# Systems unexpectedness, flatness and counterproductivity

by Nicola Labanca

## Preamble

David Cayley's latest book is an invaluable source of knowledge on Illich's thought and life. It will very likely remain a fundamental reading for future generations interested in this important intellectual, in how his thought developed during his lifetime, and in his important legacy. In his book, Cayley not only provides clear explanations of concepts that are keys to understanding Illich but also offers his own deep reflections on a large number of central questions that Illich seems to have intentionally framed in a way that allows readers to continue his research. For this article, I would like to take up the concept of *systems* by discussing views and perspectives that might contribute to further develop those I have found discussed in Cayley's book and Illich's publications.

Constraints of length prevent me from extensively recording the precious insights offered by both Cayley and Illich into how systems mark the beginning of a new and extremely disembodying age for contemporary societies. What I will do here is just to reflect 1) on systems aspects I have *not* found discussed in Cayley's book and 2) on how these aspects might allow contrasting the condition of counterproductivity that Illich associated with the large-scale diffusion of instruments or tools with the new condition of systems or systemic counterproductivity. These aspects seem to me particularly important at a time when systems

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are probably taking us to a regime of deep uncertainty and destructive instability. New technologies and crises appear to create a permanent and qualitative change in the form of the social structure. From pandemics to climate change, artificial intelligence, and cyber wars, small local or regional perturbations are able to unexpectedly propagate at planetary scales with unforeseeable consequences. In my opinion, this transformation in the degree and kind of connection between parts of the global social structure are closely linked to transformations occurring in techno-science under the aegis of complex systems science and reflect same underlying social imaginaries and strategies conceived to cope with increasing uncertainty.

Hence, I will start by focusing on some insufficiently acknowledged features of *complex systems science*, as developing since mid-20th century. Although certainly not representing an integrated and consistent body of thought, complex systems science exhibits some key features that emerge from its roots in cybernetics studies on the design and application of same control mechanisms in the animal and the machine and from information technologies generated through these studies. The description of these key features shows, among others, how complex systems science attempts to encompass and integrate the so-called hard and soft sciences while going beyond them.

Complex systems are simultaneously the object of investigation of complex systems science and the outcome of a specific, recent, and still on-going social construction. Accordingly, I believe these features can also indicate something relevant about where societies are currently heading. For example, they allow understanding how, in the age of systems, science and societies have consciously started exhibiting a condition of general and permanent contradiction or "*anomia*" (*i.e.* of absence of law). In so far as it corresponds to a condition of creativity and liveliness, *anomia* is probably not a bad thing *per se*. Nevertheless, with systems, *anomia* is achieved in a general situation of indistinctness and unlimited power where science and societies seem capable of any kind of manipulation and hybridization involving inanimate objects, humans, animals, and other natural beings at a planetary level.

To resist and contain this dangerous and destructive trend might require the extensive practice of a complementary type of relationality compared to that impressed in systems. As I discuss in the final section of this article, relations that people entertain within systems rely on deep processes of homogenization that are the outcome of techno-science assumptions concerning how all natural entities generate from an original sameness and produce, among others, the suffocating sensation that we are all living in a same world while consuming same resources and depleting available natural resource budgets. The complementary type of relationality I refer to assumes instead an original diversity and irreducibility between beings entering in relation and is therefore intrinsically self-limiting. In this respect, Illich's and Cayley's reflections are extremely enlightening, and I hope to be able to address this last point in a future essay.

## Unboundedness and unpredictability of systems

The first two key features of complex systems science can be grasped by observing how it can, in principle, deconstruct the laws of physics and employ information theory to that end.

Thanks to Stuart Kauffman[1] I have realized one sim-

1 See e.g. Kauffman, S., 2000. *Investigations*. Oxford University Press or the youtube video entitled "What's Life? Answering Shcrödinger" https://www.youtube.com/watch?v=xUSRUKOAQ7w

ple and very general fact that neither my university teachers of physics fully addressed nor several physicist colleagues of mine have fully grasped. Take for example, the case of the differential equations whereby Newton's laws of classical physics are expressed mathematically and consider their application to the study of the motion of a set of billiard balls of which you know positions and speeds at a given time. Physics teachers routinely explain that the dynamics of any physical system (*i.e.* the position and speed of all balls at any time in our example) can, in principle, be determined as solutions to the differential equations, provided the system boundary conditions (*i.e.* the space limits determined by the balls and the billiard table in our example) are specified and known *beforehand*; it does not matter whether these boundaries are assumed to be fixed in time, as it is the case of the billiard table, or if these boundaries vary over time in predetermined ways.

