Cyber-Subsidiarity: Towards a Global Sustainable Information Society[1]

José María DÍAZ-NAFRÍA

National University of Santa Elena–SENESCYT, Ecuador; *Universidad de León*, Spain; *Munich University of Applied Sciences*, Germany

Abstract: Most attempts to use the potentials of information technologies in benefit of the fulfilment of the democratic requirements from the local to the global levels are based on the power of social networks and the utilisation of big-data approaches. However, both the network itself and the portliness of data processing have fundamental limitations that need to be overcome when the size of the population is larger than a reduced group. As to cope with the related complexity, the network provides in certain conditions a characteristic structure which facilitates the emergence of new functional features, and consequently a system. It is this structure –the fibres of the systemic relations– and new functionalities concerning the circulation of data what change the portliness of data processing into an appropriate percolation and management of relevant information. By these means complexity and the corresponding information flow are managed at the lowest possible level while cooperation and higher level management is ready to cope just with the excess of complexity the lower level cannot manage properly by itself. But this is the very idea of subsidiarity whose application to the organisation of heterogeneous societies has been a foundation of decentralised government since the 16th century in many different contexts.

At the age of the global information society, the necessary management of global issues (environment, geo-politics, inequality, etc.) requires both proper levelism and information management from the peoples to communities, to national authorities, and to international institutions. Stafford Beer's Viable System Model provides a suitable approach to deploy subsidiarity with the backbone of an information and communication infrastructure based on the acquisition, circulation and processing of relevant information to enable decentralised, democratic decision-making.

Keywords: Network Theory, Semantic Networks, Big-Data, Viable System Model, Subsidiarity, Small-World, Cybernetics, Internet, Information Divide, Biological Information, Complexity Management

1. Introduction

> *Imagine a kind of city constituted by a vast number of squares, where people meet and engage in different activities, but among which there is a scarce number of streets you can see. Some people move along them, but if you pay close attention, the number of people popping up or leaving each square are much more than the ones moving along the streets. We distinguish at the sides of the squares some doors through which lots of people pass through. The doors are guarded by watchmen who either let the people enter or not. It may be a sort of custom office, though it is difficult to see whether there is anyone charging. Some of these doors seem to be just for distinguished people – we guess – for whom the doors are opened when they intend to pass through, but there are other doors which are transited by the masses.*
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> *Considering the global flow, it is quite obvious that great avenues connecting the squares must be away from the eyes, but they have to be somewhere, surely underground. And indeed the people moving in that underworld must be tremendous, just by taking into account the large*

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> *number of people in the squares with respect to the people moving along the visible streets. There is another clue to glimpse the complexity of such underworld: most of the people, before leaving one of these squares, go to a kind of small pavilion; seem to ask for something, and then, they go straightforward to some of the doors. Only in strange cases you get to see people going straight to the doors without passing by these pavilions. We presume it maybe the complexity of the underworld they are about to enter what make that people need to be informed. We also guess there is no cartography at hand about the underground streets, maybe it were too complex for human awareness. Although all that are mere conjectures we state from our bird-sight view of this weird city. Nevertheless, it is quite clear that there is no way to acknowledge the semblance of this city from any other one we have experience of.*

Still many structural features of the social network geared by big-data technologies, as I will try to show, can actually be mapped in the ideal city we have just described. The latter serve as an allegorical approach to the ethical and political issues derived from the massive use of these technologies in all kinds of social activity and subsequently of the Global Information Society (as the author has deal with in other works 2011, 2014). I say ethical issues because it concerns peoples' actions in their environments, their behaviours, affordances and constraints. I mention political issues because it also concerns the collective decision-making. The previous picture has the benefit that, in contrast to the vast and multifarious complexity of the human activity mediated by the Internet, including all relevant infrastructural details, the reader have absolute control of the ideal city she has just depicted in her mind. This is analogous to the case of having a map in your hands with respect to the complexity of the territory, what by the way seem to be alien to the assets available in the weird city.

The question I intend to delve is: what is the most proper structure of the Global Information Society (GIS), including its infrastructural skeleton, as to cope democratically with the global complex issues we are facing? For many the answer to the proper way of dealing with these complex issues concerns precisely the big-data approach. However, I argue – in the vein of Stafford Beer and Norbert Wiener – that this is neither democratic nor the most effective way to face the complexity concerned. Nature and particularly living beings show us another way to face it. First of all, we need to see what the network in general properly is.

2. Abstract Networks, the Mapping of Complex Interactions and Network Topology

A *network* in its naked flesh is nothing more than a set of *nodes* and *links* among them. It mathematically corresponds to a *graph*, namely an ordered pair $G = \{V, E\}$ which comprises a set V of *vertices* or nodes together with a set E of *edges* or arcs. An edge is, in turn, a two-element subset of V (i.e. it is related to two vertices, being such relation represented as a pair which is usually ordered). In addition, both nodes and links have some arbitrary attributes (usually codified by labels or colours in the representation); but the most relevant feature for the node is its *degree*, k, namely the number of links that connect it with the rest of the network, while for the link is its *directivity*, typically represented by an arrow (though links may also be bidirectional and then not represented explicitly). For the network altogether, it is the *degree distribution density*, $P(k)$ its most relevant attribute. These few elements of networks offer a sufficient flexibility to build a broad variety of models to map many real complex phenomena. (There are many introductory texts to network theory, Barabasi (2002) has become a successful popular option, while Steen (2010) or Newman (2010), among others, offer more technical details).

When our network is mapping something in reality, the nodes (or the vertices in its representation) stand for some sort of *agency*. This can be either *active*, if the agent act by itself, or *passive*, if it is used by some active agent to perform the action. On the other hand, the links (or the edges) correspond to the *interactions* among agents. This correspondence is quite natural because whenever two real entities are somehow connected they are actually interacting with each other. In order to have a broader spectrum of applicability, we may generally understand for agent whatever is capable of performing some action (either by itself or by other active agent) of any type (no matter whether it is of physical, chemical, biological or social nature) (cf. Zimmermann 2012; Zimmermann and Díaz 2012; Díaz and Zimmermann 2013a, 2013b). Therefore what we represent through the network is a set of agents who operate onto other agents by means of their respective interaction.

Figure 1.a illustrates a piece of network where the bidirectional interaction between two nodes, N_i and N_j is highlighted. It is represented by the information exchange between the nodes, understood through a general and processual concept of information: N_i informs N_j, which comprises first a difference in the steady state of the connection, caused by N_i, and consecutively a difference produced in the state of N_j (it is straightforward to notice the alignment with Bateson's information concept, cf. Díaz 2010). Thus we can speak of the information of N_i on N_j, i.e. $I_{i,j}$, and the information of N_j on N_i, i.e. $I_{j,i}$. The network as a whole represents synchronically all the interactions stablished among connected nodes. Figure 1.b highlights the fact that interaction happens ultimately among agents. If we distinguish among active and passive agents, both graphs are actually not redundant: though active agents (we can take it as such fig. b) may use passive ones (fig.a), there is not a bijective relation between the corresponding components of both networks. Passive nodes can be used by several active ones, and, at the same time, several passive nodes may be required to provide the interaction between two active agents (telecommunication vs communicators networks are clear examples to this respect).

Figure 1. Network as: a) set of nodes and links interacting with each other; b) set of interacting agents.

The interaction represented by links can be regarded as *internal* for active agents and *external* for passive ones, since it requires the external intervention of some active agency. This is indeed a relevant difference that can be used to distinguish between the potential interaction of active agents, provided by the connectedness of the passive agents, and their actual interaction, provided by the 'elections' of the active agents (we quote election to be aware that our agents can be of different nature, thus it should not be interpreted anthropologically). Consequently whenever we just focus on a network of passive agents (a passive network), we are in fact dealing with the potentiality or space of possibilities in which the active agents perform their actions; whereas when we attend to the real interaction of active agents, it is the actuality within the former space of possibilities what is being represented thereby. In other words, when we map the network of active agency on the network of passive agency, we are observing the actualization of the potentialities represented by the passive network. The latter can then be seen as the space where the internal network (of active agents) is moving. This space can be understood as analogous to the phase space for the active network. Nevertheless, in the phase space (or space of possibilities of a system), each possible state corresponds to just one point, while here the active network is the result of all the external agents who are really active and occupy a subgraph of the passive network.

All in all, the static graph of the network – through this relation between potentiality and actuality of interaction – has the interesting property of representing motion. Indeed we can regard the physical space as a passive network of locations where the motion of physical entities takes place (by the way, different patterns of adjacency correspond in quantum gravity to different spatial geometries and consequently to different physical relations). A city composed by intersections and streets corresponds to the space where people move around. That is what we represented in the story we started this chapter with. But the passive network, as it is the matter of our concern, could also be the one composed by telecommunication lines and nodes which is the space where telecommunication among humans and machines takes place. These are the agents (nodes) of the active network we focus on.

