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Flows of Signs on a Network

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Abstract
Theory of collective cognition implies the capture of cognitive functions that are accomplished by collective entities as groups, enterprises, organizations or institutions. The most often, the collective is provided with the same attributes and the same abilities as the individual. This recover an agglutination of individual thought in collective thought preserving essential characteristics of the individual thought. Then the problem is: to study, describe and formalize the agglutination of individual thought in collective thought preserving essential characteristics of the individual thought.

Taking in account the network of the relationships between individuals, the collective entities, and the fact that the objects of knowledge are mediatized by signs we capture the Peirce's conceptions of the individuals living under a "perfusion of signs". Indeed , the interpretations of the agents are heterogeneous : spontaneously, they "degenerate" signs according to their abilities, that is to say they construct objects phenomenologically more poor that it is possible using the totality of the information conveyed by the signs (we call this "phenomenological entropy"). Using Peircean semiotics and especially the lattice of the ten classes of signs we show that the cognition is semiotically "foliated" and that is possible to pose semiotic conditions for a rational knowledge.

To think with accuracy about collective cognition it is necessary to define with precision the subject of this cognition.This latter it is not a totality of separate individuals constituted by the unique common reference to an or several objects of knowledge. Individuals communicate, knowledge spreads in human communities so much that Sperber (1987) has been able to advance the metaphor - perhaps a bit risky - of a "epidemiology of representations". It concerns of course the capture of cognitive functions that are accomplished by collective entities as groups, enterprises, organizations, institutions (Levy 1990) ; for a lot of reasons these functions have to be distinguished from purely individual cognitive phenomena. However reflections in this area (the cognitive ecology) lead to a collective entity provided with a mind and the possibility of express in a thought like any individual. That allows us to underline that in this passage from the individual to the collective, that is most often done in spontaneous manner and without examination, the collective is provided with the same attributes and the same abilities as the individual. In other words, in this agglutination of individual thought in collective thought, and whatever the mode of agglutination, essential characteristics of the individual thought are preserved. There is a sort of a priori of mereologic nature that deserves to be examined in view of its justification. For that purpose we will put forward the notion of network that will allow us to conceive rationally the human totalities as collective totalities.

The notion of network is not required only to constitute collective individual entities; it is as necessary to form the basis of the individual cognition on which is based in turn collective cognition. Indeed, all knowledge with regard to any object (material or non) for a given individual is the result of a direct experience of this

object, and of the informations on the object that he acquires as member of the network. This latter (mediate experience) is absolutely determining1 in the meaning where it organizes the original experience. It is knowledge by signs: messages transported by the network are the amount of information about the object of which they stand for under a certain (cognitive) aspect. The effect of a sign on an individual is the production of an interpretant (a determination of its mind of a particular kind that Peirce qualifies "a cognition of a mind" in Peirce (1931-58:2-242). In the semiosis (interpretation of a sign) the individual is informed that the qualities or configurations of qualities that the sign that he perceives posseses are qualities or configurations of qualities that possesses another object that is the object of knowledge absent from the field of its current experience. He builds its conception of the object and organizes its knowledge by accumulation and successive restructurings that "stick" its conceptions permanently with the information of any nature that he get.

For a rigorous approach of collective cognition it is necessary therefore, according to us, to take social networks into consideration on the one hand and the semiotic fact that is coextensive to each acquisition of knowledge on the other hand. This is why by analogy with the mathematical flow theory on a graph we suggest to formalize collective cognition in terms of flows of signs on a network. The analogy is purely formal and exclude for the moment any quantitative approach like in the theory of information. Notice that this approach organizes formally the conception of Peirce according to whatever individual lives under a "perfusion of signs" . Note also, from these verifications of common sense, how much the semiotics is the most notable absentee of cognitive science, probably because the linguistics fills (badly) the role that, in our idea, would have to return it.