In so doing, these teachers implicitly convey the message that given boundary conditions are always definable for any natural system and that the application of the Newtonian laws is therefore universal.[2] In so far as it omits to address important cases where the application of these laws is not possible, this approach is however certainly reductionist. It does not include all those cases of systems dynamics where boundary conditions cannot be known beforehand or where boundaries are under construction or under destruction while systems dynamics are developing.

2 It might be objected that boundary conditions are not always needed to define systems dynamics. Newton's laws seem applicable also in an empty space and tell us that, in the absence of external forces, material bodies either remain in a static condition or move along straight lines at constant speed and/or rotate at constant angular speed around their center of mass. However, boundaries are also implicated in this case, since no material body can be defined without a boundary between this body and its external space. In the example of the billiard balls, boundary conditions not only define the billiard table, but also the balls!

The 'wicked questions' that these teachers avoid in this way include: how can the evolution of systems whose boundary conditions cannot be known beforehand be possibly studied? and what happens in the case of natural systems whose boundary conditions depend on the systems themselves that are, therefore, inseparable from their environment? This last is for example the case of billiard balls bouncing against the border of a billiard table while this border is assembling or is collapsing, or the case of species evolving in relation to their environment while the environment evolves in relation to them.

The first question may refer to situations where boundary conditions could, in principle, still be identified but are either simply not known or cannot be guessed with sufficient precision. The second question puts instead the very idea of definable boundary conditions into doubt and suggests the need for other approaches.

Contrary to what the example of the application of Newton's laws might suggest, the questions concerning unknown, unknowable, and mutable boundary conditions are very general and not limited to the realms of classical physics. They also apply to the probabilities used for risk calculations, quantum physics, statistics, genetics, and more. For example, the energy conservation principle, and thermodynamics laws in general, require a predefined space wherein they can be applied and verified, and this precondition must be fulfilled both by equilibrium and non-equilibrium thermodynamics, as investigated, for instance, by Ilya Prigogine. Analogously, probabilities and quantum wave functions can only be defined when the set of all possible system states can be established beforehand in such a way that the sum of probabilities over all these states equals 1. In case of human body genetics, such bounded space of options is then for example represented by the huge but limited number of combinations of the

20 amino acids that make up all possible proteins and by the sequences of bases in the genes that encode these proteins.

This necessary condition of knowable boundary conditions is so general that it is probably not wrong to conclude that it concerns any science and research field which employs mechanistic or probabilistic laws to study systems evolutions. However, it also implies that the calculations and quantitative estimates based on the application of such laws are nonsensical if a predefined space of possibilities cannot be identified with sufficient confidence.

The assumption of a bounded space of possibilities also explains the primacy of information and information theories over energy principles that has come to be implicitly acknowledged in scientific explanations of the generation of systems dynamics of various kind (pre-existing boundaries and constraints can indeed always be associated with some sort of pre-existing information).

One of the merits of complexity science is that it has led to the acknowledgement that systems and situations where the application of mechanistic and probabilistic laws may be highly misleading are routine. Although complexity science abstractly describes these systems and situations as concerning aggregates made of many entities in strong interactions, such descriptions only indicate that 1) these are aggregates where interactions prevail over entities themselves and that 2) these strongly interacting aggregates are being studied in a phase when these contingent entities and their defining boundaries could either be still under formation, or in dissolution, or could not be known with sufficient precision.[3]

3 Concerning this last point, it might be interesting to note that systems boundaries are implicated also in cases where complexity is associated with non-linear dynamics and chaos generated by uncertain knowledge of the initial position of systems' strongly interacting constituents. Uncertain knowledge of initial positions can indeed be assimilated to uncertain knowledge of constituents' *boundaries*.

In this way, complex systems science appears to leave behind the world where deterministic and probabilistic laws are applicable and enters a wider world of evolution and change where these laws represent just a particular case. In such a world of deep uncertainty and unpredictability, the bounded condition necessary for application of scientific laws can even appear as an oddity deserving inquiry.

The interesting thing is that this shift and enlargement is typically accomplished by assimilating human beings to non-human beings, dead matter, and machines and by assuming that their creation and evolution can be studied according to same principles. By addressing the question of how stable boundary conditions are generated in the universe, complex system scientists typically presume to be able to explain evolving life and the evolution of the material universe according to same principles. And the answer they generally give is astonishingly simple: life and inanimate matter are both generally assumed to be created and evolve through endogenous and self-recursive processes, which is to say, that life, matter, and boundary conditions are assumed to be *self-generated*.

