Chapter 5 – Health Systems Thinking Tools and Social Systems Theory

Key texts in the health systems thinking literature do acknowledge that tools are simplifying ways of addressing complexities. Tools ignore elements of complex realities to focus on a few of them, about which the tools can offer complexity-reducing models.

As is always the case in relation to models and modelling, they narrow down the fields of observation and provide reduced portrayals of reality. That is unavoidable. Researchers are aware of these limitations. Nevertheless, they justifiably believe the tools used will yield results that can be of use.

That is the main point of discussion in this chapter. The reduction of complexity thus achieved may deeply undermine the comprehensive understanding of what health systems in fact are. The tools selected for discussion are described in the book edited by D. de Savigny, K. Blanchet and T. Adam (2017). They are:

- Network analysis
- Boundary critique
- Process mapping
- Causal loop diagrams

Before discussing the selected four examples of tools promoted by health systems thinking, a reflection on the relation between the science system and the health system may contribute to the comprehension of what is discussed next.

5.1 Scientific systems observing health systems

Health system thinking tools were developed and primarily belong to the science system, a function system with the same characteristics of operational closure, autopoiesis and, in this case, orientation with the true/false binary code (true and false being the two sides of a distinction used to value models, explanations, theories, hypotheses, evidence, etc. communicated in the system). The efforts to apply the tools and find the value to be attached to the results yielded by them are the communicative work of the function system of science.

HST tools are therefore used inside the science system to observe health systems. The same tools were and are applied to other systems (economic system, education system, etc.). The science system is concerned with developing, testing and confirming the results of the tools, validating them with the true/false code. For the science system, the health system is external and belongs to the environment. The science system cannot interfere with or operate inside the health system; only the health system itself can operate inside itself.

This is what the Social Systems Theory says. No matter how big the effort to observe and measure characteristics of the health system, scientific observations will still be done from outside the health system. The health system already has many ways of observing itself. It must do so because its self-observations are vital for its autopoiesis and cannot be delegated to or borrowed from outsiders, no matter the accuracy and good intentions of the science system. As said, the codes and orientations adopted by each of the two systems are different. Cross-systems communications are not possible, although mutual observation and irritation can and do occur. The coupling of the two systems gives the impression that information seems to be circulating from one system to another; however that cannot happen, according to Luhmann's theory.

Possibly, many health systems find the results of the use of HST tools useful for their own self-observation and related decisions. But the health system will be the final judge of the usefulness and applicability of the findings. This cannot be different. The two systems are independent sovereign domains; not sovereign by decree or legal enforcement; sovereign for the impossibility of autopoiesis of a system being taken care of by another system, and for the impossibility of communications from one system becoming communications of another system. This would be like someone's thoughts being inserted into someone else's consciousness. This is an absolute impossibility in Luhmann's world. Consciousness operates under the same "law" of operational closure, and there

cannot be direct communication from one consciousness to another; all communications are social and all coupling of consciousnesses is achieved through the social, as long as the two observe each other.

It is therefore important to recognize the limitations of the acquisition and applicability of knowledge. More importantly, the impossibility for the science system to meaningfully reproduce the entire health system inside the science system itself has to be accepted as an unavoidable limitation in dealing with complexities (be it in the environment, in the system being observed from outside, or in the system that observes itself). No system is able to perform such a task in relation to any other system, because none of them have what is technically called the *requisite variability*, or wealth of descriptive constructs and observational capabilities, to address the complexities of another system.

Instead, the science system directs its attention to limited specific sections of the health system to which it can apply its tools. Out of these applications, some specific descriptions of details of the health system are produced, while the totality of the health system will remain well beyond the grasp of the specific tool the science system chooses to use. Indeed, the science system has no illusions about the limitations of the findings.

Process mapping, causal loop diagrams, social network analysis, boundary critique and critical system heuristics, and any of the other tools, will not overcome the incommensurability of the two systems. There will always be gaps that cannot be bridged, where a system will remain opaque or unobservable to the other.

The scientists can still continue investing time, money and brainpower in teasing out, improving the existing tools, and developing new ones. But the perspective of limitations cannot be erased. The operational closure, under which function systems operate, the health systems and the science systems alike, cannot be dismissed. Investigation results useful for the health system are only those the health system itself can recognize as such, according to its own references.

Scientific careers can still be built and developed around the ideas of dissecting the health system and finding out its secrets, attempting to get to its inner nature. As in the seventeenth and eighteenth centuries, the advance of the knowledge of human anatomy promised to give the power to heal all diseases. When the work was done, the physiology instead became the holder of the secrets of eternal health. And so on; since then, many other scientific fields have opened up to explore the secrets of the human body: anatomo-physiology, pathology, biochemistry, molecular biology, each digging into many specific

specialities such as immunology, neurology, etc. Those studying health systems should however understand that they are approaching an autopoietic entity already performing its self-observations as opposed to the unawareness of, for instance, the anatomy, in relation to itself.

Taking a short detour to add complementary reflections on this point, a research programme could try to trace the appearance of the tools and their use for detecting features of health systems. It can be expected that these tools were designed and planned within academic institutions, i.e. inside the science system. The investigation could address the hypothesis that health systems did not take the initiative to develop such tools for making self-descriptions. If this hypothesis is correct, the health system became an object of scientific investigation by the interests mobilized within the science system. One could conclude that the science system is concerned to convince itself that it has the conceptual and methodological resources to approach the health system and construct narratives about it, with internal scientific validation.

