Contribution of socio-technical systems theory concepts to a framework of Territorial Intelligence

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Abstract: Territorial intelligence approach to sustainable development is largely relying on two major paradigms of modern social sciences: social constructivism and systems theory as keys to manage complexity. But, whether in current definitions or practical applications, that is implicitly assessed by authors. The aim of this communication is to re-visit some of the key concepts and principles of socio-technical systems theory to build up a consistent, explicit and practical framework of territorial intelligence achievements in order to contribute to a general theory of that new field of knowledge.

Introduction

The Caenti project brings together people from all Europe with their diversities and idiosyncrasies. The question of vocabulary thus can brings misunderstandings and, *at the same time,* richness and new insights. For example the word “intelligence” in Territorial Intelligence is largely polysemic and ambiguous. It may be taken with its Anglo-Saxon connotation of information and inquiry, or with its Latin connotation of ability to understand. We pose the ambiguity of communication within any European project as a source of richness that however needs to be managed appropriately in order to avoid misunderstanding. This is the European way to address complexity. Complexity is our world.

Thinking and dealing with complexity has been the goal of the epistemological endeavor conducted under the banner of General Systems Theory (Gst), from Wiener (1961), Von Bertalanffy (1968), Simon (1960) in the sixties to Von Foerster (1973), LeMoigne (1990) and

Morin (1977, 1980) in Europe in the nineties. This methodological light can be seen in the work of Robert Escarpit (1976) on the general theory of information and communication, for whom "*Theorists of telecommunications have used mathematical tools that already exist, namely those of the thermodynamic and statistical mechanics"*.

We aim at revisiting some of the General Systems Theory concepts to help structuring complexity in an emerging Territorial Intelligence theory. We will address among others the socio-technical systems, the notion of inquirer, systems openness, and entropy and deduce a discussion about learning and adaptability, emerging properties, game theory, hypertely and decision-making. A case study of urban development will prove how these concepts can be useful to understand and lead a territorial intelligence program.

The socio-technical systems approach

The system as a representation

Most every one has an intuitive grasp of what a system is, since we encounter in common parlance expressions like "the nervous system", "the metric system", or "the monetary system". The dictionary says it is " a group of units so combined as to form a whole and to operate in unison" (Webster). Clearly this applies to a territory. But try to ask several persons to define, say, the "social security system". You will receive various answers to the point that you may embarrass your interlocutor. If you had asked the question about the solar system, you would probably have received similar answers from people at similar level of secondary education, while you would diverge when questioning peasants in far eastern countries. So, our immediate experience of systems approach indicates that a so-called "system" is not an object universally defined and accepted. It is rather a construct of everyone's mind, under the influence of a cultural background and a social setting. It is the difference between mechanical systems and social systems. The manner in which "a given system is described depends upon the observer, his knowledge, and interest in the operation of the system, although for many systems there are some strata, i.e. features, which appear as natural or inherent" (Mesarovic et al., 1968, p33).

The role of the inquirer

The representation is assumed to have minimal commonality (e.g. rules of construct) between at least two minds so that communication between the latter can take place. Assessing rules for the representation of the "real" is the objective of Gst. Or to put it the other way around, Gst is a meta theory for abstract modeling the real world. Speaking of an object as a system is not an intrinsic property of the object. It is a method of observing it. Anything can be a system. "Systems everywhere", says Bertalanffy (1968). Defining a system is a specific choice of someone we name "inquirer", i.e. someone who is interested in doing so.

"Inquirer" is the single denomination for two characters: the observer and the designer. Establishing this distinction between two roles of the inquirer accounts for an intrinsic dissymmetry of human experience: the human mind either informs itself about the world or is creating something new in the world. We may formulate that in terms of information exchange as measured by *entropy*[1] as we will see below. When observing the system, the inquirer takes information from the system hence the systems entropy grows. When designing, the inquirer brings information and variety to the system under the shape of ordering and purposeful action; hence the system's entropy decreases. All these processes are time-related.

Consequence for the Territorial Intelligence framework

A territory is a system that can only be defined with respect to the point of view of the inquirer, whether it is the observer or the designer. The inquirer is able to single out the system from its environment. Hence a territory possesses an inside, an outside, and a boundary. The properties of the boundary will be crucial to systems thinking (Dumas, 2006, Bertacchini &al., 2006).