Rather than accepting the limits to knowledge rooted in the ignorance of how boundary conditions get constituted, complex systems scientists generally presume to overcome these limits by replacing unknown boundary conditions with known processes that operate in both the machine and the animal.

By addressing the question of how stable boundary conditions are generated in this way, these scientists apparently situate themselves in a world of continuous change and disequilibrium where stability, substance, or permanence are the contingent and temporary outcome of *recursivity*. This can be verified by examining some definitions of complexity provided by its proponents: (i) a resonance between "a recipe inducing processes and processes inducing recipes"[4]; (ii) a resonance between "DNA making metabolism and metabolism making DNA"[5]; (iii) a process of self-organization driven by "informed autocatalytic loops"[6]; (iv) a process of self-organization "closed to efficient causation", i.e. a process that, rather than being the expression of efficient causation, is about expressing a final cause about reproducing itself and making itself more adaptable[7]; (v) learning about the validity of beliefs by using them to guide action[8]; (vi) "a difference that makes a difference."[9]

All these definitions implicitly show how complexity implies a world of self-recursive processes (also known as feedback loops) where all stable entities are created and destroyed through these processes. Reminiscent of the dizzying effects generated by Escher's drawings and Baron Munchausen tales of pulling himself out of a swamp by his pigtail, complexity science directs attention on the processes of construction and destruction rather than on the elements from which edifices are built and demolished in the world. However, as my initial considerations aimed to point out, unbounded entities reducible to processes can occur in completely unpredictable ways that escape all foresight.

4 Simon, H.A., 1962. *The architecture of complexity*. Proc. Am. Philos. Soc., 106 (6), pp. 467-482.

5 Prigogine, I., 1982, *From being to becoming*, Brit. J. Philos. Sci., 33 (3), pp. 325-329.

6 Odum, H.T., 1971, *Environment*, Power, and Society, Wiley-Interscience, New York.

7 Rosen, R., 1991, *Life Itself: a comprehensive Inquiry into the Nature, Origin, and Fabrication of Life* Columbia University Press.

8 Pattee, H.H., 1995. *Evolving self-reference: matter, symbols, and semantic closure.* Commun. Cognit. – Artif. Intell., 12 (1/2), pp. 9-27

9 Bateson, G., 1972. *Steps to an Ecology of Mind*. The University Chicago Press.

## Systems flat ontology

In a complex world of unbounded entities that contingently emerge and dissolve into processes, hierarchies assume this same ephemeral quality. De-constructability of hierarchies represents in my opinion a third key feature of complex systems emerging in contemporary societies. The concept of "panarchy", as developed by Gunderson and Holling, provides an example of how this condition can be assumed to be achieved.[10] Panarchy proponents explain how complex systems of people and nature are dynamically organized and structured across scales of space and time through sets of nested adaptive cycles and how hierarchies can be the outcome of processes propagating between the large and small scales. Representing how hierarchical levels in socio-ecological systems can operate at own paces, "protected from above by slower, larger levels but invigorated from below by faster, smaller cycle of innovation",[11] panarchy accommodates creativity with conservation and allows deconstructing any spatial or temporal hierarchy, scale, or macro/micro distinction into processes.

Contrary to what sometimes assumed by complex systems scientists,[12] the fact that all entities and hierarchies populating complex systems can be dissolved into processes implies that complex systems ontology is actually *flat*. Accordingly, any distinction between humans and non-humans or between animate and inanimate must be considered as the

10 Gunderson, L. H., and C. S. Holling, editors. 2002. *Panarchy: understanding transformations in human and natural systems.* Island Press, Washington, D.C., USA.

11 Holloing, C.S., 2001. *Understanding the complexity of economic, ecological, and social systems.* Ecosystems, Vol. 4:390-405.

12 On this point, see e.g. the discussion presented in Cilliers, P., 2001. *Boundaries, Hierarchies and Networks in Complex Systems.* International Journal of Innovation Management, Vol. 5, No.2, pp. 135-147

contingent outcome of history and evolution. Most likely, it is complex system science's roots in cybernetics that plays a key role in this respect. The identification and equivalences between humans and non-humans are established through the cybernetic assumption that the same control mechanisms are at work in both the animal and the machine, the stable parts of which are, e.g., the space of possibilities constituted by the sequences of bases in the genes that encode animal proteins and the space of options constituted by information stored in computers, respectively.