The science system fulfils its functions of communicating truthful matters, based on rigorous programmes of methods and analysis. The validation reverberates in the reproduction of publications on the same topic, adopting the same conceptual frames and methods, and the reappearance of the same contents in academic production of undergraduate, masters and doctoral essays and dissertation theses. The reproduction reinforces the validation processes, further legitimates the contents, the authors and the narratives, and that is all the science system needs in order to perform its autopoiesis.

The health system may observe, with high, low or no interest, what is happening in the science system. Where the coupling between the two systems has been working for endeavours the two may be taking together (developing new drugs, new technologies, new organizational arrangements, new programmes, etc.), it is possible that additional couplings come about with the intention of performing studies or implementing changes for example in line with what the HST tools may have suggested. Regardless of what the opportunities for such couplings entail or favour, the calculation the health system makes concerns its own autopoiesis, not the autopoiesis of the science system. Such calculations have to convincingly indicate the advantages the health system will obtain. It is therefore important that the observers outside the health system, i.e. the researchers themselves, reflect on the way the health system will see the results of the investigations carried out with the chosen tools.

Questions such as "how does the identification of the social network that exists at the moment among those implementing such and such programmes

help the system in achieving its goals?" may or may not be formulated. Of course scientists do think and strategize about the chances of project acceptance, and try to sell their work as best they can; but the health system will be judging it from its own perspective, which to a great extent is beyond the full grasp of the scientist. It might be boring to repeat this, but one should never lose sight of the fact that there are two different function systems, no matter that one may consider the apparent advantages of their coupling to be evident.

Having said that, the following reflections on the HST tools look into the specifics of each of these tools taken as examples. The overall understanding exposed in the last paragraphs touched upon the common perspective by which all tools can be judged in reference to the fact that they belong to the science system in the first place. Let's now discuss the four examples.

5.2 Network analysis

References to networks as a basic element constitutive of systems are present throughout the HST literature. However, there is little discussion on the relations between networks and systems. In fact Social Systems Theory and Networks Theory are two separate branches of sociological thinking that do not agree with each other in many respects. The explicit acceptance of networks as part of the health system would meet protest and requests for qualifications from both sides of the contest.

However, Luhmann's theory offers the conceptual arsenal to address the topic,[1] helping to clarify the role of networks in relation to systems. First, it is necessary to be clear that networks are not systems in the way the Social Systems Theory understands them. Networks are not autopoietic nor present operational closure, key conceptual notions to characterise systems according to Social Systems Theory.

In a good-humoured encounter between Graham Norton (philosopher, proponent of object-orientated ontology) and Bruno Latour (social scientist, known as the Prince of the Networks and a prominent reference for networks as a sociological construct), transcribed in a book called *The Prince and the Wolf* (2011), Graham stated that the weakness of the conceptualization of networks

1 Readers are referred to "Luhmann's Systems Theory and Network Theory", by M. Bommes and V. Tack (2006), for a thorough discussion on networks and Social Systems Theory.

is the fact that considering an object as defined by the relations it establishes with others cannot account for changes.

According to Graham, a network is studied and portrayed at a given moment, but what happens between one moment and the next cannot be explained by the network theory. Such criticism can be raised of any attempt to describe health systems as networks, and users of Social Network Analysis (SNA) are in fact aware of this shortcoming. Yes, networks can be described at two different moments in time, the differences can be identified, but the process of becoming different and the dynamic factors behind it are not explained or foreseen by the theory. The most one can arrive at with SNA is a limited picture of the relations between nodes established by ties, without being able to indicate what would happen next. The theory does not explain what in the nodes or in the ties or in both lead to dynamics that can produce changes in the network. Whether a certain node or a particular tie is established or not, is effective or not, goes beyond the explanatory capacity of the theory. Still, this is a critic of network analysis, which does not include the Systems Theory perspective; we get into that next.

From the Systems Theory perspective, a number of points are not properly taken into account. First is the recursive nature of communication, the contingence by which selections are made and then communicated, triggering new communications that may sustain or reject what has been previously said, and therefore the unavoidability of uncertainties (and need to continuously reconstruct expectations through communications – with the very real possibility of misunderstanding and rejection of what is communicated).

This is a crucial point that those working with networks in the HST framework do not pay attention to. The reflexive communication clarifying and certifying the inclusion/exclusion of someone or some organization in certain communications is crucial (although still contingent) to define who is part or not of the network. If it is admitted that the organizations and individuals in a network do not take for granted inclusion or exclusion from the networks they participate in, the reflexive processes are needed to confirm the pertinence of the addressees (the members of the network) and further assure the continuity of the communication as relevant for the network. The network can only be established if such an arrangement for confirmation is used, which implies reflexive communication, i.e. communications about past communications in view of future communications. To represent such communication as a tie in a network, it is necessary to distinguish many types, strength of ties and those nodes that are connected by them. The current conceptualization of ties and

nodes does not account for such distinctions, qualities, modes of operation and complexities.

In the same critical perspective, the metrics used to describe and portray networks with the respective quantitative descriptors (such as centrality and density of network nodes, for instance) do not capture any recursive communication process. Even the reciprocity indicator does not address this aspect. To observe the recursive nature of communication, the observer needs to follow sequences of communications over time. The social network analysis tool does not embrace diachronic orientation; it instead relies mostly on cross-sectional, synchronic and transversal cuts. Luhmann (2017b) mentions the role of reciprocity in establishing structural coupling between organizations, creating relations based on expectations and their fulfilment over time. However, reciprocity is a fragile link, he reminds us, as the autopoiesis each participant pursues cannot fully rely on it.