Nevertheless, what the effects of the global interaction are depends significantly on the statistical and topological properties of the network, which are actually entangled. This is something we can realize observing the two most important network types (Barabasi 2002): *random scaled* networks are highly homogeneous and distributed, while *scale-free* networks are heterogeneous having relatively common vertices with a degree that greatly exceeds the average. In the former type, the number of randomly distributed edges to be found is $p \cdot N \cdot (N-1)/2$, where p is the probability of one node to be bounded with another and N the total number of nodes. The grade distribution density, $P(k)$, for this type follows a Poisson law with a peak in the mean value, in which vicinity most cases arrange. However, in the scale-free networks the grade distribution follows a power law, $P(k) \sim k^{-\gamma}$ (where γ is typically in the range of $2<\gamma<3$). Here general network connectivity is guarantee by the hubs that concentrate a large number of links (interestingly major hubs are followed by smaller ones, which, in turn, are followed by others with an even smaller degree, and so on). Good examples for the first type are the vascular networks in animals and plants or the road networks of a country; while examples of the second kind are metabolic or semantic networks as well as air transportation networks. The second ones are considered scale-free because statistical and topographical features are reproduced when observed at different scales, i.e., they are *fractal*. They additionally provide an interesting topological feature making that networks of this kind constitute *small-worlds*, namely, that most nodes can be reached from every other node by a small number of steps and, at the same time, that they have a large clustering coefficient (C: number of closed triplets / number of connected triplets of vertices; that is, nodes tend to create tightly knit groups) (Barabasi 2002; Watts & Strogatz 1998).

Hence, most interaction in small-worlds happens at the level of clusters while global connectivity is ensured with other clusters. Assuming structural stability (at least for a given observation window), we can state that whenever a cluster endures this is because the interaction within the cluster corresponds to a proper issue management among cluster's agents; otherwise, the cluster would fall apart –looking for other effective interaction. In terms of information flow (which, as stated above, stands for interaction), the stability entails that the combined information in all directed loops within the cluster is convergent under issue management (otherwise issues would overwhelm cluster co-operation). In other terms, the complexity of the solutions against issues must be able to absorb the corresponding issues' complexity. In addition, information flow outside the cluster may correspond to the complexity excess not handled within the cluster but transported outside. Its amount is expected to be of a lower degree than the information flow within the cluster as a result of cluster's capacity to manage own issues.

Thus, clusters in stable small-world networks represent some effective cooperation. Subsequently, small-world networks seem to be well suited to instantiate the *subsidiarity principle*, namely, that issues are dealt with at the most immediate level that is consistent with their resolution. The additional requirements for the network structure needed to fulfil the subsidiarity principle is that only the interaction corresponding to issues that are better managed at the upper level percolate in that direction. In cybernetics jargon, this feature can be put in terms of Ashby's law of *requisite variety*, while Stafford Beer's Viable System Model offers the sufficient and necessary structural and functional requirements to enact subsidiarity and sustainability at the same time, as the author has argue elsewhere (Díaz Nafría 2016, 2014). The aforementioned scale-free self-similarity, which is typical of small-world networks, has the counterpart in the recursive levelism which is characteristic of the Viable System Model.

3. On the Internet Topological and Structural Properties

Interestingly, when the very idea of the Internet was devised by Paul Baran (1964), it was the distributed topology that was born in mind as most appropriate to provide high resilience under attacks that could eventually affect critical nodes. That is, in fact, the quite obvious benefit for organism resilience provided by the distributed architecture of vascular networks. However the self-organised evolution of the Internet has derived a decentralised topology which is instead scale-free. Indeed, its small-world property is illustrated by the fact that webpages, despite of being about 5 billions (Kunder 2016), are at an average shortest distance of only 20 clicks from any other one (assuming that such a path exists), according to the estimative model provided by Barabasi (2001). At the same time, the Internet infrastructure itself – constituted by a network of routers that navigate data packages for one terminal to another – is at an average minimal distance of some 10 steps (*ibid*, Faloutsos 1999). Both the Web and the Internet infrastructure are far away from the distributed topology, but still they provide significant robustness under random node failure (though critical nodes might severally affect global performance if they fail) at the same time that shortening network distance improves global performance significantly.

In the case of the Web, there is an interesting topological feature worth to describe, consequence of the highly heterogeneous linkage directivity: the web breaks down in several well identifiable continents (Barabasi 2002): a *central core* in which each node is at reach of any other; an *IN continent* from which one can move into the core but not turning back; and an OUT continent where one can arrive but not come out; finally, there are *tubes* directly connecting the IN and OUT continents, *tendrils*, or node chains only attached to either the IN or the OUT continent, and a few nodes form isolated islands that cannot be accessed from the rest of the nodes. All this makes that robots that are tracking the Web to index it have fundamental limitations to accomplish their task.

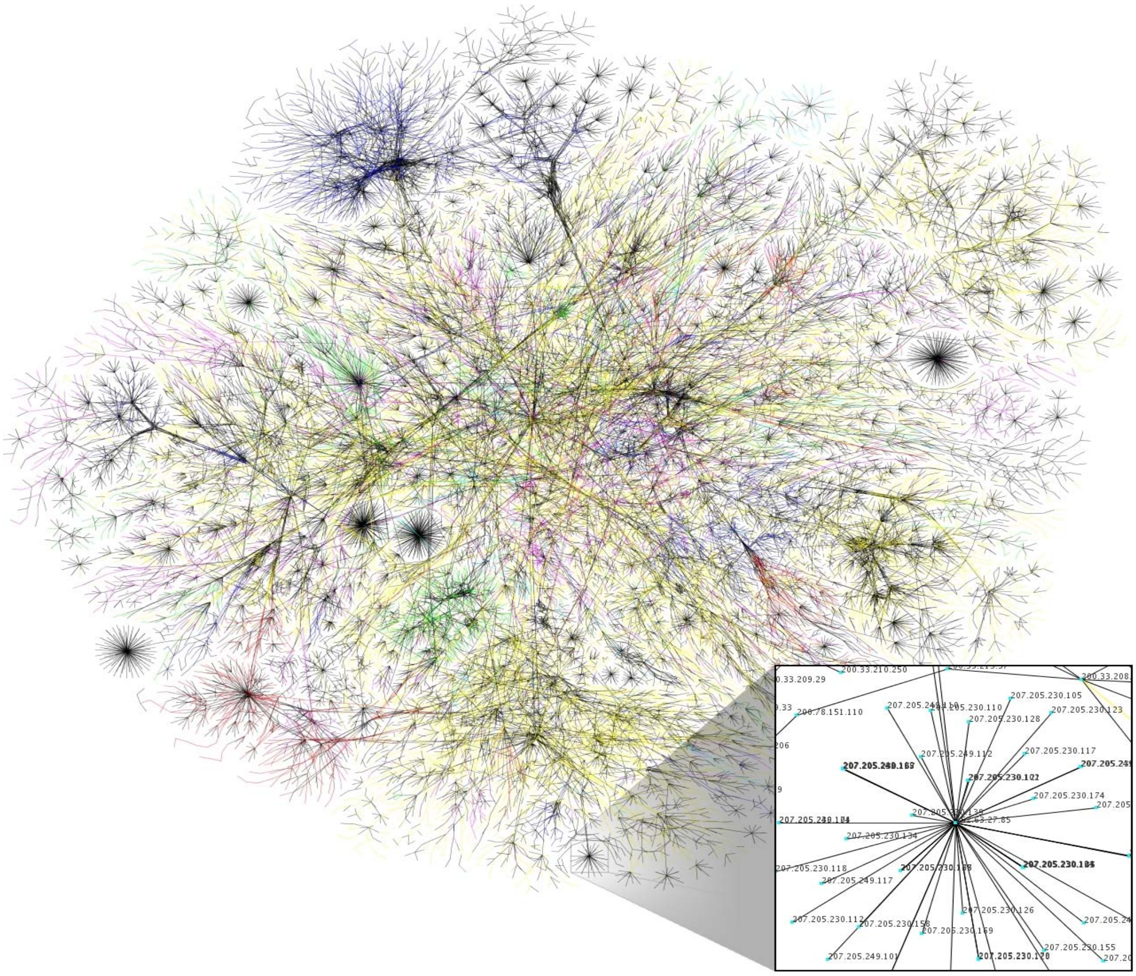
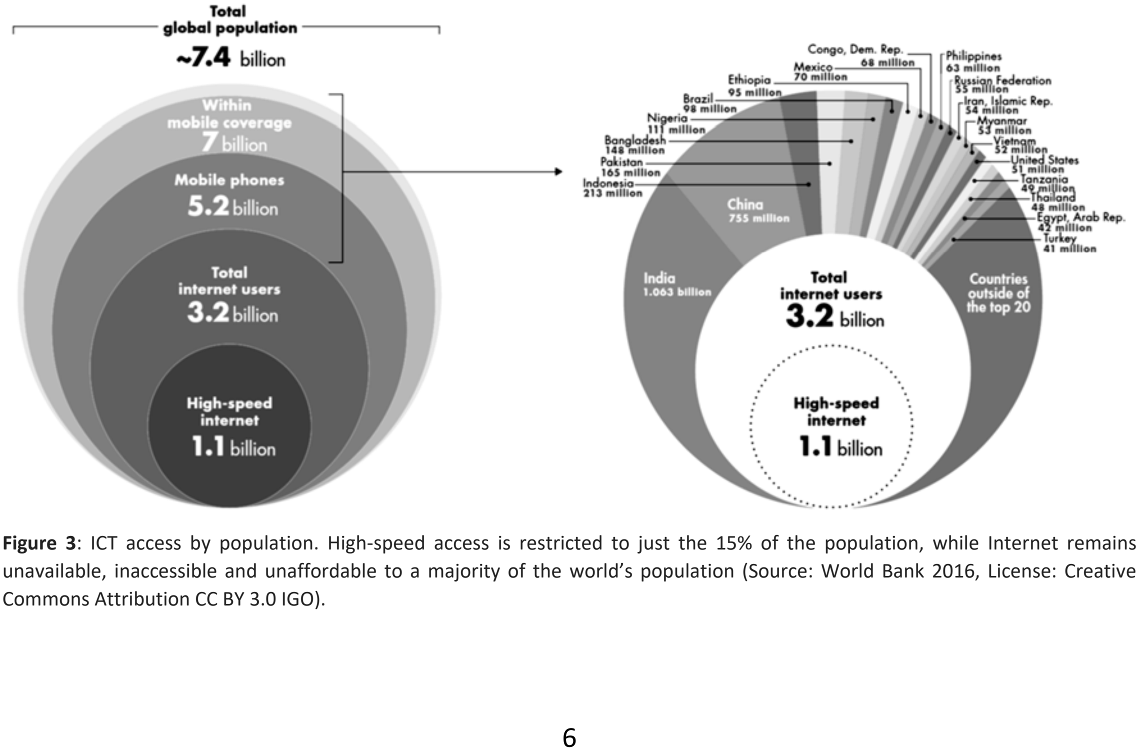