The flat ontology of complex systems is a particularly important feature that connects complex systems science to some important branches of contemporary sociology notably the approaches inspired by actor-network theory as developed by Bruno Latour and by social practice theories informed by Pierre Bourdieu.[13] Both the actors populating Latour's networks and the practices constituting the social of social practice theorists are indeed completely decomposable into pure action/performance/process according to interpretations that can hardly be distinguished from those provided by complex systems science.[14] As further argued below, it then follows that the assumed flatness of systems ontology means

13 Relational and process thinking associated with complex systems science can, for example, be seen constantly at work in Latour approaches when he deconstructs *actors* (i.e. stabilized competences) into *actants* (i.e. unstable performances), or when he deconstructs texts taken from the fields of humanities and science to demonstrate that same processes of social construction are at stake in these two fields (see for example Latour's lecture entitled "*How Better Register the Agency of Things: Semiotics*" and available at http://www.bruno-latour.fr/node/562.html), or when, in his book "Facing Gaia" he contrasts Lovelock's interpretation with maternal views of Gaia to argue that the ontology of the Earth system has to be considered as flat by science (See Latour, B., 2017. *Facing Gaia. Eight Lectures on the New Climatic Regime*. Polity Press, p. 101).

14 Latour himself seems to even claim that a *flat ontology* is what implicitly allows distinguishing complex systems science and social science from political theology and what makes these sciences "a science". (see Latour's lecture entitled "*Gaia is not a Figure of Totality*" as available at http://www.bruno-latour.fr/node/589.html).

that complex systems originate from a world of pure activity and sameness rather than, as previously hinted, from a world of constant change and disequilibrium. Disequilibrium and change could indeed hardly be considered as an original characteristic in a complex world where every difference is flattened into processes.

## Knowledge and contradiction in systems

A fourth connected feature inherited by cybernetics concerns how complex systems science relates to logical categories and contradiction in its assimilation of learning and perception processes to biological processes of regulation and to computational processes realized through machines. Gregory Bateson, one of the fathers of cybernetics, has provided enlightening examples ranging from epigenesis[15] to the phenomenology of perception and linguistic to show how single entities, functional categories, and meanings co-emerge from networks of relationships whereby a multiplicity of entities, categories, and meanings are simultaneously defined.[16]

Just as it aims to encompass and go beyond modern science, complex systems thinking also aims to encompass and go beyond Aristotelian categories and the associated law of the excluded third. When entities and (logical) categories become the provisional outcome of recursive processes and

15 As reported in Wikipedia, "epigenesis is the process by which plants, animals and fungi develop from a seed, spore or egg through a sequence of steps in which cells differentiate and organs form".

16 An example from linguistics should clarify: Bateson "maintains that the letter "p" would have no meaning if, for example, it was not part of the word "perhaps". The word "perhaps" would have in its turn no meaning if, for example, it were not part of the sentence "perhaps this is soap". This sentence would in its turn have no meaning without the context where it is stated and this meaning would be different if the sentence were mentioned, for example, in a bathroom, on a stage or within the reasoning presented in this text". See Labanca, N., Editor 2017. *Complex Systems and Social Practices in Energy Transitions. Framing Energy Sustainability in the Time of Renewables.* Springer, Switzerland, pp. 26-27.

relationships with non-entities, the law of the excluded third becomes indefensible (when *A* and *not-A* are the simultaneous outcome of recursive processes, there is no room left for an excluded third). Although this might lead to the conclusion that complex systems thinking generates and resolves contradiction by dissolving it into processes, it rather seems that, in a complex world, contradiction moves from the realm of categories/entities to the realm of processes/actions in a peculiar way. In a complex world made of recursive relationships and couplings, *transitive action* (i.e. action that transits from a subject to an object) and *inaction* becomes indistinguishable because subjects and objects become indistinguishable. When processes overcome substance, action can indeed become indistinguishable from *re-action* to environment inputs. In such a world, individuals might never know whether they are part of a kind of thermostat system (i.e. negative feedback loops) that nullifies their initiatives or of an amplifying system (i.e. positive feedback loops) whereby their smallest and unnoticed actions produce catastrophes.

The peculiar way complex systems science relates to Aristotelian categories is also reflected in how knowledge and learning come to be connected in the extremely uncertain world of complexity. A first and provisional moment of knowledge application, that might be called "categorical" or "normative", represents the moment when given laws hold. A second and more preeminent moment of learning concerns instead the unknowable transformations (for which contingency is typically invoked by scientists) whereby new categories and relations get created through the establishment of new feedback loops. An interesting aspect of this co-constitution of the two moments is the role that information technologies and extensive surveillance play in complex socio-technical systems. Extensive surveillance through information technologies is becoming the major research and social strategy to address the problem of the deeply uncertain evolution of complex systems is faced in areas like public health, weather forecasts, climate change, etc. (if I cannot know how systems will evolve, then it is better to surveil them as close as possible!). At the same time however, surveillance technologies also constitute the retroaction whereby existing categories and identities are becoming more and more provisional and fragile in an hyperconnected world, as for example testified by the continuous update of user profiles operated by learning machines for innumerable purposes on the internet.