A further assumption is that the collective consciousness of change in the territory rejects the question of disorder, in other words, all forms of entropy. The concept of hypertely, borrowed from Gilbert Simondon, presents an interesting explanatory force to reflect the logical interfaces in building large urban systems, for example. Then the systemic properties of the emergence should enable us to explain the genesis of territorial forms in the context of multiple environments. Finally, we assess whether game theory and a renewed approach to decision theory are in a position to help us build a practical model of democratic formalization of political negotiation.

A preliminary list of some relevant systems concepts

Systems openness and bounded rationality

Pure “rational thinking” is based on a complete, explicit knowledge of cause-effect relationship in a system, or between the system and its environment. This means that in rational thinking a system is conceived as a closed entity, within clearly defined boundaries. It is a self-contained set of cause-effect relationship such as a mechanical engine described by a set of equations. Such approach has proven fruitful when applied to hardware or even natural systems. On the contrary, socio-technical systems include a set of relationship that exceeds human reason. They cannot be observed and completely described by any human inquiry. Hence we will name “openness” that property. It is related with the notion of porous boundaries that accounts for interactions with the environment and the possibility for the system to regenerate itself.

When the limits of human minds are reached with regard to its ability to handle numerous variables and cause-effect relationships, the knowledge of the system must be recognized as incomplete. Systems’ thinking is based on this recognition that the human mind is unable to apprehend the real world in its totality. That is a “bounded rationality” in Simon (1960) terms.

Hence the human mind is compelled to conceive a representation of the real that is incomplete. This representation leaves something outside. It is an open system. The system (e.g. the territory) on which the human mind works is recognized as an artificial simplification of the real. To account for what has been left aside the system must be supposed related to the environment. It is conceived “open”.

An open system is, in our representation of the real territory, the counterpart of our bounded rationality.

Systems borders between openness and closure

"*The environment such as we perceive it, is our invention*" (Von Foerster, 1973, p.74). "*A growing body of new knowledge suggests that what we call reality is actually something we construct*." The planetary ecological consciousness has to be related to cybernetics, born from the second world war and partly in reaction against it (Bougnoux, 1993).

Admittedly, we are immersed in varied environments that are either close, intermediary or distant. How we deal with them is one of the answers provided by territorial intelligence.

Contrary to closed thinking approach, systems thinking recognizes that borders can be both *frontiers* in the sense that they make the world intelligible by reducing it into independent pieces, and *screens* inasmuch as they let interactions occur between all components. Screening the environment is a process of (territorial) intelligence.

Systems of territorial intelligence need to use traditional processes of transmission information and communication and information technologies through Intranet or Internet Web sites, documentation, geographical information systems - Gis -, the Community Systems of Territorial Information - Csit- and the analysis of data. The strategy of Caenti consists in promoting comparative research, with two precise operational objectives, in accordance with the set of themes "*To promote and support research, methodologies and the production of comparative data*".

Design and diffusion of tools, methodologies and accessible protocols of research, on the one hand, with researchers in Social Sciences and, on the other hand, with actors of sustainable development of the territories is a concrete strategy and results are easily checkable.

Entropy

The concept of entropy originated with the principles of thermodynamics for which we propose here an extension.

Any physical system tends to evolve into a lesser state of organization: it is said that its entropy increases. A compressed gas tends spontaneously to a state where the pressure is lowest. To reduce it to its original state, we must compress, which commits expenditure of work. The entropy of an isolated system can only increase, while the usable energy of the system decreases. This degradation can only stop with a significant external.

The first law of thermodynamics denies the possibility of perpetual motion. The second principle goes further. The energy that each has can not be used entirely for the benefit of its author: there necessarily losses. All events in reality lead to a downgrading of energy. The overall entropy of the world as a single system can only increase. This implies that not only the individual can never win (the first principle), but that he lost a portion of his (second principle).

The second principle leads to the idea of death heat of the world. If any event increases universal entropy irreversibly degrading forms of energy pre-existing (by making them less usable), it is tempting to see in each of real events, a step towards a final state where everything movement become impossible by the lack of usable energy.

To understand what entropy is and to translate this scientific concept, it is necessary to analyze three dimensions of entropy in connection with the notions of order, balance and information.

- Entropy increases with disorder. In general we can say that any natural system ordered in time is tending toward a maximum state of disorder. To recover the initial order, we must invest much effort. Take the example of a building. If the decision is made not to make the necessary repairs, the house will fall quickly into disrepair. Even if it is cared for, sooner or later it will collapse. This is the trend toward disorder. The aging and the death of biological organisms can also be understood in this manner, as deteriorating structures.