In addition to these critical views, if a system is considered to be self-organizing, and therefore necessarily able to carry out self-observations, the network can be observed by the system itself, which could therefore change it (or not). The sentence above may be interpreted as a metaphorical expression of the capacity of the system to decide. Luhmann's theory extensively explains how systems decide through the connectivity and recursive nature of communications, which reflect on communicated meanings (by communicating about communication and confirming or not previous communications), and communicating selections to keep or change the communicated topics. This means that a decision can be communicatively taken inside a system to affect the network that the system is participating in or sustaining. On the contrary, a network cannot make decisions. A network itself does not have the capability of self-reflection and self-adjustments; this has to be done through the individual, operationally closed system's communications. The theory of networks does not foresee or address such complex self-referential possibilities, carried out by the individual systems/organizations. A network that involves different organizations cannot self-refer as a unit. In contrast, the organizations can do that, and assess their own roles and behaviours in the network, but the network does not have such capacity.

Additionally, while boundaries and the correlated operational closure are key concepts for understanding systems and systems operations, networks implies "dissolution of organizational boundaries", ignoring the essential role that defining membership and separation between members and non-members is vital for an organization's reproduction and survival.

The proponents and users of network analysis as a tool for health systems thinking do not account for these limitations. The implied vision of a system established as networks and therefore to be analysed with the proposed tools, cannot explain much and cannot be used for understanding health systems more comprehensively. It is necessary to acknowledge that there are two different paradigms, one constituted by nodes and ties making up networks, and the other by autopoietic self-referred communication-based systems.

To be sure, Luhmann makes reference to networks in several of his works. Networks may appear as the connection of elements internal to the system, communicating to each other according to channels and programmes the system adopted. Besides that, he acknowledges that systems can enter into structural coupling with each other and these stable relations can configure networks; however, these networks do not perform autopoiesis on their own; instead, the systems and organizations making the networks indeed carry out their autopoiesis individually and that is what gives life to the network (not the opposite). This leads to the conclusion that, because of networks' subordination to the autopoiesis of the organizations/systems establishing them, networks are unstable and vulnerable.

In short, from the Social System Theory perspective, networks come into existence through the decisions taken by participant organizations/members. Even if the networks thus established can have influence over the decisions the organizations may take once the networks are in place, the networks remain reliant on the decisions taken by the organizations, which value their self-reproduction with higher priority over the maintenance of any agreed – implicitly or explicitly – network arrangement.

A still controversial conclusion could be that although systems operate with and within networks, and there are links and ties an external observer may consider characteristic of specific networks, any system has more elements and relations than the concept of the network can describe. The life of a function system does not essentially rely on any particular network or particular components of any network.

The life of the system relies on the communications that happen inside it, whether these communications can be understood within a given network or not. Many patients meet their doctors many times a day. They always communicate, but they often do not belong to the same networks. They may communicate once in their lifetime and never see each other again. This is often the case. It would require stretching the idea of a network too far to include such specific encounters that do not recur. The point is that not all that concerns meaning-

ful communications is relevant for networks, but they are, by definition, part of the system. The communications between doctors and patients certainly happen in their millions every day and are relevant for the health systems.

Furthermore, the concept of the network does not account for individual systems' operations, although they may use some network to perform them. For instance, communication may (not necessarily) go through established networks, but the network itself does not account for the linkages, recursive processes, successes or failures of meaning-carrying communications. An existing network may indicate pathways for some communications between organizations, but success or failure cannot be foreseen from the network structure, although many empirical works have tried to demonstrate this and ended up with contradictory conclusions; for instance, a denser network structure may facilitate the rapid spread of information or, by the same token, be an obstacle to introduction of new information (Blanchet and Shearer 2017).

The cause of the mismatch between the expectations of what the theory of networks is supposed to gain in predictive power and what it actually delivers is a consequence of a lack of consideration of the contingency of links and nodes, and changes. Network ties and nodes are contingent, meaning they are neither necessary nor impossible, and can be different. Admitting their contingence implies the acceptance that they can change very often; they are not "written in stone". The circumstances that make them meaningful are also changeable. In short, the network is always a "work in progress", with "plans and designs" being defined and constantly modified. The illusion of fixity and permanence that cross-sectional studies may grant immunizes against the discomfort of recognizing many contingencies and complexities, but, on the other hand, depletes the capacity to understand the system, as well as making predictions.

Putting it differently, it seems that network analysis makes efforts to reduce complexity and by doing so can end up with too simplistic a view of the observed phenomena. In the words of John Law:

> the notion of the network is itself a form – or perhaps a family of forms – of spatiality: that it imposes strong restrictions on the conditions of topological possibility. And that, accordingly, it tends to limit and homogenize the character of links, the character of invariant connection, the character of possible relations, and so the character of possible entities. (Law and Hassard 2005, p. 7)

In other words, nodes and links are far more diverse than the standardized "homogenized" elements that network analysis assumes; the reality is more complex than presumed.

To conclude, what has been said is not an attempt to entirely disqualify network analysis as a possible useful tool. The tool can indeed be useful for understanding particular operations of a health system. What it does not provide though is an understanding of what a health system is. Researchers may be able to find countless networks inside health systems and health organizations; it just depends on the topic in which the researcher is particularly interested. The researcher can look at the system, and find there may be such and such networks operating in it or linking the system to other systems or linking different organizations. But we need to understand that a collection of diverse networks or network possibilities does not make a system. The researcher will need to differentiate the internal networks, which have specific relevance for the system self-reference and self-organization, and external ones that are established for reasons guiding the system in its approaches to its environment. But, as said, the system has a "nature", so to speak, that engulfs all its component networks. It is the system that defines, creates, maintains, reproduces and terminates its networks, not the other way round. Systems pursue their autopoiesis while networks don't. As discussed by Bommes and Tack (2006), comparing organizations (as a type of autopoietic system) and networks, organizations are constituted by decisions while networks are made by relations of reciprocity, therefore, in their words: "the dynamics of organizational decisions tend to destroy the subtle structures of reciprocity" of networks (Bommes and Tack 2006, p. 301).

