CyberSyn and the re-construction of a holistic nature

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Abstract

We are constantly reconstructing the world's essential characteristics. This is the outcome of the on-going evolution of our relationships in a world full of surprises and challenges. The world changes as society absorbs new developments and we develop new cognitive capabilities. Our recurrent interactions construct new relationships, which provide the foundations for new organisational forms. The invention and deployment of technologies play a key role in this evolution. My purpose in this contribution is exploring this evolution. I want to explore the constitution of information and communication technologies in social relationships that re-construct the world's nature. A wide range of threats and opportunities require of all our ingenuity, inventiveness and stamina to maintain viability. Technologies, considered as tools and machines that may be used to solve real-world problems problem, have helped us in these endeavours from immemorial times. I argue here that learning to use them requires understanding their constitution in communication processes. The key conceptual construct I use for this understanding is that of *complexity* and more specifically the Law of Requisite Variety (Ashby 1964). The specific application domain for these reflections is the CyberSyn project during the Allende's government in Chile (Beer 1981).

Introduction

We are constantly reconstructing the world's essential characteristics. This is the outcome of the on-going evolution of our relationships with a world full of surprises and challenges. The essential characteristics of the world change as society absorbs new developments and we develop new cognitive capabilities. Recurrent interactions support the construction of new relationships, which provide the foundations for new organisational forms and cognitive capabilities. The invention and deployment of technologies[1] play a key role in this evolution; new technologies re-construct our natural world. My purpose in this article is exploring these constitutive processes. Most importantly I want to explore how information and communications technologies are being constituted in social relationships that re-construct the world's nature (de Zeeuw 2002).

Whether as individuals or collectives we are constantly confronted with challenges that exceed our response capacity. We are constantly challenged by threats and opportunities that require of all our ingenuity, inventiveness and stamina to develop and maintain viability. Technologies have helped us in all these endeavours from immemorial times. I argue here that a systemic viewpoint helps to understand the role that they play in this construction. This

[1] "Technology can be most broadly defined as the entities, both material and immaterial, created by the application of mental and physical effort in order to achieve some value. In this usage, technology refers to tools and machines that may be used to solve real-world problems. It is a far-reaching term that may include simple tools, such as a crowbar or wooden spoon, or more complex machines, such as a space station or particle accelerator. Tools and machines need not be material; virtual technology, such as computer software and business methods, fall under this definition of technology." (Technology in Wikipedia 2007)

is a viewpoint that emphasises a complex world that is constantly changing us and is being changed by us.

The key conceptual construct I want to use for these reflections is that of *complexity* and more specifically the Law of Requisite Variety (Ashby 1964). The specific application domain for its use is the CyberSyn project during the Allende's government in Chile (Beer 1981).

Complexity and Requisite Variety

It is a truism to say that the world is complex. It is not difficult for us to appreciate that the world is constantly surprising us with new possibilities; in the language of complexity we say that its number of possible states is exceedingly large[2]. The interactions among a handful of people can unfold in time into a huge number of patterns making it irrelevant their quantification. Any attempt to follow and distinguish these patterns one by one would be futile. Their variety is exceedingly large. Thus, we pay more attention to the collective behaviour of a group than to their moment-to-moment interactions and in doing so we choose the particular aspects that we want to observe. We need to ascribe purpose to the group's interactions unless we are prepared to be swamped by its variety. Furthermore, the members of the group need to find meanings for their interactions if they are going to maintain them over time. In a cognitive sense we define the group´s situation as a black box with inputs and outputs. This attenuation of a situational variety is unavoidable; simply our cognitive apparatus (i.e. our total body) has a limited capacity. Our relationships with nature are restricted by the distinctions our bodyhood can language[3]. The ways we construct a thing's essential qualities or a person's character or our appreciation of the physical power causing all the phenomena of the material world are constrained by our bodyhood. And, technology plays a significant role in this construction. The most significant technologies underpinning the 17th Century scientific revolution were instruments that helped us 'see' nature in ways that we had not seen it before. Telescopes and microscopes helped us penetrate the 'scopic' aspects of nature, amplifying our experiences with the eyes. As such our construction of the world was dominated by physics and the machines that helped us controlling it. It was on this platform, among other aspects, that we were able to travel further afield and discover new worlds and were able to see 'invisible' worlds that gave us new insights about our relations with other living entities. The laws of physics were the platform for the development of rational mechanics and the design of machines that helped us producing the industrial revolution. The co-evolution of the technologies of the 17th century with more powerful models of the physical world gave mankind the chance to develop new machines and harness nature's powers in desirable directions.