In this way, knowledge seems to come to be constituted through a *synchronic* and a *diachronic* moment where the diachronic moment retroacts on the synchronic moment by making it more and more unstable.[17] While logics, statistics, probabilities, and algorithms of various kinds are used synchronically, ever more frequent and strict surveillance is supposed to compensate for what cannot be predicted diachronically. Notice that this same strategy is being progressively applied in earth system science, biology, medicine, and more thanks to the kind of information available with computer technologies, genetic codes, etc. Through this strategy, science seems to face the challenges generated by fundamental unpredictability of complex dynamics by increasing surveillance and updating the field of associated possibilities. Whether it is information in climate change models or genetic information regulating body health, 'information' appears, synchronically,

17 Among other things, this transformation seems to reflect quite well the increasing prevalence of spatial analyses (and the multiplication of maps produced thanks to surveillance and information technology) over temporal analyses in the study of systems change through modelling (e.g. in weather forecasts, genetics, etc.). Surveillance technologies allow ever increasing elaboration rates of data gathered on ever larger and finer scales and models employed to reproduce how change occurs can therefore be ever more frequently adjusted while the type of variables and parameters these models rely on are modified.

to have an instructional value within a bounded options space, while diachronically, it has formative power.

Although the options space is *diachronically* expandable (this expandability being identified by geneticists and cyberneticians with evolution, creativity, and liveliness of the entities they deal with), it must remain or, must be assumed to remain, *synchronically* bounded for the kind of coded information at stake to work. As I have already suggested, it is not accidental that such Neo-Darwinist view of how knowledge progresses coincides with current mainstream interpretations of natural evolution and of the evolution of computer technologies. Advances in complex systems science have been founded on the assimilation of natural processes to the continuously expanding storage capacity and calculation power of information technologies. This assimilation of the natural to the technological is achieved by conceiving systems as a closed options space in the shorter term and as an open options space in the longer term. As also reflected in the flatness and emptiness of its underlying ontology, this close assimilation is however what makes the resulting complexity artificial and radically different from natural complexity.[18] At the socio-technical level, the increasingly uncertain regimes resulting from human-made complexity make its ever-larger options space ever more plastic and unhinged to any connections with truth. At the same time, ever more pervasive surveillance strategies that sustain this development make biopolitical drifts within societies more likely whenever extreme events induced by complexification occur, no matter whether these extremes concern weather, energy supply, human health, or finance.

18 Notice however that this difference is not certainly observable from within complex systems science, as this science typically assumes and proceeds through the assimilation of the natural to the technological.

## Systems counterproductivity

Illich's and Cayley's reflections have helped me better understand systems and complex systems science as co-related social constructions. They represent a shift in the social imaginary of modernity from one centered on such technical instruments as the clock or the heat engine, to one where the computer provides the central metaphor for understanding science and society. If my considerations offered so far can add anything to what Illich already saw 40 years ago, that concerns how socially constructed systems and associated artifacts are forming deeply uncertain regimes characterized by ever more frequent, unique, unexpected, and extreme events of various kinds at different scales. While developing approaches that go beyond those based on reproducibility of observed phenomena and beyond probabilities and risk assessments, contemporary systems science is reframing ideas of objectivity and the subject-object distinction that had characterized modern science until the mid-20th century. In the Anthropocene, the supposed symmetry between subject and object presumed by complex systems science paradoxically demands recognizing the blindness and uncontrollability of human agency on a planetary scale, and the resulting uncontrollable reactions that confer to the Earth system a disquieting and vindictive subjectivity.[19]

Further peculiar characteristics of contemporary systems can be identified by looking at the material side of this human-made complexity and at the changes occurring in the social imaginary around instruments and instrumentality.[20]

Computer technologies through which human-made

19 In this respect, see e.g. Hamilton, C., 2017. *Defiant Earth. The Fate of Humans in the Anthropocene*. Polity Press.

20 David Cayley latest book discusses extensively how Illich believed that instruments and ideas of instrumentality arose around the XIIth century and gave way to the age of systems during the XXth century.

complexity is being socially constructed are best *not* understood as instruments (i.e. means conceived to enable the achievement of specific ends), but rather as artificial prostheses that enable the achievement of an ever-increasing variety of ends (the higher the number of performed functions and ends achieved through computers, the more people have to remain attached to them and the more computers come to resemble to artificial prostheses). Since they program both means and ends, computer technologies exemplify and constitute the simultaneously closed yet ever expandable space[21] wherein people are induced to live. When contrasted to instruments, the prosthetic character of these relatively new artifacts can offer particular insights into how systems generate a distinctive type of counterproductivity that reflects a situation of permanent crisis.