Summary of key concerns:

1. The tautology by which nodes are made by ties, and ties by nodes, and nodes and ties make up the structure of the network that determines the ties and the nodes of the network creates a recurrence that needs to be stopped at some point. However, the circularity does not incorporate theoretical elements that could break the tautology, for instance when the structure determines the behaviour instead of being determined by the behaviour of the nodes and ties.
2. The weakness of the SNA in addressing changes in time is well acknowledged by those working with this tool. There have been attempts to solve this problem with more sophisticated software capable of handling the data collected from the same network at different moments in time. The

difficulty is that the explanation of the changes will always be sought outside the frame of the SNA itself, because the SNA theory does not identify dynamic factors to explain how a network may develop in one direction instead of another.

3. SNA does not incorporate contingencies. Social systems have contingencies in all their dimensions.
4. A network is not a system; it does not have the structure of a system. It only describes some of the features and relations that may exist inside a system and between the system and its environment.
5. SNA does not account for the specificities of communications. It reifies ties as if once they are said to exist they become an essential part of reality. Therefore, it does not account for the fact that both nodes and ties are contingent and neither necessary nor impossible.
6. An important aspect of communication that is not incorporated into the SNA models is the recursive nature of communication (by which communication can be used to clarify, confirm, change, adjust, and make expectations etc. about previous and future communications). This functionality is of high importance for keeping the autopoiesis of any social system based on communication. It is not only relevant to know that A shared information Y with B, but also that B let A know that he understood what A had said and A checked whether that understanding was indeed correct or needed corrections. The back and forth of communication processes are vital for system survival, but SNA does not pay attention to this. A network tie is hurriedly assumed to be perfectly functional at the point the researcher identifies it.
7. The position of the observer is not a theme or point of concern in SNA. The fact that the observer is outside the network or belongs to it as a node does not seem to be relevant for SNA. On the contrary, Social Systems Theory highlights the need to be aware of the observer's position.
8. Finally, by radically removing complexities and narrowing down the system to homogenized and standardized nodes and ties, the network analysis unavoidably ends up with too simplistic and particularistic a narrative of the system it intends to describe.

5.3 Boundary critique

In spite of the explanations given by the proponents of the boundary critique (BC) technique (Reynolds and Wilding 2017), clarifying that it is not a research method but a reflective approach to methodological design, the BC can be examined for what it is proposed to do, i.e. indicate how to make boundary judgements. They say: "making boundaries judgements constitutes the core of systems thinking. Wherever the term 'system' is used … there are implicit or explicit boundaries invoked" (Reynolds and Wilding 2017, p. 39).

The authors do not make an explicit definition of what boundaries are or what they separate. They say that: "boundaries mark out the map (systems of interest) from the territory (messy or 'wicked' situations of interest)" (Reynolds and Wilding 2017, p. 39), but this does not help much to identify what is being separated from what by whatever boundary one is talking about. The separation of "map" and "territory" and how boundaries are drawn between them is as confusing as the separation of "interests" and "situations of interest" and the connection between these two distinctions.

A second attempt, though still not a fully articulated definition, appears on page 40, referring to a triangle proposed by Ulrich (1996, as referenced by the authors), using notions of value judgements, fact judgements and boundary judgements. Although calling attention to the role of the observer in figuring out the relevance of these judgements, how a system will become visible from those judgments remains obscure. For an observer equipped with Social Systems Theory concepts, facts, values and boundaries become relevant as they enter the communications inside the system, when the system self-referentially communicates about those matters (more on this later)

The authors also propose a critical system heuristics (CSH) – a guiding enquiry tool comprising 12 questions for developing a model of the system being studied. The 12 questions are entries in a 4 x 3 matrix, where the 4 rows represent sources of influence (in their words: motivation, control, knowledge and legitimacy), and the 3 columns represent stake-holding references for making boundary judgements (to say: stakeholders, stakes and stake-holding issues).

The proposed tool looks like a rather complicated arrangement, as it is difficult to figure out what sort of system boundaries will then be drafted combining the answers to the 12 questions in a meaningful identification of a system's limits (distinguishing the system from whatever might be on the other side). Instead, the outlook of the elements of the matrix resembles a list of points for an exploratory assessment intended to identify the relevant issues a researcher

should take into account while trying to understand a specific system. However, there is no definition of systems as such in the approach. Neither the concept of system nor of the boundaries and the respective attribution of what is separated from what become clearer with the proposed enquiry.

We can contrast this impressionistic approach to boundaries with Luhmann's precise notion of systems' boundaries. According to Luhmann: "Biological systems distinguish themselves from their environment by means of spatial material boundaries. Psychic and social systems are not material in the same sense. Their material condition are part of their environment but do not enter into the autopoieses of their specific medium, which is meaning" (introduction by Peter Gilgen on page xv of *Introduction to Systems Theory* by Luhamnn 2013). "The boundaries of social and psychic systems are therefore not material artefacts but two-sided forms, which is to say, distinctions." In other words, the boundaries are constructed at the level of meanings, whereby the system recognizes, through distinctions, the meanings that are relevant for it, and discards the rest.