- Entropy increases with the balance. Unlike an a priori, the balance is not related to the order but disorder and thus the increasing Entropy (note the difference between disorder and imbalance). The disorder is to be avoided because it is a defect, deterioration. This is the imbalance which otherwise is a potential towards equilibrium. Anything in nature that is in a state of imbalance creates a usable energy. The Earth has two poles of opposing polarity. Such

imbalance is allowing terrestrial magnetic fields to exist. A drop of water comes from an imbalance in gravity and can be used to create energy. The entropy is very low. By contrast, the ocean contains considerable energy in the form of heat. However, the latter being in balance, it is impossible to use it. The ocean has high entropy that makes it unusable. Man was able to control locally and on a limited time increasing entropy. The centrepiece of our churches uses the sum of local small entropies to create a point with high entropy and therefore stable. This system generates not only a balance, and therefore high entropy, but also ordered and scalable low entropy. This evolution is part of a relation to time when the balance is split. The vault will eventually collapse to its minimum entropy, a pile of stones.

- Entropy and information. In information theory, entropy is a measure of noise in a channel where we try to send a message. In other words, when we transmit the information via a canal, there is noise. Entropy and information can be distinguished. In architecture, for example, building requires information. The latter are reflected in a manual or orally transmitted. The more a construction is sophisticated, the higher information is. On the other hand, we do not need to build manual with the same materials, a heap of stone. Its entropy will be much higher than that of construction.

The concept of entropy has been used repeatedly information science and communication. However, moving from theory to the social sciences thermodynamics must be done with caution. If the notions of entropy and neg-entropy may apply to information science and communication, it must take into account the human side the area considered: "*We can venture the hypothesis that the concept [of information] is structurally linked to that of entropy, but it differs by the fact that it takes into account two elements ignored by the physical science: life, and especially thought"*(Escarpit, 1976).

Lucien Sfez, indicated in *Critique of communication* that "*these considerations lead to promote a relative entropy, which, among a total mess of uncertainty and random and repetition (redundancy) without information, maintain an adequate degree of entropy*" (Sfez, 1992). Rather than entropy itself, Robert Escarpit preferred to speak of neg-entropy. While entropy tends to chaos, neg-entropy moves away. These are two interpretations of the same state, one optimistic and the other pessimistic, "*But sometimes, there may be incidents of communications requiring amendments to the program. These changes are changes that can be neg-entropic as in the case of adaptations to the environment, or entropic as in the case of cancer*" (Escarpit, 1976). It is clear from these notions that if we want to lead a constructive meeting between people on a particular project, it is necessary to create conditions such as microcosm entropy is locally reduced. The latter goes through:

- A place where law and order prevail and are regulated and enforced. Place where the rules of the game are fixed in advance and where everyone enjoys legitimacy.

- A place that is not in balance, where all views can be presented, as well as all categories of users. The balance, we have just seen, is not synonymous with order, but thermal death. The same is true for ideas. In a balanced situation, they do not circulate and do not thrive.

- A place where information is clear about and is suitable for use by all.

The approach requires communication and, these three characteristics as a result, in order to locally reduce the entropy and create the necessary conditions for a constructive discussion. We will see another view of these imperatives in the further section about conditions of decision-making.

Learning and adaptability

An adaptive system is in the class of complex systems that show self-direction in an evolutive environment. Adaptation differs from controlled behavior inasmuch as it understands a quest for efficiency[2], goals being unchanged. Says Ackoff (1974, 668): "adaptiveness is the ability of a system to modify itself or its environment when either has changed to the system disadvantage so as to regain at least some of its efficiency".

For Ackoff, this definition implies four types of adaptation: other-other, other-self, self-other, and self-self adaptation depending upon which one of the system or the environment is induced to change. For instance, the quality of gasoline drops unexpectedly due to uncertainty of the environment (the markets). The car owner may continue to ride his car at the same speed by increasing his consumption: he then displays goal-seeking behavior under feedback[3] control, at the expense of the reduction of his efficiency (ratio speed/consumption) in an other-self adaptation. He may also change the gas in an other-other adaptation, or change the car or change the desired speed in a self-self adaptation. We presently watch such kinds of conducts in relation with sustainable development issues.

"To learn is to increase one's efficiency in the pursuit of a goal under unchanged conditions" (ibid; p 669). It is noticeable that learning requires time, the ability to make choice and a memory.