Figure 2: Small look at the backbone of the Internet, actually less than 30% of the Class C networks reachable by the data collection program in early 2005. Each line is drawn between two nodes, representing two IP addresses. The length of the lines are indicative of the delay between those two nodes. Lines are color-coded according to their corresponding RFC 1918 allocation as follows: *yellow*: net, ca, us; *magenta*: com, org; *light blue*: mil, gov, edu; *blue*: jp, cn, tw, au, de; *green*: uk, it, pl, fr; *dark blue*: br, kr, nl; *black*: unknown (Source: English Wikipedia).

Figure 2 shows what can be taken as an image of the skeleton of the Global Information Society (GIS), the Internet infrastructure expressed in terms of connected nodes (identified by IP addresses), though only for a part of it. According to the small-world properties, we can actually expect that the mapping of the whole Internet exhibits a similar structure. This topology offers at a time the potentiality to link any Internet node in a short time and the robustness of keeping overall performance before failures. However, is this actually all we need in order to provide connectiviness among two Internet (active) agents? If they know each other, they can exchange their addresses, and for that purpose, the Internet infrastructure provide the alleged potential, but this is not the general case for Internet agent interaction. These are often looking for contents or other agents to do things. As in the story we started with, "the complexity of the underworld they are about to enter […] make that people need to be informed [about what venues they need to enter]"… Here the big-data technologies enter the scene as an essential part of the Internet infrastructure.

However, there are still some issues regarding global connectiviness worth to be discussed. Figure 2 does not show the geographic distribution of nodes which are located for sure at the reach of some active agents. The very idea of the Global Information Society assumes that everybody has the possibility to interact globally through the information infrastructure. But as fig.3 shows us this is not at all the case. The majority of world's population is still actually offline, as shown in fig.3.a. Looking at the expanded information provided in fig.3.b, we can notice that the geographic distribution of the –so to speak– offline continent is mostly located in the so called developing countries. Something we can also observe in fig.4. Here global access inequality is clearly represented, but in comparison to income inequality, it seems to be lesser acute, though just in terms of bare connectiviness, which is of course a primary condition. Indeed the qualification of the information society depends on what is ultimately done online, and this depends, in turn, on who can actually operate digitally. If many people is left aside, online social life will not be so important. Indeed a critical mass is needed to make online life locally relevant, since it can effectively dealt with social issues.

In short, if the global information society is to be inclusive, then the primary condition is to have global online coverage. Although we are not in that situation, one can argue that, according to the trend of the ICT service evolution with respect to other basic services in the arguably called developing countries (shown in fig. 5), there is a reachable horizon of global accessibility. In that respect, we can consider that in order to provide a proper skeleton for the Global Information Society, it is not only bare connectivity but the structural properties of the linking infrastructure as a whole, which also includes the technologies facilitating the finding of proper connections, than matters in the end.

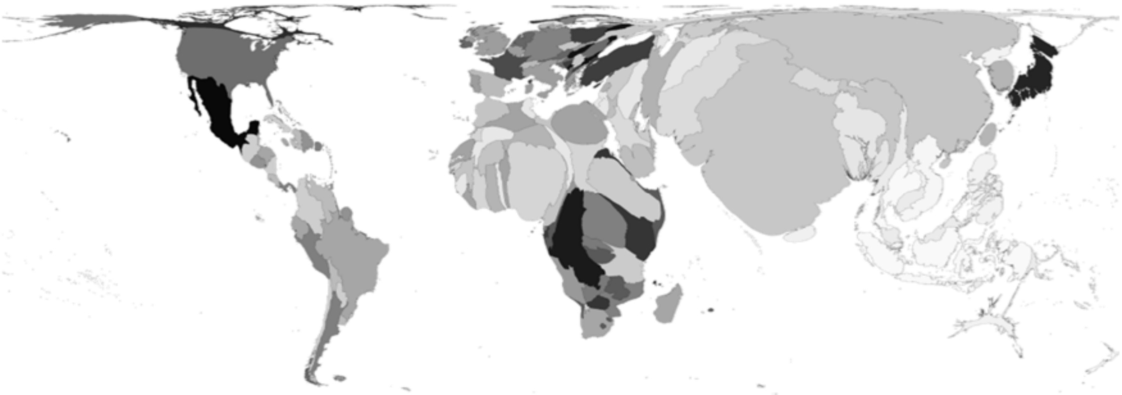


a) ICT access by population

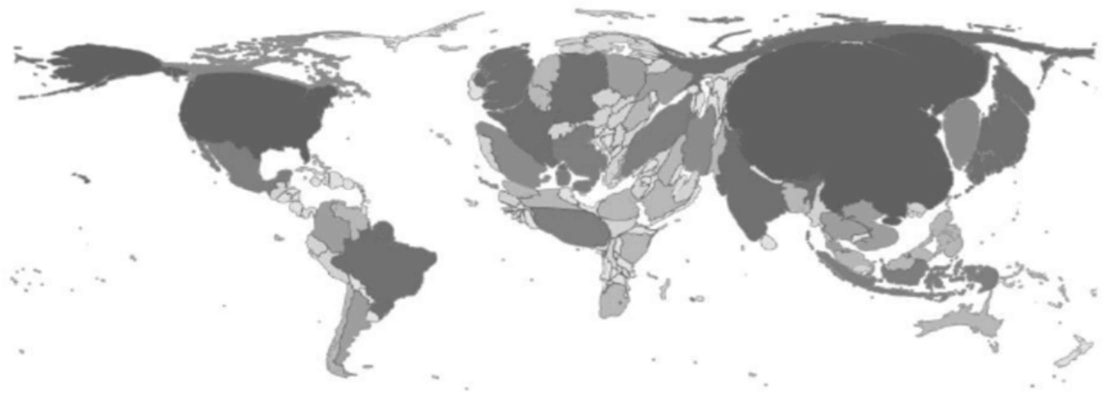
b) A closer look at the world's offline population

Figure 3: ICT access by population. High-speed access is restricted to just the 15% of the population, while Internet remains unavailable, inaccessible and unaffordable to a majority of the world's population (Source: World Bank 2016, License: Creative Commons Attribution CC BY 3.0 IGO).

a) Country size rescaled in proportion to *population* estimate for 2050



b) Country size rescaled in proportion to *internet population* in 2014



c) Country size rescaled in proportion to *national income* in 2014

Figure 4: The Internet is not worldwide distributed as population (comparison between *a* and *b*), but nevertheless more evenly spread than income (comparison between *b* and *c*). Country's size is rescaled in proportion to total and Internet population and national income. In *a*, different tones correspond to dissimilar population growth; In *b*, the darker the shade the higher the internet population; In *c*, the darker the shadow the higher the national income (Sources: World Bank 2016, CC BY 3.0 IGO; worldmapper.org, CC BY-NC-ND 3.0).