A myriad of similar processes of co-evolution of human appreciation and technology are being responsible for the on-going transformation of the physical and social worlds. These are learning cycles that emerge from perceived threats and opportunities in the world. Dealing with threats such as terrorism or global warming or dealing with opportunities such as introducing new services in the market or empowering communities to make their own decisions, requires from us far more than trial and error; they are too complex and time is too short. We need ingenuity, inventiveness, creativity and *resources* to anticipate undesirable outcomes. These are all problem solving situations that share a common structure; persons or collectives, limited by their biology and organisation, want to achieve desirable outcomes in a surrounding that poses challenges that are indeed difficult to overcome. The perceived complexity of these situations is indeed large, but –SO FAR- not large enough to threaten mankind's desire for progress and quest for viability. For instance, when old civilisations confronted the challenge to move heavy stones from quarries to burial sites they were not stopped by the apparent impossibility of the task; they basically did two things, one was to develop means to simplify the task, such as constructing roads and the other was to develop means to enhance their physical strength, such as lifting equipment and transportation vehicles. The first type of response was all about *attenuating* (reducing) the complexity of the

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[2] The complexity of a situation is measured by its variety or number of possible states (Ashby 1964).
[3] Cf. Maturana 1988

task and the second was all about *amplifying* their capacity to do the task. Their performance depended on the balance they achieved between attenuation and amplification. The less good they were in constructing roads the more difficult it was for them to move construction material. Quite naturally they went through long term learning processes that eventually made them very good at building, say, pyramids.

An explanatory principle of these learning processes is Ashby's Law of Requisite Variety; in his words "Only variety absorbs variety" or in my words "The complexity at the disposal of the regulator has to match the situation's *residual complexity*". Residual variety is the complexity that those in the situation itself are unable to absorb but needs to be absorbed to achieve the regulator's required performance; this is the variety that needs to be absorbed by the regulator (Espejo 1989). This residual complexity depends on the desirable performance; *ceteris paribus* the more stringent is the required performance the larger is likely to be the residual variety[4]. Early on, when knowledge and practice to build pyramids was small, the architects responsible for their erection (i.e. the regulators) might have required several decades to complete them. However, as individual and organisational learning took place most likely workers increased their capacity to respond locally -by themselves- to more and more situational variety. This had the effect of reducing the residual variety relevant to their supervisors, who perhaps used this as an opportunity to improve processes and collectively all had the chance to build up pyramids quicker and better.

The Law of Requisite Variety is fundamentally a relational construct; it is about the relations between regulators and situations. Living in any context poses challenges –it is a learning experience- suggesting that one way or the other we (either as individuals or collectives) are always matching situational variety. We, as regulators, are constantly striving to regulate a challenging surrounding. In this practice of living we develop *variety operators*, that is, particular strategies and practices to deal with the variety of the world we live in. Possible variety operators are amplifiers such as those that *add strength* to the source variety (e.g. broadcasting that allows one-to-many communications), or *increase the resolution* of the source variety (e.g. software to increase the resolution that we see in an object or telescopes and microscopes vis-à-vis our vision capabilities), or *create new variety* (e.g. develop an organisation's structure to make viable a policy or inventing transportation equipment to create new variety vis-à-vis our muscles), or make source variety *time independent* (e.g. keeping in-print good recordings and books or transmitting news originated in the regulators 24 hours a day 7 days a week i.e. broadcasting the same variety on and on…). Equally from the perspective of variety attenuation, we have variety operators that make *weaker the source variety* (e.g. using sunglasses to reduce luminosity or earphones to reduce the strength of a radio's output), or *decrease the resolution of the source variety* (e.g. summary reports of complex events) or *filter out part of the source variety* (e.g. editors of a film about a real situation that chop off aspects of this reality thus conditioning our experiences about that situation), or make *the source variety time dependent* (e.g. media stopping reports about a catastrophe even if still the lives of the affected people are a misery). What is of significance is that for any situation unwittingly a wide range of variety operators co-evolve, thus defining the communications between the regulator and the situation being regulated. The quality of these operators defines the regulator's performance and furthermore gives us the opportunity to diagnose the variety management in use. This is of significance in a world experiencing more and more challenges; not any variety management is adequate or even viable. Not only we may find an imbalance between amplifiers and attenuators, something that implies a waste of resources and/or poor regulation, but sometimes we may find attenuators where we should have amplifiers (e.g. unreadable small print of relevant issues in a contract) and amplifiers where we should have attenuators (e.g. detailed reporting of irrelevant issues). This is happening precisely in challenging situations where we should be striving for more and more ingenious forms of problem solving. Thus, from the perspective of complexity, how can we develop more ingenious and effective *forms* of variety management? Indeed, historically