It is now common say to extend the notion of learning to organizations. This implies in addition a collaborative capability. E. Morin has shown that an open system like an organization (e.g. a territory) demonstrates capabilities of self- learning by recording its own behavior.

Emerging properties

Open systems display emerging properties when learning and adapting, in the sense that new behaviors tend to create new functions, forms and significances whether in the learning individual or the learning organization. There are strong correspondences between properties, functions, forms and significances. The application of this concept to Territorial Intelligence should allow us to better understand the changes in our present world under the pressure of sustainable development. Networking, social communities are examples of new functions and correlative forms (Mallet, 2007). Information technologies are both the trigger and the result of adaptation in organizations.

The emergence is a property that makes the whole is not reducible to its parts; it is more –it has its own properties that are overhanging-, and less -it does not possess all the properties of its parts, some information is lost. A quote from Robert B. Laughlin (2005) summarizes the concept: "*It (a solid, a cloud, an agency) leads its life in an autonomous manner. The rules governing it do not depend on those governing its constituents. It reflects a new level of organization. They testify to the phenomenon most mysterious and therefore the most fascinating of nature: the emergence*".

The existence of emerging properties implies that the addition of several elements is not equal their sum. Thus, interactions between components may cancel their differences and combine in a new system. This limits the scope of certain forces that cancel (electrically charged) or balance to a higher level of observation where the components are no longer taken individually but as a whole, at a comprehensive statistical level (crowd, thermodynamics, noise). Holism is a common application of that concept. New properties may be dispersing as entropy or amplifying as the phenomena of rhythm, strengthening or piping (a river that widens), which are not reducible to the elements involved; this also may happen at the molecular level. Emergence is the simplest in statistical mechanics. Beyond these simple

mechanical properties, emergence has the trait to establish any macro level different from the sum of the properties at the micro level. This is the case, for example, for the water molecule (H2O), whose properties are clean and are quite different from those of oxygen and hydrogen. Each element has lost independence to meet the purpose of the combination of the two.

These are phenomena or reflexive construction of a recursive interaction with the environment. Causality is no longer just domestic. It is really emerging not only from the elements but also from the outside and effects. What is emerging here are the purpose and the project. It is in a reflexive, all-capable of changing itself, controlled interaction with the environment, a constant adjustment with the reality. Extrapolation of this physical phenomenon can be made for a meeting of participatory democracy:

- Confrontation of individuals with different expectations cancels their own opinions in favour of a combination of more than their own money.

- The discussions raise the dynamic progresses that take precedence over the views of each.

- This dynamic imposes its own rules.

- For feedback, the project will become the purpose of this micro-organization. Each individual is different, not by his own opinion, but with a specialization in a particular field of discussion.

It seems that participatory democracy, to work, should respond to basic rules minimizing its entropy and encouraging the emergence of the collective opinion.

This axiom questioned the conduct of a conciliation meeting because even when there is enough qualities of entropy, the emergence of the collective opinion will be held. In the wake of scientific borrowing, one of the solutions is based on a mathematical theory, the game theory. This theory is called upon to illustrate any situation that features players under certain conditions. They must develop strategies to maximize their earnings. The situation has generated a balance and the emergence of a solution around which all will agree.

These gains are varied and depend on the expectations of citizens in a process of participation. This may be the personal welfare or a more altruistic motivation. This theory tells us more about the conditions of equilibrium.

Game theory: toward the balance

The game theory is a mathematical method for analyzing the strategic interactions among individuals with divergent interests by the study of configurations where the situation of each depends on the behaviour of all. It takes its roots in the strategy games. Thus a meeting of conciliation, as well as any meeting of participatory democracy, can be treated as a “game” because every players use strategies to maximize their earnings.

The translation in terms of gaming of these meetings is done by the initial configuration of the situation described by parameters such as the number of players, all possible strategies, the order of speakers, the information detained by each, and the expected gains. Based on these pieces of data, each actor- player (i.e. each participant in a meeting) develops a strategy characterized by the potential gain he can draw from it.

The mathematician Nash is at the origin of a theorem to demonstrate that this type of situation gives rise to a balance called “Nash-balance”. It is the set of strategies (one strategy for each player) such as no player can’t gain more if he unilaterally changes strategy. The choices reflect the strategies of other players. This implies no regrets.

