *sustainability* feature, as principle for determining the space of freedom (choice), related to the carrying capacity of the socio-economic and natural environment in which it is immersed; b) *heterarchical* feature, concerning the possibility that component subsystems belong to several systems; c) *fuzzy* boundary feature, for enabling the emergence of new relations or entities; d) *horizontal networking* capabilities have to be ensured to avoid the security threatens of a too hierarchical structure. An architecture to deploy the model at a global scale for sustainability issues has recently been posed by Schwaninger [2005]. Are not we before an ethical/political approach for living in global complexity?

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