Instrumental counterproductivity was carefully distinguished by Illich from other effects like so-called externalities and diminishing returns on investments. Instrumental counterproductivity mainly concerns the end associated with a given instrument and the effectiveness of the specific action undertaken with respect to that end. For example, the counterproductivity of cars relies mainly on the fact that cars, beyond a certain scale, become an impediment to mobility.[22] In contrast, systems counterproductivity refers to the effects on the whole system. Specifically, actions undertaken through prosthetic artifacts for given purposes can permanently create unplanned ends and events which can put whole systems' survival at risk. Instrumental counterproductivity is limited to the operationalization of an associated specific conceptual

21 In so far as any function comes to be performed through these protheses, the space where they constrain people is closed. In so far as new functions can always be added and reproduced, this space is always expandable.

22 On this point, see for example the chapter dedicated to *specific counterproductivity* in Illich, I., 1976. *Medical Nemesis: The Expropriation of Health*. Pantheon Books.

category (e.g. mobility, education, etc.). Systems counterproductivity implicates action in general, since action taken for any specific purpose nevertheless rebounds with system wide consequences.

Situations of systems counterproductivity look very similar to situations of potential crowd crushes (like the one sadly occurred in Israel a year ago or a previous case occurred Italy during an open-air concert in Turin). Whatever you do within closely coupled environments can rebound on you unexpectedly, negating the premises that have framed your action.[23] The prosthetic character of artifacts whereby people are integrated into systems[24] might hence render any purposeful action not only potentially and disruptively self-reflexive (within these kinds of system any system part can be tightly coupled to any other system part and any action you undertake can unexpectedly and disruptively rebound on you) but might also render any action whatsoever full of unintended and potentially disruptive implications for the whole system (within these systems you cannot intervene on one function without also potentially and unintentionally altering other potentially vital functions).

Notably, economic transactions and associated exchange values can however transform given instruments into prosthetic artifacts by changing single instruments into a means for a generalized end (i.e. money) and therefore into a means for a large variety of ends. This suggests that money can transform instrumental into systemic counterproductiv-

23 One of the best strategies that might be adopted to face these circumstances would probably be represented by collective inaction and immobility. The tragic thing is that the kind of complexity being socially constructed seems to oblige to stay constantly on the move (I have in mind here how integration into information networks is being accompanied by a progressive reduction in the stocks of existing material, energy and competences that impel the need for constant resources circulation) and activities *suspension* becomes therefore harder and harder to achieve.

24 As mentioned, I intend here a prosthesis as a single means whereby a multiplicity of ends become achievable.

ity. Through economic transactions and associated exchange values, specific instruments can be integrated within many closely coupled networks made of monetary, material and energy flows where situations of systemic counterproductivity can arise.[25] For example, cars become prostheses when their production keeps the economy of whole countries' running and, when this happens, cars become prostheses that cannot be dismissed as, through them, people directly and indirectly get access to food, education, health care, housing, etc.. In these circumstances, cars can become an essential and irreplaceable constituent of the exchange system, no matter whether the average speed achieved by car drivers falls permanently below that achievable by bikers, or the pollution generated by mobility becomes a major health threat, or cars become a major energy consumer.

Moreover, systems counterproductivity can also be ontologically differentiated from instrumental counterproductivity by looking at the radical regimes of technical and conceptual monopoly from which both types of counterproductive emerge. Instrumental counterproductivity emerges typically from extensive homogenization and radical monopoly exercised through single means over all possible alternative modalities whereby people might potentially achieve a same end. For example, when cars become the main means of transport, the employment of alternative transit modalities becomes hindered by accompanying transformations in the urban landscape and in the social practices whereby people commute, shop, etc.. Noticeably, this radical monopoly is however reflected also in the universalization and standardization of the conceptual category operationalized through the means in question (e.g. a specific idea and category of

25 I have realized this point while reading the Italian edition of Jean Robert's latest book (2019) "*L'Età dei Sistemi nel Pensiero dell'Ultimo Illich*", Hermantena.

mobility —passenger miles —is typically operationalized and universalized through the diffusion of cars). In case of instrumental counterproductivity therefore, a loss of flexibility generated in the social texture by this material and conceptual homogenization could unexpectedly generate states of contradiction where the universal category that is being operationalized and its complement become temporarily indistinguishable. To refer again to the case of cars, the loss of flexibility affecting densely populated geographical areas where cars exercise a radical monopoly would expose these areas to unexpected situations of congestion where *mobility* becomes temporarily indistinguishable from *immobility*. However, as instruments still represent something that is detached from people and that people can still leave when not needed, instrumental counterproductivity and associated states of contradiction are somehow still perceivable by people and, above all, this type of counterproductivity is probably still potentially and temporarily reversible (e.g. technical counterproductivity of cars can in principle still be prevented by reducing the number of vehicles in circulation or by using GPS and other control systems to optimize traffic flows).