The Nash theorem states that all ended game admits at least one Nash equilibrium. This means that any interaction between various individuals admits a Nash equilibrium, and

therefore a strategy. Once implemented, it gives way to the absence of regrets of the participants. This theorem can be applied to our subject. In this case, the Nash balance coming out of this strategy game is a process of participation. That is a solution, which is not necessarily the best, but there are no regrets and a degree of satisfaction sufficient for concerned parties to arrive at the resolution of the problematic situation.

Moreover, game theory allows for two investigations that help to the study of the participation process:

- The duration of proceedings for participation should be fixed and known. Nash balance exists if the number of repetitions is finished. However, if the game is repeated infinitely, or if the players do not know how many times it will be repeated the system is not determined and there is no possibility of prediction. Thus, the rules of a process of participation must be clear if a Nash balance is search.

- The solution that emerges from a game or a participation procedure is not necessarily the optimum solution for each. It is one of the inputs of the theory of Nash in the understanding of human strategies. Personal rationality of the players do not necessarily lead to a collective rationality[4]. This is the dilemma between individual rationality and collective rationality. To escape, it is necessary to explain to both players gains matrix to move towards a cooperation agreement.

The game theory shows that the participation procedure, if properly defined in terms of rules of the game and planning, gives the emergence of a balanced solution. It is all the more optimal when it is conducted in a cooperation spirit.

The use of these three theories highlights the auto-emerging character of some forms of participatory process, if the conditions in which these are conducted are able to make the phenomenon occur, i.e. if an entropic value is low. These conditions are reflected in the proposal of a model derived from the laws of physics and mathematics reviewed here above. However, in the context of continuously adapting systems like a city, negative hypertely is to be avoided.

Hypertely

Hypertely is that way of adaptation of a system to its environment (self-other) based on the hypertrophied development of existing functions. Hypertely is a term borrowed from biology that has been adapted to technical objects by Simondon (1989), and applied to territorial development by Gardère (2006, 2007). There are two sorts of hypertelies. The one is named “negative” to characterize endogenous developments. An example is the expansion of regulations to control public space in city development. The other is “positive” in the sense that it improves efficiency of the system. For example, traffic lights can be used intelligently to regulate the flows of public transportation at the expense of the speed of private vehicles.

Functional relations between objects make up a sub-system within the socio-technical system with emerging properties that induce self-self adaptations. These are both efficient and effective when hypertely is positive. Making it positive is the process of participative democracy at the level of the territory, a process that implies certain types of decision-making as will be evoked hereafter. The management interfaces contained in the notion of hypertely is central in the development of a theory of participatory democracy. The interface between the citizen and the elected exists. To avoid the pitfalls of a poorly proportioned interface (Negative hypertely), it is desirable to determinate this interface while developing the process. This is the keystone of the *micro representativity* (Gardère, 2006). Here again we come close to the notion of permeable and evolutive borders that characterizes system’s approach.

Decision-making

Decision-making is classically introduced in the literature in the form of an individual exerting a choice between several alternatives of ends and means. A given choice is motivated by its expected outcome(s). This general framework has given rise to several approaches to decision making. Among them are the economic approach to "rational decision making" and the behavioral approach defined by the March-Cyert-Simon school. In short, rational decision-making assumes that 1) all possible alternatives are known, 2) all outcomes are known, and 3) preferences for every outcome can be ordered. Under these conditions, the decision maker is assumed to choose so as to maximize the pay-off. The behavioral approach recognizes that not all alternatives are known: choice is only satisficing. Yet preferences are ordered, and the decision maker seeks to know as many alternatives as possible. Hence a quest for good "information for decision" is a permanent goal of information specialists (Goria, 2006). But that quest will ever be limited by our "bounded rationality" (see above).

Meanwhile less emphasis can be put on the individual since most organizations decide collectively. Then decision-making is rather viewed as a process of negotiation between social actors linked altogether in power relationship. A given decision is neither optimizing nor satisficing in the sense given above, but it is the result of compromises, trade-offs between conflicting rationalities so as to square with the balance of power between those who hold the rationalities. This is the basis for the experiments in participative democracy and micro-representativeness (Gardère, 2006). It is demonstrated that trade-offs and compromises are possible, but not systematic. A way to reach democratic consensus in territorial organizations consists in recognizing that people behave differently depending on their beliefs about outcomes –implying beliefs about cause-effect relationship- and the way they order their preferences. Thompson (1967) and Dumas (1978) have proposed a model that later orientates the type of "inquiring" adapted to reach a decision.