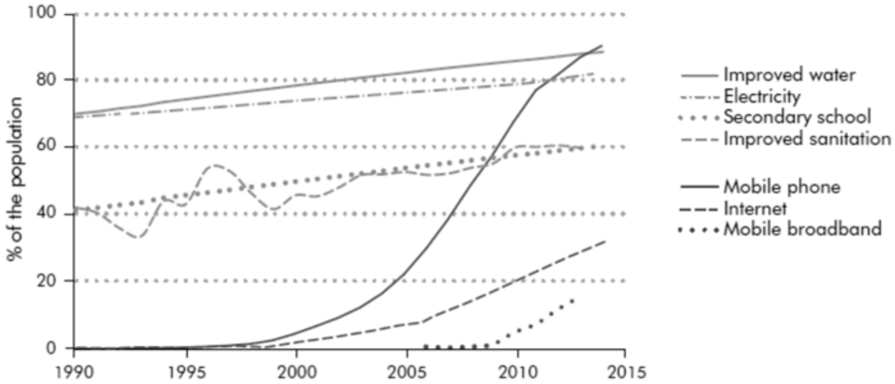


Figure 5: The rapid spreading of digital technologies in developing countries (Source: World Bank 2016, CC BY 3.0 IGO).

4. Qualifying Connectiviness or How Good the Ties Must Be to Be Really Linked

Connectiviness is not all we need to know in order to qualify the value of the interaction among agents, as argued above. *Bandwidth* determines the space of possibilities of the interaction (how much one can affect another), *asymmetry* drives role distribution among actors and the share in decision-making, and *offline likelihood* affects trustworthiness severely and therefore what is ultimately done online. Moreover, the latter will always be paired with the offline activities, i.e. if essential agents cannot reliably operate online (due to either lack of connection or insufficient quality) the interaction carried out digitally will be shadowed. This is, of course, a major issue of the alleged Global Information Society aligned to mere global connectiviness. In that respect neither the relative good news derived from figure 4, or from fig. 5, are enough.

Therefore, beyond bare connectivity (which represents that some internet interaction is just feasible), it is also important to inquire:

(Q1) the quality of such connectivity in terms of the probability that a link between two arbitrary nodes fulfils some minimal requirements to perform proper interaction, $p(Q_{li,j}$ > threshold);

(Q2) the probability to find the adequate internet peer or resource.

4.1 Ability to Operate Online

With respect to Q1, the Internet infrastructure composed by nodes and telecommunication pipes is decisive. Since *bandwidth* and *connection stability* are typically aligned we can mainly focus on the former. Figure 6 shows us that telecommunication lines are extremely concentrated in high-income countries. The distribution of this basic infrastructure actually follows approximately the real traffic telecommunication exchange distribution, due to the fact that in the past two decades new lines have been added following traffic demand very directly. Browning et al (2012) display in more detail how both actual and potential traffic is highly concentrated in the connections among most busy nodes (London, Frankfort, Paris, Amsterdam, New York, Miami, etc., arranged according to 2012 global traffic data); in addition, we can observe that the regional density in Europe and North America with respect to other regions is even higher than income inequality, while peripheral regions, as Latin America or Africa, exchange even more with other regions that with themselves. This represents indeed an important breach in the subsidiarity principle we discussed above as a property that could eventually be at hand of the small-world structure exhibited by the internet architecture. How can this gap be closed? If the offer and demand of ICT resources is exclusively driven by monetary value, as it is in a substantial extent, the used approach to keep pace of customers' demand cannot suffice to satisfy peoples' demand unless there is a minimal equality among people's purchasing power, which is far from being the case. The problem is even worse if we consider that telecommunication rates are more expensive the further away you are from the economic center of the Internet (i.e., where more traffic is concentrated), due to the fact that the corresponding service provider is paying more expensive "transit" agreements to interconnect their networks. In sum, if subsidiarity is to be a regulatory principle of the global information society, then we should enact its positive sense to call for action at the higher level to enable that a minimal equality is guarantee (as a requirement for an inclusive information society) because at the lower level (with insufficient purchasing power) the problem cannot be solved.

A remarkable feature of user digital lines concerns its *asymmetric connection*, i.e., the inward vs outward bandwidth unbalance. That download bandwidth should be higher presupposes that information citizens are primarily consumers (as it is the case of ADSL connections). However from a network perspective it must be a sort of balance among the overall interactions (i.e., information), particularly if under a sustainable horizon we admit some sort of metastability. Balance is breached just locally, at the global level producers must compensate what is being flown into consumers. If we group both kinds of agency, consumers on one side and producers on the other, information seem to flow mostly in one direction. However from the network perspective, information is after all an interaction that is compensated. If the only compensation were monetary, the information flow clearly corresponds to the commodification of cultural assets, in its general anthropological sense, namely, solutions given to social issues of any kind (manufacturing goods, knowing the circumstance, producing beauty, etc.). But this process would extract the creation of information goods from the flesh that ultimately produces it in the end (Fleissner 2006).

Nonetheless, if we pay close attention to the current trends of digital capitalism, many subtle ways that uses the Internet infrastructures have been created during the last two decades to feed from the consumer side the productive pole: several big-data technologies serve to this end, but there is a plethora of crowdsourcing techniques, among which Amazon Mechanical Turk is a good example, to illustrate the trend. Hardt and Negri (2009) characterize this process of global capitalism very clearly:

> *"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." (pp. ix-x)*

Thus, through this process, in which capitalism is using people's creativity and work performance to cast the values, products and services that providers put in the market, we are assisting to a detachment of human activity from people's problems or at least the way to dealt with them have stretched the loop, taking people's hands away from their own problems. Under the subsidiarity principle, the way to manage problems is other way around. First people's hands have to be put on directly, thereafter wider loops of the global net can get involved just to deal with the complexity excess. One direct consequence for an information society based on *cyber-subsidiarity* were a substantial decrease in long distance information flow and the increase of the relative weight of the short-distance one. The overall flow of information would decrease dramatically – measured in bits per second moving along a meter, b·m/s. This is indeed the case of information management in living beings (Díaz 2016): the shortest loops solve most issues through the corresponding information flow. Take, for instance, human motion: afferent and efferent neuronal information regulates "symmetrically" muscles' contraction to fit the coordinated actions of numerous muscular fibres to carry out a sophisticated cooperative action as regular walking. This flow circulates in a loop which is mostly closed at the level of the sympathetic neuronal network located in the spinal cord. Most information flows without any leak to higher network levels.