In case of systems counterproductivity, the large-scale homogenization processes that started with instruments by leading us into a sort of Homogenocene[26] instead achieve a much deeper level of abstraction. These processes manage to flatten universal categories associated with the concepts of life, human, animal, and machine to a common background, nowadays mainly reified through the information flows by which artificial prostheses are put in operation. Rather than interacting with other humans or non-humans, people acting within complex environments are, as a matter of fact, interact-

26 Mann, Charles, C., 2011. *Living in the Homogenocene: the first 500 years*. Knopf, New York

ing with and are inadvertently being reduced to information flows. The common background constituted by these flows represents a kind of ultimate level of indistinctness to which humans, non-humans, and any inanimate object are assumed to be equally reducible.[27] For example, the realization of this deep level of indistinctness is nowadays recognizable in comatose persons, bodies conserved for organs transplantation, or other operationalized conditions where life comes to be identified with some "vital" parameters that are kept within given ranges of variability.

It is very interesting to observe how this condition of indistinctness can generally correspond to a *permanent* state of exception and contradiction where, contrary to homogenization from which instrumental counterproductivity emerges, any particular being comes to be assimilated into the same abstract entities. Resembling a perversion of Nicholas Cusanus's *coincidentia oppositorum* where plurality is united in the Absolute,[28] this condition entails a permanent contradiction in human action between what people expect to get and what they actually get from what they do while integrated into systems.

Elsewhere,[29] I have tried to characterize this contradiction through antinomies that I have named "managing the unexpected", "isolating interconnection", "rational irrational-

27 What I am generally suggesting is that the large-scale diffusion of mentioned prosthetic functioning might represent a *necessary* precondition for the generation of systems. If so, this necessary precondition could be equivalently intended as a condition of large-scale reproduction and employment of technologies enabling the circulation of single and different "artificial" entities (as represented e.g. by monetary, energy, time or information units) that, through the establishment of some principle of equivalence, come to constitute means for the achievement of an increasing number of ends. Among others, this simple fact seems to make these particular entities *scarce* by definition.

28 I owe this insight to David Cayley.

29 See Labanca, N., 2020. *Coronavirus and enaction of human-made complexity paradoxes*. International Journal of Illich Studies, Vol. 7(1) pp. 122-150

ity", "invisible presences" and "deadly vitality." By taking the coronavirus pandemic as a telling example, I have discussed how, in the age of systems, several extreme events are created endogenously by tightly interconnected societies and how systems put people in the paradoxical situation of having to manage the unexpected by preparing for devastating systemic events whose occurrence remain deeply uncertain, without having the possibility of verifying the effectiveness of their anticipatory actions.[30] Our lives behind screens, together with a series of other rational, individual, and selfish behaviors that are proving more and more detrimental at the social level are instead manifestations of the two other permanent contradictions affecting systems that I have named isolating interconnection and rational irrationality. The coronavirus pandemic has then made visible, to a certain extent, the importance of the invisible base made of social and bodily practices on which systems functioning permanently relies (e.g. activities ensuring physical health as carried out by nurses, cleaning ladies, etc., or activities carried out by people providing maintenance of machineries, local farmers, physicians, and, more generally, activities linking the body of people to other people and the body of people to the earth). By reflecting on the paradoxical generation of this invisibility, I argued that these invisible presences are the outcome of a reversal operated by increasing complexification whereby immaterial abstractions like monetary values, energy units, time units, information bits, molecular codes and their combinations are given further reality, while the role of material and bodily entities becomes increasingly invisible although reliance on these latter

30 If the devastating systemic event does not materialize, it can indeed be claimed that the anticipatory action has *not* served to avoid it (nobody can indeed tell with certainty that an extremely uncertain event would have occurred without this action). Same claim can be raised once devastations, though extremely uncertain, occur (nobody can indeed tell what the anticipatory action has allowed preventing).

grows in proportion.