In that systems modeling of decision making, two basic dimensions account for a typology of decision-making.

1) The beliefs of decision makers about the cause-effect relationship of their action to the future outcome;
2) The standards of desirability against which effects of causal actions can be evaluated.

By combining the extreme occurrences on these two continua, we obtain a typological matrix of organizational assessment (Figure 1)

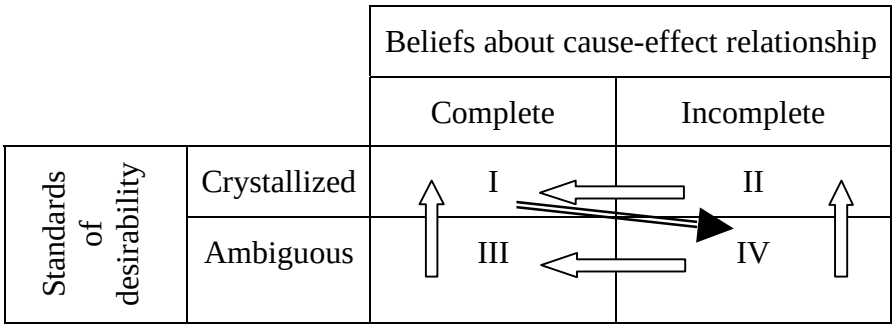

Figure 1: Four types of organizational assessment based on the complexity of decision situations

The four cells identified in that typology correspond to the following organizational situations in Territorial decision-making.

I: closed systems' thinking relies on the hypothesis of efficiency maximization of outcomes; it is the area where consensus is obtained because everyone thinks alike.

II: goals are shared, but the ways to attain them are controversial.

III: goals are not shared but the cause-effect relationship is fairly clear, so that negotiation can take place in power relationship.

IV: confused situations where all arguments are set forth and debated. It is also the situation where creativity will provide a way to return to cell I where consensus can be reached.

The interest of that typology is that situations are shifting from one cell to another (as figured by the arrows in Figure 1) and this shifting game will explain the collective decision making process.

A case study: urban development as territorial intelligence process

The development of a city, its zones, neighbourhoods, suburban, outgrowths, tracing of the streets and logistical uses create infinite hypertely to adapt the changing environments.

Over the change in a city, the citizens' interactions with each other and with public space generate continual adaptations of the environment according to usage. Thus, the increased requirements on the road leading to arterial roads carry out ever more important. The problem saturations and pollution increases, a transit was privileged. This example demonstrates the various bodies that are successively being hypertely during changes of the city.

In the city, we cannot fail to communicate about the disorder, the immediate signs of disorder. The entropy of black facades, tags, comes into its own policy in the long term: what makes sign, in the public space affected by this so urban disorder is the persistence of the trace. This explains the stranglehold on the political and technical hypertelic solutions. The political instance delegates to the technical power to counter the inherent chaos of the city. The quality of life of a city, as expressed in its flow, its passages and bridges, always a policy hallmark in favour of an optimal technical solution and therefore a successful hypertely: "*hypertely research by value analysis useful information to resolve technical malfunction and / or*

humans in the implementation of a project. Cells possess the experts who could innovate and ensure the success of the project"[Gramaccia, (2001)].

The transition from disorder to order is the result of a technical choice in the political process. Two political instances divide public space in the city. The first is the election, which orders (in all senses of the term: in order, to order, to prescribe, to spend). This is what we call the major uses of the city: traffic, access to commercial spaces, security, and hygiene. The second is the user who suffers, in its daily life, the harmful effects of a temporarily disabled or restricted hypertely.

So, what urban public spaces have to redesign for creating settlement spaces? Can we argue that communicational power could be created from the coexistence of institutional political power and popular power? This concern is at the heart of democratic debate. One condition for success is that citizens can freely come to an agreement on collective solutions at the cost of hypertelic sacrifices and individual entropy at short term (provisionally accept losing a little commercial time to build a road for example).

The experience of neighbourhood associations shows that the procedure is difficult to apply if the hypertelic constraints are not resolved.

The adaptation of representative democracy to participatory democracy should not cause negative hypertely. It would make the system malfunctions. The dialogue is not an end in itself but a means. A hypertely of the organizing services of participatory democracy in a city should not, by its heaviness, act against the project. Indeed, a hypertelic communication mismanaged can take precedence over the project. But if the aim is to begin a reflexive process on the terms of proximity, it is to find the way of another technical design, more sustainable.