1. Networks, signs and cognition

1.1. Networks

In the perspective that come you to evoke we will suppose therefore that nodes of networks are occupied by agents rather than by individuals and that its arcs are canals of communication effectively covered by signs. We underline in the way the active character of the nodes of the network which can be interpreters as well as sign transmitters. In addition we will suppose that the network is related, that is to say that no agent or subnetwork of agents is isolated. By organizing a priori agents in network have insured to incorporate in the modelization of collective cognition not only interindividual communications that bring a part of the cognitive information on objects of the world but also communications between individuals, groups, organizations and institutions. It suffices to notice that to every group, organization or social institution one can associate a related subnetwork and to consider that all agents of this subnetwork are equivalent, (under a certain aspect that corresponds to specific communication canals instituted by the membership to the group, to the organization or to the institution). That does not forbid that, furthermore, individuals preserve their interpersonal communication canals. The game of the multiple memberships make that all agent can belong to several subnetworks of this type. That will authorize us to replace some subnetworks linked to social groups by an unique collective agent able to emit and to interpret signs in the same way that an individual agent. The same one agent, for each of its memberships, will be able therefore to play the role of representative of each collective agent (it will be, in each of these roles, a "Sir as" like has told P.Bourdieu: as consumer, as viewer, as professor, as taxpayer, etc, etc,...). We will not seek to specify unduly the formal structure of the network beyond coherence or consistency demands because that would lead us to pilot the construction of the model by considerations that are not stemming the observation of facts. We can admit a certain vagueness as for representations in the network of the different collective agents

and individual agents that constitute them. It is clear however that, in many areas, it is possible to implement abstract formalisms clearly more advanced (Parrochia 1993).

1.2. Signs

In our introduction, we have made implicitly reference in a notion of sign that situates us in the triadic semiotics of Peirce and this of a vague way as above-mentioned: a sign is something that stands for other thing for someone. Note immediately that there is no question to introduce any pair signifiant/signified or any pair expression/content. Indeed, the saussurean signified as well as the hjelmslevean content have universal value for a culture: they are normative in the meaning where, in the semiological analysis, they are considered as the "already-there is" to which a given subject accesss or does not access according to its anterior cognitive trip. It is difficult, from there to conceive the collective cognition in its relationships with the individual cognition because the first emerges from a universalism that ignores the singularity (therefore also the negativity) of the second. On the other hand, the peircean triadic sign such that we have formalized it and completed (Marty 1990) is perfectly adapted to our purpose since it allows to individualize the relations of every agent to any object of knowledge according to its personal implication in institutions of the meaning that rule the relationship between the signs and their objects (that we could have call cultural codes if the notion of code was less rigid, less reified). We will analyze further the role and the cognitive function of these relationships.

At present it is advisable to expose briefly and more precise manner the triadic conception of the sign that we will implement. To tell that a sign is triadic is to tell that it is constituted three elements: the object, the sign itself and the interpretant. The object is the reality or fragment of the reality that determines the sign (a "knowable"); it can belong or non to the physical world. The sign is the concrete thing that represents and the interpretant is, in the first moment of the analysis, a connection "already-there is" between object and sign, connection instituted by the culture (a micro-social institution in the meaning of the Institutional Analysis, Lourau, 1970) and internalized in varying degrees by members of a community2. The agent is therefore the place some which micro-institutions expresses itself; it is the place of their particularity. It is at this level that appears possibly the negation of the institution as universal norm. Then one sees that this conception of the sign brings social dialectic to the heart of the model because it is easy to conceive that a denied norm and transformed by a significant majority of agents of the network opens up in the short term on a transformation of the norm in question and allows to take charge the temporal dynamic of meaning. In short, the interpretant is a social norm established under its universal aspect (moment); and under its psychological aspect, internalized hic et nunc by an interpreter; it is the particular determination of a mind conditioned both by this norm that it has internalized (in the "Teacher Society" in the meaning of Lourau) and by its own experience of the field to which the norm applies.

In conclusion the signs that circulate in the network refer, in the meaning that comes to be stated, to the objects of knowledge with which they maintain an instituted relationship (but always under way of institution) because they carry some characteristics these objects. They allow agents of the network that receive them to enter in mediate cognitive relationship , that is to say informed by the culture, with these objects.

1.3. Cognition

How signs do they bring knowledge on real objects to an agent of the network? A prerequisite is that this agent has internalized and/or builds a connection signs/object; in others terms it is necessary that happen what we have called a phenomenology of seconds intention (Marty 1990) according to whether a perceived thing - the sign - is present to the senses but it is a thing generally absent from the field of the perception - the object -

that is present to the mind.