In the chapter on "Operational Closure" in the same book, Luhmann says:

> The distinction between system and environment is produced by the system itself. This does not exclude the possibility that a different observer observes this distinction, which is to say, observes that a system exists in an environment. From the viewpoint of the thesis of operational closure, the important issue consists in the fact that the system draws its own boundaries by means of its own operations, that it thereby distinguishes itself from its environment, and that only then and in this manner can it be observed as a system. (Luhmann 2013, p. 63)

This theoretical perspective defines precisely what boundaries are. Boundaries are thus drawn by the system in operations distinguishing itself from its environment, and thus establishing itself as a system. It is important to keep in mind that when Luhmann speaks of operations, he is talking about communications.

The authors of the chapter describe an example where their approach to boundaries is applied. The case study is a partnership between several institutions in the context of a comprehensive policy for urban, social and health services development.

Had the authors' approach been informed by Luhmann's explanations about the role of boundaries and how they are constituted in correspondence to the systems/environment distinction, they could have reached different

conclusions. They perhaps would have recognized that, before entering a partnership, each organization involved has already constructed its boundaries, distinguishing itself from its environment in ways fundamental to its existence and reproduction. All other organizations, whether in the same partnership or not, belong to the environment not to the organization (as a system).

They would then see that the question of boundaries in a partnership has to be addressed from the point of view of each organization's self-definitions, vital for their self-identity and internal operations. Coupling with other institutions may or may not be of interest vis-à-vis the organization's self-references. Their own boundaries, as self-defined, are more important for the preservation and continuity of their operations than any partnership per se; no matter how strong the political pull to bring institutions together, combining them into a single partnership unit.

A partnership therefore never supersedes the autopoietic drive of each individual organization participating in it. Partnership is only meaningful as long it is coherent with the autopoiesis of the organizations taking part in it. This is the logical conclusion the Social System Theory could suggest in relation to boundaries and partnerships. The theory thus does some work for the researcher. If a theory is not well designed or not made explicit in the investigation process, the researchers will struggle with the fluidity of aspects that are always changing and can only be observed contingently.

According to the proponents of the critical system heuristics, boundaries should be pointed at according to 12 possible combinations of sources of influence and the stakes, stakeholders and stake-holding. It looks rather a patchy network of several bits and pieces of possible relations between elements in a mosaic, lacking a sense of unit or integration. The impression is of a collage without perspective, as if the observer tries to apprehend a system addressing many of its details in a vain attempt to grasp the whole, ending up with the suspicion that there are many boundaries and they can be constructed in many ways.

No system would operate as such if it had to address its boundaries following so complex an approach. It would collapse. The point is that systems need to clearly define their boundaries in simple terms to prevent being overwhelmed by the complexities of the environment. They need to know and they do know where they set the boundaries. If boundaries are defined as the line that separates communications that are meaningful from those with no meaning for the operations of the system, things become a lot clearer and more precise.

We are certainly not talking about spatial boundaries, and the spatial metaphor (of maps and territory) does not help much in understanding a system's boundaries. However, any system made up of communications can know which communication should be considered relevant and which should be discarded or ignored altogether. The differentiation of many systems in the same society is achieved by this process, through which each system individually separates what is from what isn't relevant for it.

Where doubts might be raised, answers can be found within the system itself. If the observer is an operator inside the system, using the communication codes of the system to generate, receive and reply to legitimate communications, they will know what to do, how far they can go and where the communication should stop. A health professional in a hospital perfectly distinguishes what are the matters of health/sickness they should be concerned about. Even if the employed semantics and meanings go through transformations and changes, the processes will run with full continuous cross-checking and guarantees that whatever is internally communicated is relevant and therefore should (or should not) be part of the system. Everything else belongs to the environment – belongs to the other side of the boundary. That is a precise way of defining boundaries.

Surely there are communications about issues classifiable as related to "values", "power", "knowledge" and "morals", the four "sources of influence" of the framework, and these communications may involve "stakeholders", "stakes" and "stake-holding issues", as established in the CSH. However, the system itself elects mechanisms to live with such internal complexities. For its autopoiesis, the system relies on codes and programmes that can select the topics according to criteria of relevance, as far as the topics and themes are indeed of matters the system needs to communicate about.

In line with the Social System Theory, for the constitution of a partnership between organizations, the point of departure would be the acknowledgement by all partners that each corresponds to a fully established system, i.e. they are equally entities with the required attributes to operate as a system. This means that all are already aware that their organizations have their boundaries, have their on-going operations and keep the daily flows of communications by which they communicate as they need, in line with their core purpose and reproduction aims.

So, no one is naive. In being a member of an organization, one is committed to it; the commitment is inherent to membership. Without that clear-cut definition of who is a member of which organization, neither the organiza-

tions nor the partnership would survive the first meeting. Once the recognizance and acceptance of this basic constitutive characteristic of each partner is reached, then the progress can be measured in terms of designing and proposing "coupling" mechanisms that are of interest for all.

The partners will be constructing together the coupling details, by which their boundaries are preserved. At the same time, room for joint initiatives is created, fully recognizing and respecting the boundaries that constitute each partner. Even if they proceed with as much openness as they may choose, an external observer may not grasp the boundaries being preserved, but each organization will clearly distinguish and observe what concerns it.

Each organization will observe its partners, and as observer it will choose the distinctions to employ. The joint effort may consist in aligning the distinctions so that every partner will be able to assess the others in the same terms as each is assessed, including self-assessment, in the context of the partnership.