Conclusion

This short insight into systems thinking has proven that those concepts developed in the last decades can provide the theoretical framework for organizing findings on the field. At present this review is sketchy and incomplete. It is an objective of Caenti research to complete it.

Bibliographical notes

Ackoff, R.L. (1974) “Towards a System of Systems Concepts”, *Management Science*, vol 17, N° 11, July, pp 661-671.

Bertalanffy, L. von (1968) *General System Theory*, N.Y. Braziller.

Bertacchini,Y., Girardot,J-J., Gramaccia, G., (2006) "De l'intelligence territoriale. Théorie, Posture, Hypothèses, Définitions.”, in : Actes du 5e colloque "TIC et Territoire : quels développements ?", *ISDM*, http://isdm.univ-tln.fr , juin 2006, n° 26.

Bertacchini, Y., Pennalva, J-M., (2006) « L’intelligence territoriale : posture théorique, hypothèses, définition. », in *Intelligence collective*, pp.9-17, Presse de l’Ecole des Mines de Paris, Paris.

Bougnoux, D., (1993) *Sciences de l'information et de la communication*, Textes essentiels, Larousse, Paris.

Dumas, Ph. (1978) Management Information Systems: A Dialectic Theory and the Evaluation Issue, PhD Thesis, University of Texas, Austin.

Dumas, Ph., (2006) ‘Is The Region The Most Suitable For Sustainable Development?’, First Annual Conference Of Territorial Intelligence, University “1er decembrie 1918”, Project CAENTI Alba Iulia, Romania.

Escarpit R., (1976) *Théorie générale de l’information et de la communication*, Paris, Hachette.

Gardère J-P., (2006), *Démocratie participative et communication de proximité dans l’aménagement urbain. Le projet urbain : un outil de reconquête de la démocratie*. Bordeaux, Thèse de doctorat, Université Bordeaux 3.

Gardère, J.P. (2007) “Démocratie participative en aménagement urbain vers la micro-représentativité » *Isdm*, N°31, 136, http://isdm.univ-tln.fr/PDF/isdm31/isdm31_gardere.pdf

Gardère, J.P.(2006) *Démocratie participative et communication de proximité en aménagement urbain*, Thèse de doctorat, Université de Bordeaux 3.

Goria, S. (2007) “Proposition d’une démarche de questionnements pour modéliser un système d’intelligence économique » *Isdm*, N°31, 135, http://isdm.univ-tln.fr/PDF/isdm31/isdm31_goria_afolabi.pdf

Gramaccia G., (2001), *Les actes de langage dans les organisations*, Paris, L’Harmattan.

Laughlin R. B., (2005), *La Recherche*, p. 106.

Le Moigne, J.L. (1990), *La modélisation des systèmes complexes*, Paris, Dunod.

Mallet, J. (2007), « Intelligence collective, équipe apprenante et Tice. Les problèmes culturels sous-jacents », Actes du Colloque international TiceMed, Marseille, Mai, in *Isdm*, N° 29 , http://isdm.univ-tln.fr/articles/num_archives.htm#isdm29

Mesarovic, M.D., Macko, D. (1968) « Foundations for a Scientific Theory of Hierarchical Systems », In Whyte & al. (1968) *Hierarchiccal Structures*, N.Y. Elsevier.

Morin, E. (1977-1980), *La Méthode*, Tomes 1, 2, 3 et 4, Paris, Seuil.

Sfez L., (1992), *Critique de la communication*, Paris ,Essai, p 67.

Simon, H. A. (1960) *The new Science of Management Decision*, N.Y. Harper and Bros.

Simondon G., (1989), *Du mode d'existence des objets techniques*, Paris, Aubier, p. 50.

Thomson, J.D. (1967) *Organization in Action*, N.Y. Mc Graw Hill.

Von Foerster, H., (1973) "On constructing a reality." In: W.F.E. Preiser (ed.): *Environmental design Research*, vol 2, Stroudberg, 35-45

Wiener, N. (1961) *Cybernetics*, Cambridge, The Mit Press.

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[1] A measure of internal degradation of closed systems diversity towards an ultimate state of uniformity.

[2] Efficiency refers to a ratio between systems outputs and inputs, while effectiveness qualifies the degree of achievement of a systems goal.

[3] Feedback is the process by which a system corrects the inputs so as to maintain its goal.

[4] Also known as The prisoner's dilemma.