This prerequisite being supposed one can begin to give general elements of reply by calling on a taxinomy universally adopted of signs, borrowed to Peirce (and used sometimes without proper judgement) namely icon - index - symbols. An icon is a sign that possesses qualities or a configuration of qualities that possesses also the object (it is a sign by "resemblance" , this term having to be used with a lot of precaution, just to give an idea because it is too vague). An index directs the attention on the object with which it is really connected. A symbol is an interpreted sign as being an instance of a social convention, law or collective habitus (one sees here the necessity of the prerequisite); more generally a symbol is a sign to which a community attributes a value of regularity for an indefinite future. Iconic signs bring information on their objects since they possess qualities of this object. These qualities, configured or non, are selected de facto to the moment of the actualization of the connection with the object whose they constitute the essence itself. Index allow to identify objects on which is brought the information and symbols mobilize to their purpose concepts, laws or habitus that them are applicable (for example the membership of the object to a class of objects labelled by a name in the culture; a symbol states therefore that its object "tomb under a concept"; in other words, is an instance of law).

It is important to note that these categories do not constitute a tripartition of signs. More precisely and by definition, an index contains necessarily an icon and a symbol contains necessarily an index therefore also an icon.

However for a given sign a little bit complex, it can happen that parts of this sign function as icons, others as index, others again as symbols not without that these icons have any relationship with those that are logically incorporated in index. The same notices holds for symbols in relation to index. The perfect sign is that that functions simultaneously to the three levels[3]; it does not exist necessarily for each object on which one wants to transmit the knowledge. It will be necessary then to resort to a combination of the different categories of signs to give a complete cognitive representation. This are considerations of this order that are going to allow us complexify the model.

2. Complexification of the model

2.1. Modes of being

Signs that circulate in the network represent therefore, for agents that are in place in the nodes of the network, objects to which they are connected, under a certain aspect. It follows that the representation of an object and, by way consequence, the cognition on this object, depends a priori on the performance of the sign in this connection. The latter is conditioned, in a way, by the capacities of the sign to connect and it is clear that, in the case of connections by social convention at least, it is what motivates the choice of signs. Modes of being covered categorizations of possibilities a priori for a thing to be connected with an other. It is advisable therefore to grant them the greatest importance since they determine entirely the mediate cognition. As far as we are concerned, since a sign is a concrete thing, we are going to categorize relational capacities of concrete things. Previously, it is necessary to notice and keep constantly present to the mind that a sign is a fragment of the physical universe that "loan" a part to its being to another fragment of the universe. If Peirce could write: " it is a thing to be and it is another thing to be represented ", it is precisely because the connection between a sign and an object, even if is it highly faithful , can practically never represent the whole of being of the object. A such thing would be possible only in a "singleton" universe with an unique element that would be both sign, object and interpretant.

Modes of being are therefore categories of connection possibilities. One can define them rigorously from formal purely

considerations by situating them in the relational algebra from a formalization of the perception of the physical world into relational structure terms (Marty 1990 and 1992a). We give here only the results by underlining that it is in perfect concordance with phaneroscopic or coenopythagorean categories of Peirce, that is to say categories of elements of phenomenon. One distinguishes modes of being unary or monadic corresponding to the peircean Firstness that connect a sign to its object by reference to common qualitative possibilities (connection by the quality: two things producing, for example, a "feeling of red" belong to the class of red things that bases the "redness" as general quality and this common membership connects them); modes of being binary or dyadic that are connections de facto in which two things merge in an event whose they are protagonists and that they constitute (it is the case of every action-reaction in the physical universe that illustrates the peircean Secondness) and modes of being ternary or triadic that institute the mediations between two other things (it is the case of a mental act that connects a sign and its object in accordance with a law or regularity whose it is an instance : this case illustrates perfectly the peircean Thirdness). Laws or regularities in question preexist in the explicit form (laws the physical world, concepts, social conventions institutionalized), or the implicit form (habitus, instituted social, "practical" ideologies",...). There are not others "relational" modes of being possible. Indeed, a relational algebra theorem whose Peirce had the intuition and established in different but convergent theorical contexts(Herzberger 1981, Marty 1990, Burch 1992) allows to establish that any other mode of being can be described as a combination (like to the one which , in chemistry, put together atoms in molecules) of the three fundamental modes of being .

In addition these three modes of being are organized into hierarchy by non reciprocal relationships of presupposition : the Thirdness presupposes the Secondness which presupposes the Firstness. It is obvious since all regularity concerns necessarily the Existent and Facts which presuppose incarnate general qualities of the matter.