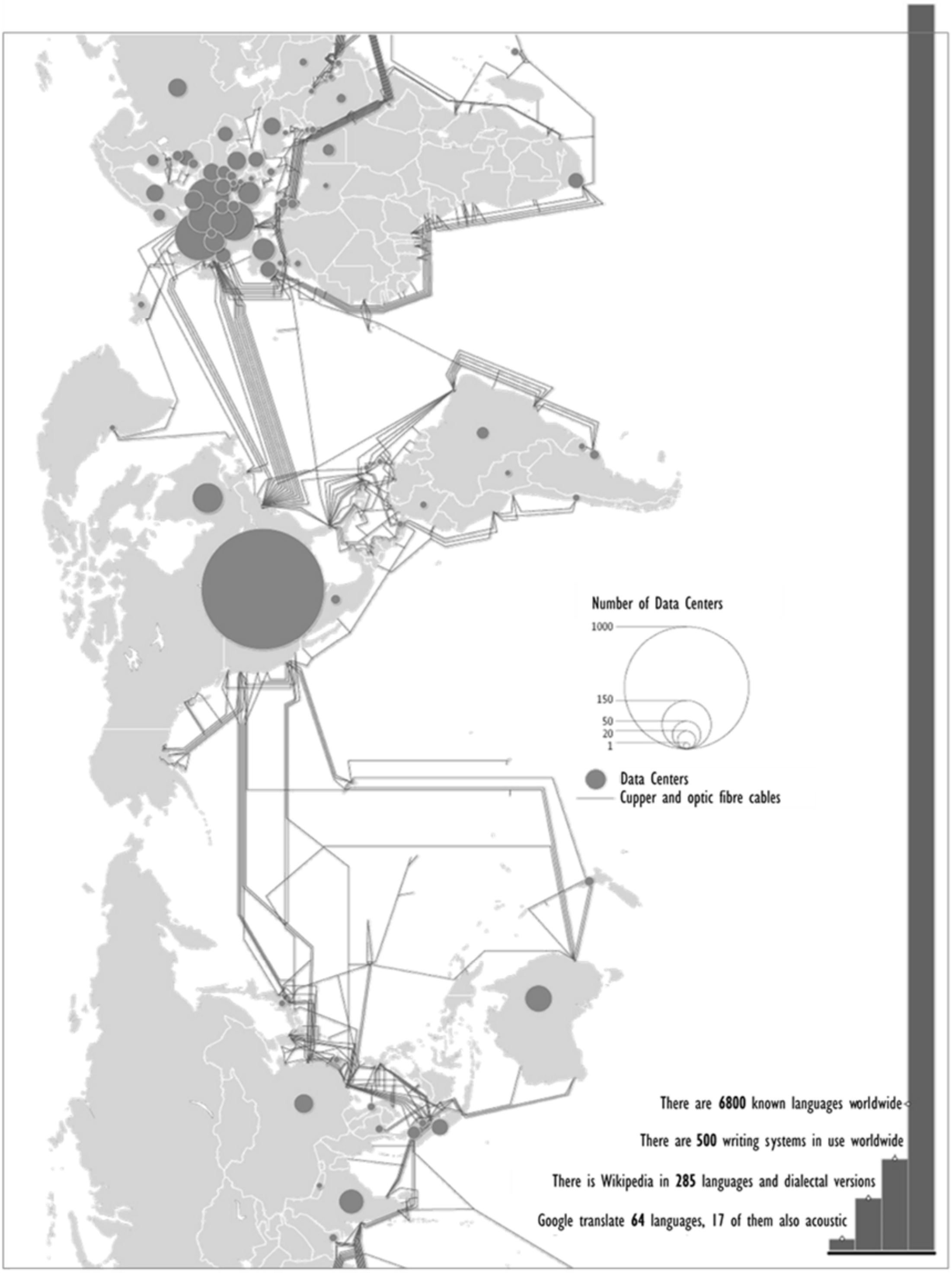


Figure 6: Information Pipes and Data Centers in 2012. Though the representation regarding telecommunication pipes is limited to overseas cables and its relative capacity is not represented, it can be observed that most communication pipes are concentrated among a limited number of nodes, mainly located in Europe and North America. Moreover, most information services as well as data and computing units available in the Internet are not within user devices but in high security infrastructures connected at high speed rates with other network nodes, known as data centers. How much these information services are represented in the language space is illustrated in the right bars, showing that the Internet sphere is dramatically exclusive (Source: Le Monde Diplomatique (2012), CC BY-NC 3.0).

4.2 Ability to Find Resources and Peers

Regarding Q2, the finding of the proper resources or peers is certainly one of the highest concerns in ICT development during the last decades before the unprecedented increase of human capacity to store and to communicate information (represented in figure 7). Even though each user can be a powerful information producer, the required processing and data curation has been put in hands of a few *data centers* as illustrated in fig. 6. Therein we can see how most information services as well as data and computing units available in the Internet are not within user devices, but allocated in high-security infrastructures connected at high-speed rates with other network nodes and highly geographically concentrated, known as data centers which are geared by the big-data technologies. Its role in global economy, administration and resolution of complex social and scientific issues has often been highlighted. Besides, the relevance of this –so to speak– guiding infrastructure is, for our inquiry, similar to the role of the pavilions located in the squares of the weird city of the introductory story: the unfathomable complexity of both the underground streets and the internet backbone, requires that the reach of proper nodes is assisted. Besides several alleged similarities, this situation is significantly different to what could be expected for the worldwide documentation system devised by Paul Otlet and Henri La Fontaine in 1910, Le Mundaneum. Such directory, actualised to today's World Wide Web content, instead of being centralised in Brussels, could be perfectly reproduced in anyone's computer while the search for any resource we were interested in could be easily found using own computing resources. Right after, we could directly access the resource using the address provided by the directory –like the "people going straight to the doors without passing by [the] pavilions." The directory were somehow equivalent to the missing cartography of the underground streets.

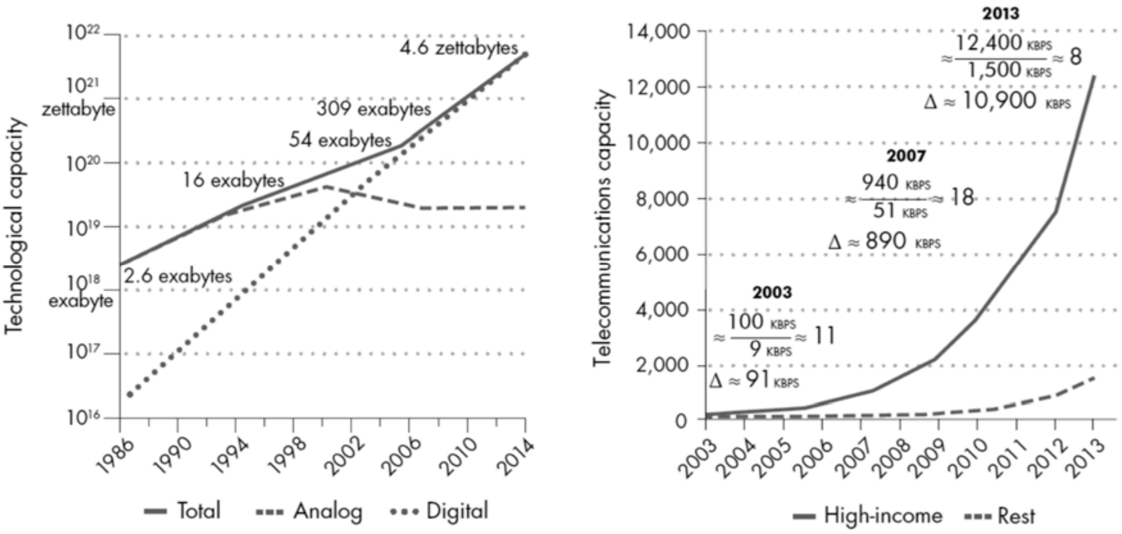


Figure 7: Increase of human capacity to (a) store information and (b) to exchange digital information in high-income countries and in the rest of the world. In both cases the figures considers optimally compressed information (Source: World Bank 2016, License: Creative Commons Attribution CC BY 3.0 IGO).

From the structural point of view, the Internet geared by big-data technologies change in a substantial extent the effective structure of the Internet that we have discussed above and was illustrated in fig.2. In fact, whenever the interacting (active) agent requires big-data mediation, the corresponding network structure turns out to be highly centralized. On the other hand, the activity of the big-data agents is significantly alien to the subsidiarity principle: the bottom level (of data acquisition) is directly connected to the highest level (of storage, curation, analysis and predictive processing) providing meaning affordances and constraints that are used in the making sense of the data which is ultimately top-down oriented and used in benefit of some decision-making process (as far as we know, we cannot devise theoretically unbiased algorithms after all) (Cavanillas et al 2016). There is no mediating upward-downward causation loop in between – closer to where the issues arise – which could contribute to the meaning extraction process. The data is collected massively, but the means to make sense of them are oriented by the need of extracting value from data, which necessarily adopt a top-down perspective. Nonetheless, according to the subsidiarity principle, this approach seems to be appropriate when dealing with global issues which in virtue of their complexity cannot be properly handled at a lower level. Indeed it offers a path to face many sustainable issues of the global information society, as global inequality, environmental issues, and the like, and therefore it may become a pillar to devise a sustainable information society (*cf*. Schwaninger 2015). The problem arises when instead of dealing with global issues the big-data approach is used to gain a competitive advantage when no minimal equality is guarantee. Since its ultimate usage concerns the enhancing of the decision-making, it is clear that an asymmetrical access to these technologies (significantly because of the necessary investment) drives to widening the gap among competitors and moving inclusiveness further away. On the other hand, letting aside intermediate subjects who are closer to the objects under study represents a significant loss in the understanding of problems and concerned reality and consequently a loss in the global problem-solving capacity.

But figure 6 shows us another relevant characteristic of the Internet infrastructure geared by big-data technologies with respect to its potential to become a sustainable Global Information Society. The bars at the right side of the illustration show how big-data information services are represented in the language space. As we can observe, today's Internet sphere is dramatically exclusive: only 0.25% of the languages existing worldwide is acoustically available in the well-known translator resource offered by google, which could be naively seen as a tool for bridging cultural gaps. The relation between language and Internet is worth to be further explored to get a step ahead in our search for a sustainable information society. To this end, we will analyse from a network perspective what the language is for the corresponding community of speakers.

5. Lessons to Learn from the Semantic Network of Natural Language

In virtue of the centrality of language in the development of cultures in the broad sense and therefore in the human evolution with practical independence from genetic change, its corresponding semantic networks offer us valuable clues to rethink the architecture of the Internet infrastructure if it is to become the backbone of the alleged global information society.

A language can be mapped in terms of both a passive semantic network of linguistic elements and the active network of peoples who uses and drives language dynamics. The passive semantic network is constituted by the components of a language (words, syntactic, and semantic relations). Here the underlying infrastructure is constituted by the vocal tract of the speakers and the auditory system of the listeners together with the air that conveys the vibration generated by speakers towards listeners. This can be regarded as the passive network in which languages coevolve with a certain level of interaction.