[4] This is ceteris paribus because it is not considering that those in the situation itself could increase their capacity for self-regulation i.e. could absorb more of the situational variety by themselves, thus reducing the residual variety that is relevant to the regulator. However, if this option is not accepted, the stringent is the required performance the more variety will be relevant to the regulator.

different technologies and scientific discoveries have emerged from these challenging situations[5].

This way of 'seeing the world' opens new opportunities to understand, dissolve and resolve social problems. It implies seeing them in terms of the mutual influence and co-evolution of regulators and regulands. This is what I refer to as a holistic view of social nature; the meanings emerging from a situation *are* the de facto balances of their complexities over time. It is about recognising the loops between us, in our practice of living as tacit regulators of situations, and the situations themselves; meanings emerge from the balance between our appreciation of both the attenuation of the situation's variety and the amplification of responses' variety. When, in any relevant situation to us, new developments (such as a scientific discovery or a technological breakthrough) trigger a regulatory imbalance between attenuation and amplification we are confronted to a learning situation; it is necessary to redress the lost balance or otherwise we are either accepting failing meeting our expectations or we are wasting resources. For a society under pressure this is not acceptable. This makes it necessary an appreciation of the qualities of the situation's '*holistic nature'*. For instance health is a situation relevant to all of us. Medical research, like the genome programme, increases diagnostic possibilities that in their turn open the space for more medical procedures. But, in practice, medical services are finding it increasingly difficult to match with (amplifying) resources our improved diagnostic capacity. The reality of our health services, whether we like it or not, emerges from the grounding of our distinctions in operational capacity[6]. This view implies that to improve learning and performance we have to improve in tandem our capabilities on the one hand to observe and articulate distinctions and on the other to design and produce responses. And, a more ethical behaviour implies that we answer questions such as to what degree health services are right increasing their diagnostic power at the expense of decreasing (in relative terms) their response capacity, thus triggering a growth in unsatisfied expectations.

A holistic nature is an outcome of the hugely interconnected reality we live in. This is the nature that emerges from people's purposeful activities in their quests to deal with personal and collective problems. Dealing with these problems requires communications with those agents producing the situations of concern. Regulation is experienced as communications that restrict behaviours to a set of desirable (for the regulator) outcomes; it depends on communication channels that amplify and attenuate complexity and also on *transducers*[7] that relate the regulators to those being regulated. These experiences are underpinned by knowledge and technologies that change our cognitive and operational capabilities and with that the situations' essential characteristics. This is in my view the process that reconstructs a *holistic nature*. With this conceptual background I want to explore the CyberSyn Project that was developed in Chile in the early 1970s.

The CyberSyn Project

Did the CyberSyn project succeed in re-constructing the nature of the Chilean society? This project, an invention of Stafford Beer, was an alternative to the extremes of running a centralised planning system or an unrestricted free market. This *third way* wanted to favour governance for social cohesion and distribution of power. The project had four components;

- Cybernet, was a communications network connecting enterprises and state institutions through telex machines. It was a basic Internet ahead of its times,

[5] This is my interpretation of Thomas Homer-Dixon's *Ingenuity Gap* (Homer-Dixon 2001).

[6] Humberto Maturana (1988) offers a compelling argument for ontology as the grounding of epistemology.