But the perspectives can never be fully aligned because the observers have diverse perspectives of observations, and the issues of their own organizations will have prevalent weight in the considerations for making observations.

Nevertheless, partnerships and coupling are possible, as long as the boundaries are acknowledged clearly. For instance, each one's budget is each one's matter and cannot be shared or submitted to decisions external to the organization itself. This is just an example that partnership will have its limits when the inner life of a partner cannot be invaded by the attention or interest of the others. These sketched points seem to be a more promising approach to system boundaries.

5.4 Process mapping

Process mapping (Muñoz and de Savigny 2017) considers activities that depart from decision nodes in mutually exclusive directions. A decision node indicates that the subsequent activity will be either of two options. This representation of decisions portrays formalized steps of idealized sequences, which although helpful in providing a visual idea or mental map of how the process should evolve, exclude a number of important aspects.

This tool is not based in any theory of systems and could therefore be employed as a managerial tool for dealing with specific types of organizational problems involving flows of information. There is nothing specifically related to systems in it. It can be considered a redressing of tools such as "flow charts"

or O&M (organization and methods) developed in the 1950s and 1960s to make clear diagrammatic representations and descriptions of organizations' activities, emphasizing the connection between the steps and the coherence of sequencing to achieve the desired results. The tool can be compared with the step-by-step computer programming languages widely available in the 1960s.

Obviously the intention in drawing such schematic maps is reduction of the complexities it permits, or, in other words, the "taming" of complex realities into a selected arrangement of links and steps that wipe out the discomfort of noises and interference. However, if one considers what has thus been removed – if for instance one has Luhmann's theory in mind and asks: "Where are the communications?" – the tool can be assessed in a different light.

According to Luhmann, organizations are social systems built by communications. In fact, at each step of any mapped process, one can expect that there should be communications between those involved, at both the sending and receiving ends of any step in the process. Communications are crucial for the actual occurrence of the expected activities. If one side does not understand the communications (or rejects them), it is unlikely that the activity will unfold as it has been mapped out.

The framework ignores communication and the inherent double contingency, taking for granted that the parties involved at each step of the processes know precisely what actions are expected from them, and will act accordingly because the mapped process implies clear rationales for everyone involved. Often, this is not the case. The individuals involved may not perform as expected for many different reasons.

The civil registration and vital statistics (CRVS) example presented in Muñoz and de Savigny chapter is valuable in that sense; families do not accept or do not care about (do not have the need or incentive for) doing what is expected from them in terms of taking the medical notification of death to the District Registration Office. They may be clearly told (or not clearly or not at all) to do that; they may have understood (or not) what they have been told, but they may have forgotten or perhaps refused to follow the instruction; they may not communicate any of these possible "unexpected" alternatives to the officers involved, and the officers may never know what has happened next and why.

Because communication is so crucial, it must be included in the analytical framework. If there is interest in making sense of processes, the occurrences and successes of communications have to be assessed. The recursive nature of communication, by which it can repeatedly go back and forth to ensure under-

standing and possible compliance, is one of the characteristics of communication that needs to be taken into account. For purposes of guarantee, understanding can be assumed to be an unlikely outcome of communications.

From Luhmann's theory, one may also consider the "operational closure" of the system. Not all elements in a process involving clients or external players or stakeholders can be considered as part of the system. If they are not identified members of the system/organization, with their respective roles and sets of expectations about their behaviour, the coupling with the system is loose. They may or may not fulfil the expectations because the consequences for complying (or not) may not be relevant, as opposed to a member of the system to that effect.

Analysed from this perspective, process mapping should give different weights for different participants in the process. In a continuum from those for whom certain expectations are considered highly relevant, to the other extreme, of those who are completely indifferent, or even against the expectations, the variation can have a crucial effect on the outputs of a process.

Process mapping is a planning tool. As mentioned above, computer languages, available since the late 1950s (like Fortran from 1957 and COBOL from 1959), used diagrams that are very similar to those proposed for process mapping. The step-by-step sequencing of operations, with the conditional decisions in between, orienting the direction of the flow of logical decisions and calculations, is suitable for computer programs where external interferences are 100 % under control – a situation that cannot be likened to the processes inside an organization or between organizations and elements in their environment.

These social processes have to rely on many contingencies that cannot be taken for granted. Contingencies means that things can be different, and communication involves double contingencies because both sender and recipient of the messages can always make different selections of what they communicate about. One can either ignore the contingencies, running the risk that things will be different from the expectations, or try to incorporate them in the uncertainties, to critically consider as inherent uncertainties any that cannot easily be accommodated within the precise logic of process mapping.

Additionally, an organizational process is a relation between acts and things that surely has been established by a decision taken at some point in the life of the organization. Such a decision organizes the "world" and becomes, in Luhmann's terms, a "decision premise" for subsequent related decisions. Whether the decision is of an operational or strategic nature, or, in other

words, a decision intended to keep activities in line with adopted processes or a decision to introduce new processes, the options are picked considering what had been previously decided.

In any case, a process is not unalterable. It is contingent (can be different). Because of that, processes rely on the preservation of the expectations that created them in the first place; however, these expectations may not be maintained in the implementation of the processes. These uncertainties are not considered when mapping processes.

Those who initiate the processes and those who correspondingly follow the prescribed subsequent steps all have expectations in relation to what will come to them and what they will deliver next. They also acknowledge that the ones above or below any given point in the processes also have expectations. Several communications (by oral utterances, or paperwork, or electronic messages, etc.) are expected to follow the chains of expectations, up or downwards from any given point.