At our level of abstraction, words (of a language) interact with each other passively. The speaker is needed. She puts them in interaction while making sentences. Through such interaction, namely the relations established among the parts of the sentence, words mean something. Though they always mean it for someone (active agent) who is able to interpret it. Structurally, it holds a kind of democratic virtue: it practically offers to all language users the same space of potentiality, including the possibility to be directly connected to any other user. Figure 1.a can be used to represent the network of words (where the directivity of links corresponds to predicative relations), while fig 1.b represents the network of agents. They are connected to one another through the semantic network of linguistic interaction.

If we consider that speakers utter what is relevant for them, we can map relevance for a given population as the average of actual usage of the semantic network by such population, R_p=E[{R}] (fig. 8.a). The dynamics of social relevance can then be mapped through the dynamics of the semantic network as actualized through the usage of each speaker (fig.8.b). One can say that each speaker possesses a passive semantic network (acquired along her life) which is very similar to the ones held by other speakers (lower part of fig.8.b). The dynamics of her speech corresponds to the dynamics of what is relevant for her while immersed in a communication network. Thus fig.8.a stands for the average of the relevance dynamics represented in the lower part of fig.8.b.

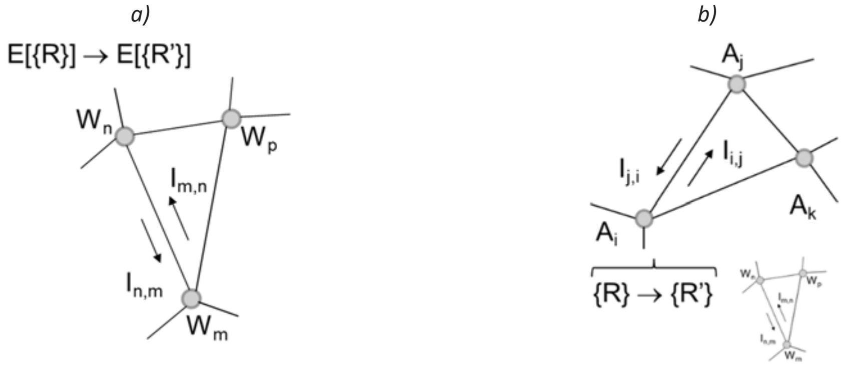


Figure 8. Semantic network as: a) passive network of words (concepts) highlighted according to its relevance in social communication; b) set of interacting agents

In contrast to the people linked through the existing Internet infrastructure, the community of speakers enjoys a space of possibilities (passive network), which is very equally distributed throughout the people and where the communicative acts can be developed. As we argued above, the Internet infrastructure offers a completely unequal space of possibilities for the deployment of social interaction.

Observing the semantic network in more detail, there is a central core of most used words which is shared by practically all speakers, at the same time that we can find clusters of words more connected to one another which are not so equally distributed. For instance, the vocabulary used to describe in detail living beings is mostly known by people associated to life sciences, and it is very tightly connected within words belonging to the same cluster; an even more specific vocabulary just dedicated to animals is more exhaustively known by zoologists, and so on. Since most issues related to a specific discipline are just dealt with among the people involved, the corresponding semantic cluster offers tight connections within itself and is shared by all the people involved. At the same time, enough connectivity is provided with the rest of the semantic network to deal with problems that require a broader intervention. Moving to a broader perspective, we observe language dynamics in permanent adaptation to cultural activities within their environments of evolution. For instance, inuits need referring to a large variety of snow types using different words, while other cultures do not need to be so specific. As we see, it is straightforward to notice that the semantic networks of natural language holds the subsidiarity property we have discussed above (s. section 2).

Regarding the small-world properties, Sigman and Cecchi (2002) have found that for an extended vocabulary of 66000 words, which includes domain specific terms, the average minimal distance between any two words is about 7. In addition, they found out that polysemic words and triangles (closed triplets) distributed all over the place seem to confer critical benefits. Polysemy offers shortcuts that tight the network effectively together. If we take them away, the average minimal distance between arbitrary words turns out to be 11. Concerning triangles, when they start to appear during mother language acquisition, the learning process experiences an explosive growth which can be understood as a sort of emergence of the language ability (Corominas-Murtra et al 2009). Interestingly during this transition, the semantic network acquires suddenly the small-world properties discussed in section 2, which enables the enacting of the subsidiarity principle in semantic development: child's language grows in permanent adaptation to the dealing with issues grouped in thematic clusters. These offers at a time a dense connection within domain vocabularies and a strong linkage to higher hubs (*ibid*). The enacting of subsidiarity can also be seen in terms of systemic emergence from the network: (i) initially the learner grasp a tree-like network of semantic connections that provides a basic linkage between herself and the things surrounding her in an activity language geared by a two-term syntax far away from adult language; (ii) the distance among terms and the vocabulary grows poorly clustered; and, (iii) within the critical transition the clustering grows, distance drops down, linkage and words increases; here the child turns to be able to utter adult-like syntactic structures characterized by its unlimited productivity. In other words, the system of language, able to refer our dealing with the surrounding world unlimitedly, emerges from the set of relations provided by the semantic network. Curiously, this unlimited productivity of language is determined by the *recursiveness* of natural language: the syntactic structures are built through a nesting process of substructures with no upper limit. Thus, as we have seen, recursiveness seems to be a fundamental feature of: small-world networks, subsidiarity (s. sec.2) and language.

Summarizing, there are several lessons we can learn in a network perspective from the semantic network of natural languages: 1st) the language offers a passive network which is very equally distributed among language users; 2nd) language exhibits an evolutionary pattern adjusted to the subsidiarity principle which provides at a time flexible domain adaptation and global connectivity; 3rd) the semantic network of natural languages has small-world properties which seem to be fundamental to the enacting of subsidiarity; 4th) the acquisition of natural language exhibits the sudden emergence of systemic properties driven by the qualitative transition of the network structure from star-like to small-world; and 5th) the unlimited productivity of natural language rely on its recursive nature.

6. Lessons to Learn from Human body's Management of Information and Complexity

As illustrated in fig. 7, human's capacity to store and exchange information has increased exponentially and today's Internet seems to have an unprecedented size with respect to any previous collected information. This bulk, on the one hand, overwhelms individuals; and on the other, encourages corporations, governments and international institutions that struggle to take advantage of it through the big-data technologies as we discussed above. However, if we compare this tremendous information volume with the amount of information that is actually managed in the human body, the apparent giant becomes certainly small. Only the expression of the DNA (which information content amounts about 10^9 bits) to produce the cells contained in your body (about $4{\cdot}10^{13}$ among which most of them have been replaced many times over) corresponds to an information amount much larger than what in fig.7 was termed as "human capacity to store information" (Milo & Phillips 2015). And we have omitted that for the development of many physiological structures like the nervous, or the immunological systems (and of course the bacteria we carry on, which are even more than our own cells), the information provided by DNA is completely insufficient. In addition, the information flow that is being managed in the body is definitely broadband. For instance, only the replacement of the red blood cells requires a flow of some 10^{16} b/s. Besides, there are lots of information corresponding to regulatory, metabolic, and productive interaction at the level of the cells and below. Before all this information flow circulating in ourselves is not astonishing that we can quietly contemplate a beautiful sunset?

The key for this quietness in the contemplation of the sunset relies on the physiological architecture of our organism which enacts as we will see the subsidiarity principle. In fact, Stafford Beer (1994) devised his Viable System Model, which corresponds to a systematisation of subsidiarity, from the observation of the information and complexity management in the human body. Let us see Beer's analysis of the human organism. According to him, human body can be seen as primarily composed by three interacting parts: (i) the muscles and organs, (ii) the nervous system and (iii) the external environment. The first part is being concerned with the primary activities, i.e., the basic interactions with the environment and it is regarded as a solidary network of *operational units*. The second part 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 operational units). And finally the *environment* refers to the parts of the outside world directly relevant to the organism, namely, in direct interaction with it – be it immediately or in the foreseen future (see fig. 9).

Though the three parts are dynamic, there is a balance among them whenever the organism is in a sane situation. This means that the three parts are constantly adapting upon each other: (i) the muscles and organs adapt in a way or another in relation to the physical interactions with the outside, the metabolic activities, and the constant exchange with the nervous system; (ii) the neuronal and mental processes performed to regulate the organism, its activities, and metabolism conforms the constant adaptation of the nervous system in relation to the sensing interactions with the outer and inner environments, as argued above and elsewhere (Díaz & Zimmermann 2013, 2013b); and (iii) the environment is similarly adapting according to organism's activities (for instance, some living beings run away, some others cooperate, and others play against).