[7] Transducers are media that transforms signals from one expression into another expression that is more appropriate to the receiver system. They are necessary every time that signals cross a system's boundary; they transform signals in other communicative forms that are more meaningful for the receiving system. A decoder alters the input code into internally meaningful code and an encoder alters the output code into externally meaningful code.

- Cyberstride was a suite of computer programmes supporting an information system in real time and by exception,
- CHECO was a dynamic simulation of the Chilean economy and,
- The Operations Room was an environment to support decision making processes at all structural levels in the industrial economy (see figure 1 below).

Figure 1: Photo of the Chilean Operations Room (1972-73)

Stafford Beer (1981) and others (e.g. Ulrich 1984, Medina 2005, Espejo 1981) have given critical, historic and conceptual views of this project. My purpose in this short article, supported by the above conceptual framework, is clarifying its role in re-constructing the reality of the Chilean industrial economy. I was one of its initiators and its operational manager. Our intention was to develop a technology to distribute information and decision capacity throughout the enterprises owned by the state and more fundamentally to give power to the people. However a critical review of the project suggests that its outcomes were more modest.

Was it a technology that enhanced people's capabilities to influence the government or was it a technology that unwittingly helped politicians and managers to manipulate the people? Did Cybernet enhance people's capabilities for building up relationships or was it an instrument to give managers and politicians another controlling device? Was it emancipative or manipulative? In other words, was it a means to increase the power of politicians or a means to distribute power in society?

Beer's fundamental concern was improving communications between the industrial economy and those responsible for its management. In the 1970s in Chile, and elsewhere, the attenuation of situational variety was indeed weak; ill-structured information arrived to managers long after the events, seldom appropriate to their needs and more often than not to the wrong people. CybeSyn was used to overcome these weaknesses. Most of our resources were focused on these deficiencies. But changing the nature of communications implied more than an effective attenuation of situational variety. Even the communications network – Cybernet- a tool which naturally could have been used to amplify politicians and managers' varieties, was used for some time, until October 1972, mainly to transmit data to a computer centre rather than as a tool to increase the metabolism of decision making. It was only during that month, when the government was challenged by a damaging strike of retailers and truck owners, that dawned into politicians and managers' minds that Cybernet could be a tool to increase their decision making capabilities; with it their decisions could flow and reach in almost real time enterprises that so far had been remote from them. This was a major breakthrough at the time. Though this was a powerful lesson and much learning followed it, what did not happen then was a significant change of social relationships to increase the autonomy of social enterprises and the cohesion of the total industry. These changes were necessary to change the nature of the industrial economy. Beer came to Chile with a manuscript of his book the *Brain of the Firm*, in which he had developed the Viable System Model[8] as model for the *third way*. Participants in the CyberSyn project were able to study it and model the organisational structure of the industrial economy. The model was a blueprint to understand relationships to enable autonomous production units in the context of a cohesive and adaptive economy, but its embodiment in social practices did not happen. We neither had an appreciation of the magnitude of these efforts nor the necessary influence, and in relative terms, little of our resources and efforts were focused on changing these relationships. We should have done much more dealing with political and organisational challenges to create a context for autonomy. Our mindsets were over influenced by the need to improve reporting practices along the hierarchies of management. We gave little attention to influence mores and create practices to increase the likelihood of coordinated actions among workers and between then and administrators; these were the necessary communications to reduce the need for vertical interactions. We paid little attention to increase responsible trust in the overall economy; this was necessary to reduce the need for inspections. These were necessary amplifiers of managerial complexity that would have made more meaningful the reporting practices proposed by CyberSyn. Indeed, moment-to moment coordination was necessary to increase local problem solving thus reducing the need to refer problems to bureaucrats and responsible trust was necessary to allow local autonomy without the fear that situations would run out of control. In fact our understanding of coordination issues was weak and perhaps with the exception of the incipient CyberNet, technologies to support them were unavailable. These were problems not only in Chile but also elsewhere and it is only in the last 25 years that conceptual and technological solutions have been creeping into management and organisational practices. And, alas! Fernando Flores's contribution[9] to these developments has been significant (Winograd and Flores 1986). It is now, after decades of co-evolution of people's appreciation of social communications and information technologies, that new social relationships are being enabled by these technologies. These changes are providing politicians and managers with the amplification necessary to take advantage of better decision support systems and thus making possible more effective governance.