However, communications are contingent and often need confirmation, or back and forth to assure the correctness of the understanding and adequacy of the subsequent step.

These peculiarities of communications are not addressed in process mapping. Process mapping gives the illusion that once a process reaches a decision node it can only go in one of the predefined directions, while in the reality of communicative interactions such characterization of nodes is often not the case. The communication may go backwards for clarifications, corrections, or because of errors of interpretation and misunderstanding along the line. Processes do not accommodate well such reversal of directions; as models, processes reflect the irreversibility of time, always moving ahead, even with the artifice of incorporating feedback loops that may move the process back to a previous step. In fact, a feedback loop is still "a process moving forward", in contrast with a communication that goes backwards because a decision was not made or to request clarification or additional instructions.

The existence of mental representation of processes does not guarantee their correct implementation, their stability and immunization against misunderstandings at every single moment. Processes change by design or by practice (or lack of it), and mapping them only provides very limited assurance of their reliability or even correspondence to reality.

If processes are mapped as actions or activities, they lose the crucial connective "glue" of communication, which assures that those involved in a process actually share the same understanding of what is being communicated

and therefore act as expected. Communication has inherent features that actions do not have. Without proper communication, the processes have a high chance of breaking down. As opposed to communication, action does not inherently require recurrent confirmation or subsequent interlacing; Luhmann is eloquent in affirming communication as the only pre-eminently social action, as it can only happen with the concurrence of at least two individuals and requires understanding (including misunderstanding) to be accomplished, while any other type of action may end in itself without producing interlacements. In his words: "'Action' first of all refers to an individual human being and not to a process that links different human beings" (Luhmann 2013, p. 183).

The lack of adequate theoretical framework has undermined the construction, application and self-critique of the utilization of this tool. The study of prescribed or practised flows of information is obviously useful for representing, planning and improving existing routines. However, such an undertaking is far from enough to capture crucial aspects of the life of the system.

We make next a final comment on this tool, reflecting on how Social System Theory could approach civil registration and vital statistics problems, putting the issue in a new light. We can consider that families can be classified as systems as they have the characteristics of the organization type of system as described by Luhmann – which is to say, they are constituted based on membership and they have internal decision-making communicative operations in which only members can participate. These are the two central features of organizations as social systems: membership with decision-making prerogatives.

As systems, families can enter into structural coupling with other systems, such as with the governmental organizations providing social benefits (pensions, financial support, etc.), educational services (providing scholarships, school fees exemptions, etc.), health services (providing user-fee exemptions, specific healthcare support, etc.), judicial decisions (for inheritance of assets, etc.). The families need to produce death certificates to gain access to some of these benefits, according to countries' legislation.

The families will see and value the relevance of having a death certificate when they need to negotiate their way through the respective bureaucracies. The certificates become a fundamental piece in the communicative exchanges between the families and the institutions. Once the established legal and institutional structure of the country makes a death certificate an essential element for decision-making, the families, reflecting this characteristic of their environment, incorporate the death certificate as a theme in their internal com-

munications. Once that is achieved, the effects are clearly felt in the respective bureaucratic apparatus. Otherwise, the families might just carry on without registering the deaths of their members, as they will not see any advantage in having to go through the ordeal, spending time and money dealing with institutions.

In conclusion, a systems approach to the problem of CRVS will, first of all, need to recognize the systems and organizations involved and, considering their functionalities, assess the linkages between them. The exclusive focus on process details may hinder the acknowledgement of the larger picture where the systemic aspects effectively play the key roles.

5.5 Causal loop diagram

Usually presented as diagrams and therefore known as causal loop diagrams (CLD), this tool has been incorporated into the HST literature with the explicit acceptance that health systems are governed by and have causal loops embedded in them (Tomaia-Cotsel et al. 2017). In its simplest version, a causal loop may consist of a recurring linear cause–effect link. It can also describe a binary decision according to a defined threshold (thermostat model, switching on/off a loop according to measurements of temperature). Advanced diagrams may include more complex combinations of variables and causal links and scales. Nevertheless, the "governed by" assertion needs to be assessed critically.

The chapter written by Tomaia-Cotsel et al.[2] in fact refers to representations of "mental maps" of assumed causal relationships between variables relevant for addressing a given problem, where loops may be presumed. Such mapping exercises may obtain large sets of variables to be subsequently reduced to a few that can reveal a consistent and simplified "one cause, one effect" relationship with possible recurrences. A loop, representing a positive or negative effect over key causes may then be proposed to explain the problem and indicate solutions. Obviously this is an observation technique deployed by the interested researchers. The researcher can be located inside the system but can also be an external observer with academic interests. The attempt to reduce complexity is a tenet of the tool.

2 Tomaia-Cotsel, A. et al. (2017) – *Causal loop diagrams: a tool for visualizing emergent system behaviour*, chapter 6 in in Applied Systems Thinking for Health Systems Research, a methodological handbook, edited by De Savigny, D., Blanchet, K. and Adam, T.

If one accepts the understanding of systems as capable of self-reference, however, with continuous observation of their own operations and capacity to introduce changes in correspondence to the results of the observations, causal loops can hardly explain the dynamics driving a system. Even if loops actually exist in some instances, they cannot govern the system. This is the point we try to explain in this section, based on the Social System Theory.

In cybernetic terms, social systems are not *trivial machines* processing inputs and throwing outputs in a predetermined fashion, until they run out of inputs or processing capacity. Essentially, as mechanisms of *trivial machines*, feedback loops operate in a "blind mode", repeating themselves until they are somehow interrupted. In this sense, closed loops are artificial and cannot be used for predicting the behaviour of real social systems. To understand social systems, in relation to the external sources contributing with inputs, it is necessary to add decision-making dynamics such as coordination and supervision, to keep the loops operating, adjusting or switching them off if required.