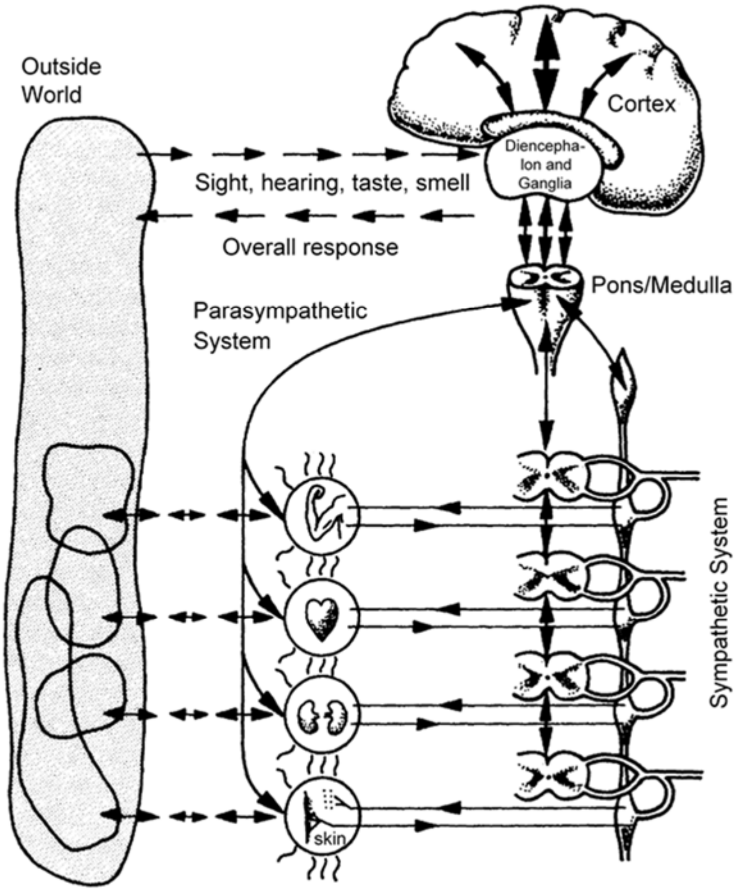


Figure 9: The human organism from Stafford Beer's cybernetic perspective can be regarded as being primarily composed by (i) operational units (muscles and organs) inscribed by circles; (ii) the nervous system which in turn is composed by the sympathetic system, the base brain, the diencephalon and ganglia and the cortex; and (iii) the environment (Illustration elaborated from: (Beer 1994, p. 131)).

The articulation of the human's nervous system, as proposed by Beer (1994), is particularly relevant to understand his model for the management of information and complexity. 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 the resolution of conflicts;

System 3) the base brain, including pons, medulla, and the parasympathetic system, 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 learned shows us that most information actually circulates at the level of system 1, particularly if we include 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 to regulate through information exchange with the higher nervous system, but in most cases this only embraces 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 only 100 b/s or less while, in contrast, the bandwidth of the information managed in the retina is about 6 x 10^6 b/s (Anderson 2005; Norretranders, 1998).

We can still move to a lower level to observe, for instance, that the simple contraction of a muscle fibre corresponds, at the level of the cell, to a number of metabolic interactions among the constitutive parts of the fibre which complexity is higher than the afferent/efferent exchange to regulate the contraction. And we can go even deeper if we focus on the inner activity of the subcellular organelles within the eukaryote cell. Whenever we deepen an additional level, the overall information flow at the lower level is larger. Towards higher instances, few information percolates.

This reduction of information flow from the lower to the higher regulatory bodies corresponds to a distributed and autonomous management of operational complexity and simultaneously the percolation of only 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 fibres will only circulate at the lowest level, in which the corresponding network of synapsis has 'learned' 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 (Beer named this type of percolation as *algedonic,* stablishing a symbolic relation to pain, *ἄλγος*, and pleasure, *ἡδονή*).

All in all, the biological management of information shows us that it is possible an intense alleviation of information flow and the coping with a maximal complexity thanks to a proper hierarchical architecture (or rather heterarchical as we have just seen) composed at each level by a network of relatively autonomous agents, whose cooperative actions are oriented to the resolution of issues at the lowest possible level, and the coordination of actions among the parts. This architecture clearly endorses the subsidiarity principle, offering additional clues to cope with global complexity in the information society. Therefore we take it as the model for cyber-subsidiarity.

In comparison to the big-data approach discussed in section 4, we observe here that information only percolates if it becomes relevant for the overall operation, therefore value is directly guarantee in benefit of a more appropriate decision-making. By these means the whole is able to coordinate action according to what is most relevant for the present and future adaptation to the environment, therefore guaranteeing sustainability of the whole and the parts.

7. Cyber-Subsidiarity as a Backbone of the Global Information Society

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 multinational. National life is more and more entangled with international relations, and cannot be conceived anymore with our backs turned to intercultural populations, and 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, and ethics and politics become more entangled than ever. Anthropology, ethnography, and intercultural ethics has shown the fragility of such pretentious positions whose social and political correlate is bureaucracy. The realm of goals is fixed therein and the effective pathway to achieve them seem to be at reach of its rational determination. The efficiency of this paradigm for the organization of the industrial enterprise and the state has been indeed a decisive factor for the extension of its power. Just the rational determination of means implies a substantial reduction of complexity driving to an efficient performance of the prescribed actions and goals. Observe that the praiseworthy precursor of the big-data data approach corresponds to the gathering and processing of statistical data for the organisation of the bureaucratic state and enterprises since the 18th Century and it was within this endeavour where the computing and information technologies were pushed forward (Mattelart 2003).

As we discussed in section 4 regarding big-data, the upward flow of data to the center, where the meaning and value is produced, as well as the downward flow of its application evades the conscious intervention of the intermediary agents and therefore the participation of the peoples in the decision-making. If this is the case, are not we reproducing through the big-data technologies the bureaucratic approach to a magnified scale? When we have confirmed that this organizational paradigm accumulates unsolved problems, we must encounter a different way of diminishing the complexity at the level of the human agency and all the way up to the global scale. Is not possible to make sense of information and computing technologies in a direct assistance of human autonomy and in benefit of people's democratic participation while looking for a global sustainable horizon?

Let us see whether the fulfilment of democratic sustainability is actually feasible from the local to the global scales, considering an account of democracy beyond the common nominal use of the term, in the vein of *qualitative democracy,* particularly as conceived by the *Quadruple Helix* model (Campbell, Carayannis & Rehman 2015). Democracy since its Greek roots is conceived as linked to both equality and liberty (In Aristotle, these principles are aligned with the ethical virtues which in turn stem from the very human nature; *cf.* Aristotle 2004, VI, 2): equality with respect to the capacity to decide upon available common options and 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 guarantee 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" (OECD 2009: 146). As we saw in sec.3 (fig.4.c), the global information society is far away from such situation.

In historical perspective, it can be observed indeed 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 of the citizens during the decades following World War II (Milanovic 2009). But since the 1980s, we observe within these countries a general increase of national inequality, as well as between EU countries, which provides a clue to the often highlighted EU democratic deficits (Díaz Nafría 2014; Díaz Nafría et al. 2015).

To this respect, it is remarkable to recall that, though the *principle of subsidiarity* was first proposed in the context of the early Calvinism, it was the striking increase of inequality in the early industrialized societies what brought the principle to the fore of sociopolitical concern. In the XVI century, Althusius developed the concept in the milieu of the Calvinism communities immersed in a Catholic empire as to preserve their autonomy while enabling symbiotic relations with the larger society. However in the industrialized areas of the 19th century Europe, it was the dramatic increase of observed inequality and the subsequent arisen contradiction between work and capital that made evident the undermined autonomy of the many and consequently the inability to accomplish the principles of democratic liberalism. In this context the principle of subsidiarity was developed and incorporated into the socio-political agenda (Nell-Breuning 1990). It progressively became a fundamental principle of democratic liberalism and a pillar of the Catholic Church social doctrine, and it is now one of the foundations of the EU, who has coded the principle as a pillar of the Union itself (EU 2008: art.5). Internationally the principle has been coded as a foundation of decentralization and co-responsibility (UN 2014) 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). This is in fact what underlays the aforementioned organization of organisms devised by Stafford Beer in his search of the principles of any sustainable organization.

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.