Finally, the antinomy that I name "deadly vitality" represents probably the most relevant type of permanent contradiction led by complexity. In complex environments, life becomes indeed synonymous of intricate circulations of information, energy and materials and, as again shown by the pandemic, these same circulations can become sources of illness and death. The age of systems requires the acknowledgement of this circulatory process that is taking hold in any type of complex system, whether social or biological. The integration into information networks is accompanied by a progressive reduction in the stocks of existing materials, energies and competences and demands therefore ever-increasing resources circulations — to the point that high levels of interconnection can become both source of systems health and collapse caused by enabled large-scale amplifications of any small local accident. Health and illness therefore come to be generated by the same processes and connections and become somehow indistinguishable because life is captured within circulatory processes.[31]

As happens with vaccines whereby bodies' immune-systems are being reprogrammed during coronavirus pandemic, remedies that can be found to systemic crises can represent at best temporary solutions for unexpected events that can constantly arise within mentioned circulations. The chasing of health through the continuous reprogramming of immune-systems that are tightly coupled to an external environment that in turn co-evolves contingently with reprogrammed bodies exemplifies the kind of knowledge that comes to be generated in the age of systems, i.e. a knowledge

31 This circulatory view is, for example, supported in Margulis, L., 1991. *Symbiosis as a source of Evolutionary Innovation*. MIT Press, where Margulis argues that body health depends on the conditions of their *holobiont*, i.e. kind of extensive networks constituted by the body and plenty of symbiotic microbes in constant and reciprocal interaction.

that loses stability and connection to any form of definitive truth while inviting to constant surveillance in order to be continuously managed.

What has nevertheless to be emphasized is that, frighteningly enough, extreme events due to the systemic counterproductivity emerging from permanent contradictions generated by *same* intricate circulations can, in principle, unexpectedly arise in any area. The *same* circulations could be at the origin of or could constitute the correlation factor[32] among a pandemic happening today, a global financial crisis happening tomorrow, a severe global energy shortage or climate change happening the day after tomorrow. The unforeseeable variability in the type of extremes generated by complexity indicates that, rather than just focusing on medical, financial or engineering approaches to selectively prevent or adapt to extremes of specific types in specific areas, specialists and societies at large should probably better focus on the circulations from where *all* of these extremes might arise.

## Resisting systems counterproductivity

Overall, the artificial prostheses by which people are being integrated into systems seem to enable unprecedented levels of creativity and diversification while disabling any conceivable singularity and particularity. Nevertheless, these prostheses constitute systems that ultimately rely on a preexisting and unique underground that reflects the achievement of unprecedented levels of standardization and homogenization. Rather than resulting from pre-

32 Rob Wallace has for example conducted interesting studies on positive correlations between global financial market investments (e.g. in the agribusiness) and flu outbreaks in e.g. Wallace, R. G., 2009. *Breeding Influenza: The Political Virology of Offshore Farming*. Antipode. 2009 Nov; 41(5): 916–951 and in Wallace, R.G., 2016. *Big Farms Make Big Flu. Dispatches on Infectious Disease, Agribusiness, and the Nature of Science*. Monthly Review Press, NY.

existing differences, systems appear as if they are the result of an extremely diffused and socially constructed *sameness* that, contrary to what is happening with instruments, can seem to generate high variability while also appearing very immaterial.

In this text, I have tried to discuss how the socially constructed *sameness* that constitutes the ever more invisible underground which systems rely on produces a situation of permanent contradiction where opposites coincide. This situation might be responsible for the generation of ever more frequent disruptive and unexpected events that put the survival of large portions of the system in peril, representing the hallmark of systems counterproductivity. The question that naturally arises at this point is whether and how the way people relate to other people and to the world out there, whether and how systems artificial prostheses can be resisted and complemented in order to somehow prevent systems counterproductivity.

As I intend to discuss in a further essay, Illich's studies on instrumentality and Agamben's Anthropological machine lead me to hypothesize that the kind of relationality reflected by systems represents the final outcome of a type of relationality that has started prevailing within Western societies only as of modernity. In that essay, I would like to argue that the scholastic notion of *relatio subsistens* that nourishes Illich's concept of gender, as I came to know it through Cayley's latest book, might complement while encompassing systems relationality. I suspect that the former type of relationality which presupposes the existence of *two* irreducible singularities that might (or might not) acknowledge each other through a *third* still represents a safeguard against the ever more extensive and unsustainable processes of homogenization and technological multiplication entailed by instruments and systems. Compared with the age when instruments prevailed, the cultivation of this kind of relationality and associated possibilities to limit systems diffusion might nevertheless require markedly different, and as yet, unexplored, ways of thought and being.