CyberSyn was a project ahead of its time. Its creation was visionary; however its intended implementation did not have requisite variety. The necessary social and organisational contexts to re-construct the nature of social relationships did not exist; however desirable it might have been to provide information in real-time and by exception, the necessary relationships for cohesion and adaptation had not evolved enough to reinforce effective autonomous action throughout the social economy. A mooted point is whether a longer period of implementation, uninterrupted by the coup d'état of September 1973, would have supported this requisite learning. Some participants in the project had an appreciation of the *need to embody these relationships in the social fabric of the economy* but collectively most of us did not see CyberSyn beyond being a powerful theoretical framework and our practice was biased towards a technical implementation at the expense of the values of building up a truly autonomous decentralised industry and furthermore an inclusive democracy.

In conclusion, my view is that CyberSyn did not succeed in reconstructing a more humane and just social nature in the Chile of the 1970s. However, there is more to this story. For the past two years Chilean artists Enrique Rivera and Catalina Ossa have been working revisiting this experience. They have focused on the chairs of the Chilean Operations Room as iconic manifestations of the intersection of the virtual and physical worlds of decision-making. The Zentrum fur Kunst und Medientechnologie Karlsruhe, Germany (www.zkm.de) is currently displaying a modern computerised replica of the original chair (figures 2 and 3) in the context of the "YOU_ser, The Century of the Consumer" exhibition. This chair allows the visitor a virtual visit of the Operations Room (figure 4) and is connected to a similar chair in the Cultural Centre of the Presidential Palace in Chile. Furthermore a new exhibition, inspired by

[8] The Viable System Model (VSM), developed by Stafford Beer, is a model of the organisational structure of any viable system. It is a conversational device useful to account for the complexity of the recursive structure of an organisation (Beer, 1972, 1979, 1981, 1985).
[9] Fernando Flores was the principal political force behind the CyberSyn Project.

the idea of operations rooms is currently in progress in Gijon, Spain (Bosco, R. 2008). Its purpose, influenced by the CyberSyn room, is transforming these installations, which historically have had the stigma of *control rooms*, into complex instruments for civil engagement and information. Pablo de Soto, the Spanish artist behind this exhibition, is concerned with creating a physical space for architects, software specialists, hackers, artists and activists to research in theory and practice the grounds emerging from the intersections between physical space, mobile bodies and electronic flows. His aim is to put new technologies at the service of the people. Somehow, it would appear that the last word about CyberSyn has not been written yet.

Figure 2 Connecting Karlsruhe's Chair with the Chair in Santiago, Chile

Figure 3 Artist's impression of CyberSyn's Chair

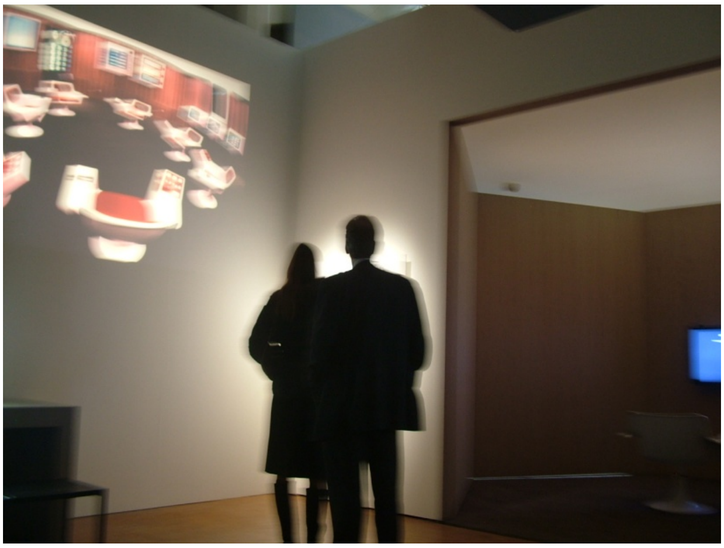

Figure 4 Virtual reconstruction of the Operations Room in Karlsruhe

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