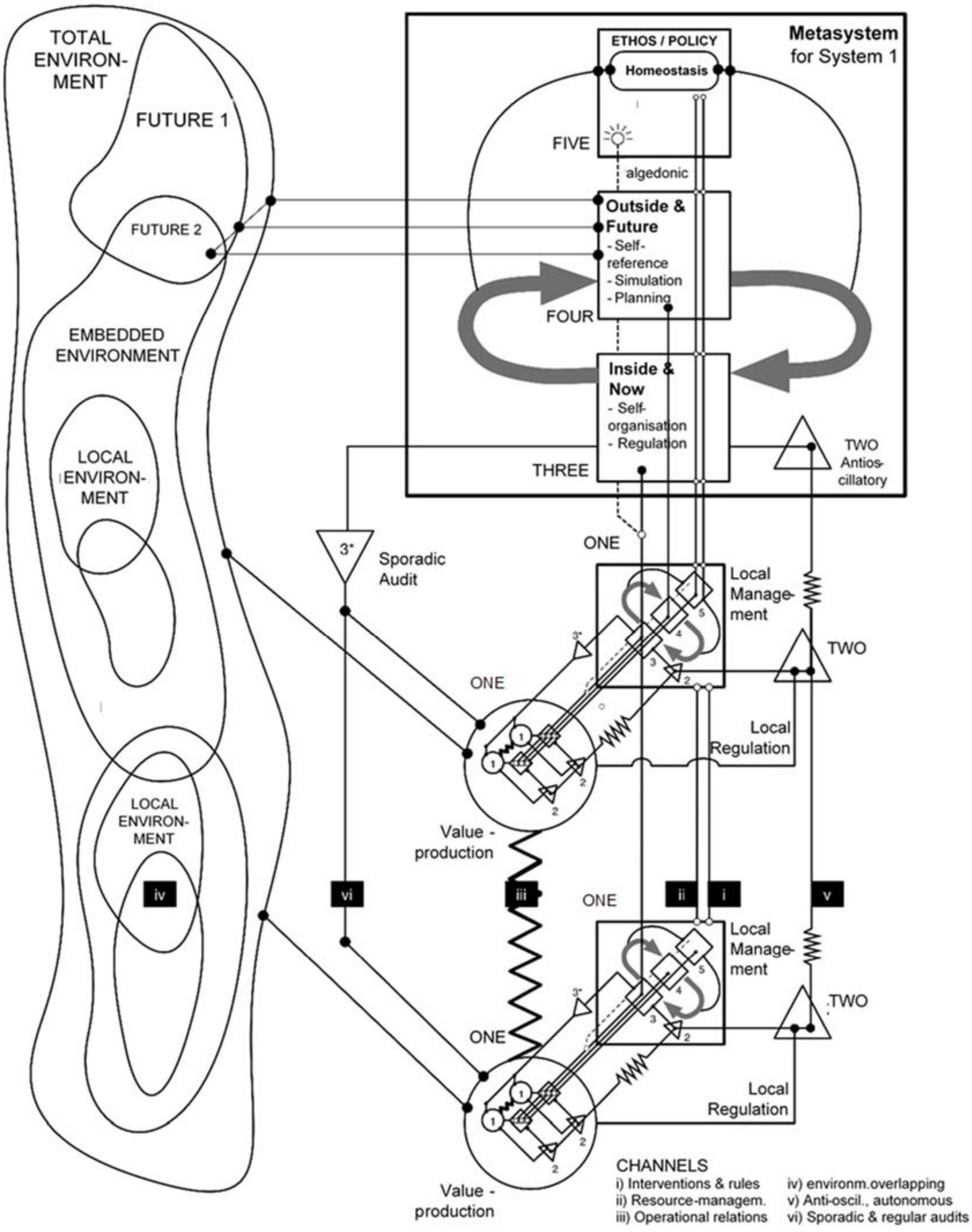


Figure 10: Stafford Beer's Viable System Model (cybersubsidiarity) for any sustainable organisation. Its recursiveness is explicitly represented in System 1. System 3* correspond to an extension of System 3 to enhance its knowledge about System 1 performance in order to provide a better regulation. (Illustration elaborated from: (Lambertz 2016))

As we can observe in Stafford Beer's Designing Freedom (1974), his positions clearly stands for the development of a completely new way of making sense of computing and telecommunication capacity as a means to overcome the bureaucratic paradigm in the benefit of both deploying freedom and the coping with complexity. By these means, he envisions a reconciliation of ethical and political action superseding the limitations of the liberal ethics and the bureaucratic organization of economic and political life. As we saw above, he learned from biology the lesson of how to deal with complexity, deriving the fundamental and necessary structure depicted in fig.10 that any viable system – able to constantly adapt to its environment – should hold (Beer 1994). The functionality of Systems 1 to 5 are the direct correlates of the ones described in section 6. In short: *System 1*) autonomous and mutually adaptive operative units; *System 2*) coordination and conflict management; *System 3*) strategic planning and optimization; *System 3**) auditing of system 1 performance; *System 4*) long term planning; and *System 5*) ethos and normative management.

The model relies on two fundamental principles (Beer 1981): (i) *Ashby's law of requisite variety* and (ii) the principle of *recursiveness*. According to the first principle, the capacity of System 1 has to be balanced with the framework of operations that it assumes, leaving a sufficient leeway and guaranteeing that the only variety (complexity) left corresponds to what is better achieved at a higher cooperation level. The recursiveness is an obligated counterpart of the former principle in order to distribute the coping with a complexity which is much higher than what a reduced number of autonomous agents can perform. Downwards, the levelism stops at the agency that is taken as the model of sustainability (namely, the human), but upwards it is in principle unbounded. We can symbolically express the recursive structure of the VSM as:

$$\mathrm{VSM} \overset{\mathrm{def}}{=} \left\{\{\mathrm{S1}\}, M \,\middle|\, \mathrm{S1} \overset{\mathrm{def}}{=} \mathrm{VSM};\ \mathrm{M} \overset{\mathrm{def}}{=} \{\mathrm{S2}, \mathrm{S3}, \mathrm{S3}^*, \mathrm{S4}, \mathrm{S5}\}\right\}$$

Similar to the unlimited productivity of the language, argued in section 5, this property enables its application to an unlimited complexity, which management comports the devising of appropriate information channels (as illustrated in fig. 10). The success of this architecture has been 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 (Medina, 2012). This had the objective to connect people's issues and decisions at the lowest but most notorious level with state management at the highest, through an appropriate levelism in which relevant information (and particularly the algedonic one) percolates from one level to the next. 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 (referring to the distinction coined and advocated by Joseph Nye (2004)) 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 9/11th of 1973 (Díaz Nafría, 2011; Medina, 2012). The case is of significant interest, on the one hand, because it addresses at a time the question of developing individual liberty and the coping with global issues and, on the other hand, because it has been extensively documented particularly since Medina's book (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 argued above. Fortunately, the scalability of the organizational core model of subsidiarity, stemming from its recursiveness, is capable to address the additional complexification that should be dealt with in order to handle *cyber-subsidiarity* at a global scale, which is in fact the level that is needed to enact sustainability properly (Díaz 2011; Díaz Nafría et al. 2015, Schwaninger 2015).

8. Conclusive remark

Looked through the glass of the *Quadruple Helix* model (Campbell, Carayannis & Rehman 2015), we can easily observe that the cyber-subsidiarity model provides sound means for the development of qualitative democracy at the Global Information Society in its four dimensions, namely, freedom, equality, control and sustainability. Consequently, the cyber-subsidiarity model serves as a regulatory account to boost a decent global information society, particularly concerning the requirements that the global information infrastructure, discussed above, should meet. With respect to the structural requirements of the links connecting the parts of the cyber-subsidiarity model (fig. 10), it is quite clear that the backbone of the global information society critically analysed in sections 3 and 4 lacks significant components. First, the positive account of subsidiarity has to be strongly claimed as to achieve a proper universal coverage in terms of an equalised capacity to operate. Second, the information that should percolate from the links belonging to clusters at a given level (arranged in operational networks) to the higher level is just information that is relevant to the operation of the higher level (frequently obtained as nonlinear aggregates), while the information concerned with the issues attached to an specific cluster is just shared within the cluster. By these means a proper control is provided from the lower levels to the higher ones (through accountability and participation), and at the same time that autonomy is preserved, sustainability fostered (through responsibility and adaptability), and information flow significantly alleviated. Third, forecasting capacity should be placed not at the highest level, as in the big-data model, but distributed throughout the different scales from the local to the global. This enables a distributed tackling of global issues, and subsequently a substantial alleviation of what is to be dealt at the global level, at the same time that general sustainability is achieved in virtue of an enhanced adaptation capacity at all levels of concern.

The structural similarity between the small-world (and scale-free) network exhibited by the Internet backbone, and the cyber-subsidiarity model, offers a convergent path for the development of the later. The evolutionary benefits of the scale-free networks in terms of trustworthy connectivity and robustness, as observed in linguistic or biological networks, are worth to be keep, but not to the expense of the necessity that they supposed to be responding to. Namely, the connectivity of all peoples with an equalised capacity to operate. However, if the market, driven by financial capacities, keeps on offering the basic mechanism to the deployment of the Internet, this can never suffice to meet the objective unless a minimal equality is achieved. Consequently, a global and conscious endeavour – not driven by the market – to boost cyber-subsidiarity would offer the double-faced benefit of promoting global qualitative democracy (including the four dimensions mentioned above) and rationalising the development and costs of the ICTs infrastructures (alleviating the global information flow – as observed in the organisms, section 6 – and shaving the huge investments devoted to the big-data projects).

In contrast to the weird city we depicted at the beginning, in an allegorical city corresponding to the cyber-subsidiarity model we would not see the small pavilions used by the people before leaving the squares; the visible streets between near squares would be mostly populated; some squares were highly connected to others in each quartiers and these to others of the city center, etc. Probably it could also be hard to acknowledge the semblance of this city from any other one we have experience of, but just considering the fact that the people seem to be able to move around by their own, we have the feeling that this must be a better place to live.

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