An attempt to absorb the role of loops into the understanding of systems should try to reconcile the idea of loops with the notion that systems have a self-reference drive to perform self-preservation and self-maintenance (autopoiesis), for which they set in motion their self-organizing capabilities. In line with Social Systems Theory, a system needs to maintain its distinction from its environment, and by its own means preserve its distinctive internal operations. The system chooses the criteria it uses both to select what it considers of interest in the environment, and to select the internal elements and processes as it sees fit.

These self-management functions are incompatible with "governed by" automatic causal and deterministic "trivial machine"-like loops. Self-management requires continuous reflections on the status of the system and its operations. To be sure, a system can make mistakes, which may even lead to its destruction; one of those potentially destructive dynamics is exactly the continuous operation of a loop that depletes the system of its resources.

In such cases, unconstrained causal loops with negative effects can lead a system to collapse, unless the consequences they generate are compensated somehow by the intake of resources, or the loop is properly managed, meaning it is adjusted as necessary or even switched off, as mentioned above.

A causal loop may have some determinant factors beyond the system's control; however, the self-reproduction of the system ensures that it can select the elements and the relevance of their determinations, particularly when they be-

come matters of survival for the system. Systems face causal links between variables, but are not entirely dominated by them.

Furthermore, there is no way of assuring the functionality of a system that will be set with feedback loops controlled by other feedback loops controlled by another set of loops, and so on, in an endless chain of ever-increasing complexity. Such a system will be extremely vulnerable in consequence of its very complexity, curtailing its possibility of recognizing and adjusting itself to unexpected changes in its (internal or external) environment.

In a system's life, there are decisions, dilemmas and paradoxes that cannot be described in causal loop terms. The semantics of the dilemmas, tautologies and paradoxes have to be processed, solved and decided upon by "machines" that are, in the first place, *non-trivial*, or in other words are not "governed" by feedback loops.

Another feature of causal loops that deserves consideration is related to the fact that causal loops involving recognition of variables, selection or information and decisions require communications within the system. Indeed causal loops may be useful in stable and well-defined cycles, such as replenishment of drugs, avoiding stock-outs of critical medicines. However, the loops are operated by communications and they are subject to the double contingencies of expectations and selections at both communicating ends.

Communications are very different from and cannot be likened to models like electric, electronic or mechanical switches in control devices such as thermostats or airplane stabilizers. Even in a simple causal loop set in motion, for instance, to keep drugs stocks at the required level in a health facility, the unavoidable reliance on communications makes the loop vulnerable to all sorts of communication contingencies. The CLD tool does not account for that. Health system staff both on the side of requesting/receiving the drug replenishments and on the side of providing/dispatching them may face disruptions and adversities hampering their communications. It can be expected that in some contexts the drug supply mechanisms are more likely to be disrupted by countless factors than to operate regularly as designed.

As a last reflection, organizations constantly assess the internal and external environment of their operations and identify causal links (whether locked in loops or not) and especially the vulnerabilities and the risks involved for the operation of the enterprise. The techniques for doing so have been developed since management started to claim its scientific status. Enterprises all over the world have been seriously interested in identifying organizational models and possible cause–effect relations associated with the models.

The issues at stake have always been the achievement of efficiency and growth as well as development of distinct identity traits in competitive environments. Certainly the inventory of possible causal relations as well as interfering factors is and has always been of vital importance for any enterprise, whatever its nature. Organizations deploy a substantive portion of their observational efforts and create specific departments for that purpose. But, in this pursuit, efforts fixed on finding causal loops may hamper the self-referencing drive of the system rather than providing a helpful tool.

To be clear, the CLD is helpful as an auxiliary tool to model behaviours of variables of interest in a number of diverse scientific and management endeavours. The exercise to map out the variables of relevance and the relations between them is undoubtedly part of the techniques the systems can deploy in their efforts to internally represent the environment as well as making self-descriptions.

The system may identify loops that need to be observed and managed, as well as identifying the full range of other relevant variables outside the loops and, more importantly, having contingent decision influences over the inferred relations between variables. All selections a system makes are contingent, i.e. can be different; therefore causality can be fragile and explanations in traditional *trivial machines* terms are not very useful. In that regard, CLDs are very weak tools for the analysis of systems.

In short, causal loops do not reconcile well with the notion of selections and contingencies. In contingency terms, relations between variables can be otherwise as different selections can be made (by the observers and by those communicating). Selections are not determined beforehand by definite causal factors that have power over how observations should be done. The distinctions used for making observations are the object of selection. Selections are deliberations the system makes and communicates about. In the realm of communications, the selections can always be different. This goes to the heart of the epistemology of social systems.

To conclude, we can mention as an example that a biologist may find many causal links and possibly some loops among the interactions between different species in a forest. However, the ecology of the forest is not an autopoietic system as Social Systems Theory defines it. The interplay among species is an example of causal links between variables where neither the links nor the variables (species in the forest) comprise a system. Causal links and loops can exist without being part of a system. Autopoietic systems can address and incorporate causal links according to their relevance for their autopoiesis. This

is essentially the confusion CLD makes between models and systems. Models are representations of sets of variables and the interactions (including possible causal loops) between them. In contrast, systems are autopoietic self-referred units communicatively controlling their own reproduction. In this sense, CLD is a good technique for modelling and problem-solving, but not for systems analysis.