To take in account the modes of being in constitutive relationships of the sign lead logically to a categorization of signs that complexifies the initial purpose and presents a great interest for the study of the collective cognition.

2.2. Classes of signs

A finer analysis of the triadic sign shows that the triad is established by means a twofold determination : first, from the sign by the object, second, from the interpretant by the sign.These dyadic relationships are implied, incorporated in the triad. They express modes of being in the sign of the elements of the sign. Now, the hierarchy of modes of being impose that these determination respect the order 3,2,1 according to whether a mode of being Third able determine a Third, a Second or a First, a mode of being Second able determine a Second or a First and a First can determine only a First. Correspondingly 10 combinations only are phenomenologically possible. There are therefore only 10 classes of signs possible. In addition these 10 classes of signs are ordered in an algebraic structure called lattice (these results are established and widened in Marty 1990 using algebraic category theory).

The lattice of 10 triadic classes of signs constitutes therefore a real grammar that governs relationships of signs . It follows that every set of signs given to the perception as a collective totality is structured a priori by these relationships. It seems that a result of this nature that concerns notably the representation of knowledge could have be usefully taken in account in cognitive science.

2.3.The cognitive foliation

The knowledge in relation to an object that reach the agents of the network by means signs are therefore determined by modes

of being of the objects that they represent and by modes of being of the signs that support the representation. An object "third" (a regularity) will be able therefore to be represented by an other object third, an object "second" or an object "first", an object second by another second or by a first, a first only by a first. The same happens in the relationship of the sign to the interpretant and the two modes of being are concatened. It can happen a sort of phenomenological entropy (for example, a third that is represented by a second can be interpreted as a second or a first that is incorporated in this second). In other words each agent builds, according to its particular relation to institutions of the meaning, a set of objects determined by modes of being that it identifies. These objects are structured by these modes of being; they belong to classes of signs that are ordered by the lattice. These objects are, in a way, "above" signs to different levels determined by their phenomenology. They constitute a very "foliation" of knowledge transported by the representation (for an application to semantic networks, to see Marty 1992a, and to the theory of text to see Marty 1992b). In addition, the different levels of this foliation are linked by relationships of the lattice a bit to the manner whose sheets of calculation can be linked in a spreadsheet It follows that flows of signs that reach an agent of the network are in fact the "multiflows" in a different and more precise meaning that expresses Parrochia (1993 : 213). That allows an approach clearly more structured of the "communication in movement"(Parrochia, 1993:71).

3. Cognitive multiflows on a network

3.1. From the individual to the collective

We are now in position to formalize in new terms the real situation in which agents of the network receive and emit signs by means canals that are to their disposition. What stands to reason, it is that one will not be able to speak collective cognition if all agents of the network have not obtained the same information, directly or indirectly, and if they it have not all interpreted likewise (that is to say if they have not all attributed to the same object qualities -configured or non - of an even signs, and/or if they have not all taken in account its objective relationships with other objects, and/or if they have not interiorized the same law or regularities and they have not considered that this latter incorporate the object and his relations in their application area).

However, we have seen furthermore that, according to the relations that agents maintain with micro-institutions of the meaning (notably correspondingly of their social status) agents can spontaneously "degenerate" signs (in the meaning of the phenomenological entropy, that is to say that they construct signs by taking only in account modes of being underlying to these that have determined the sign to its emission). It follows that the collective cognition situates necessarily at the lowest phenomenological level: it is the common sign inferior to the others the highest in the lattice that characterizes the collective cognition in relation to this object.

Conversely the sign less raised superior to the others characterizes the highest knowledge level reached by at least one agent of the network.

3.2. Image and cognition

Every experience is cognitive because it consists of a relation with the object that brings necessarily some information on this object. With Peirce we define the conscience as a "bundle of feelings" and therefore the conscience of an any object is a certain bundle of qualities of feelings whose this object is the cause. Now, in addition, the sign of the lower level are precisely the qualisigns or signs of quality. It suffices therefore that all agents of the network have had an unique relation with an object in order that one could speak collective cognition of this object. There is, in a way, a guarantee cognitive level . It is the product of an "emotional" immediate interpretant that builds the

qualisigns materialized in the iconic sinsigns (singular things that possess qualities of the object). These latter are, approximatively, images of the common sense. It follows that the "civilization of the image" is that that produces surely the collective cognition of lower cognitive level. This conclusion that is not the result of the intuition, precisely match up the observations of many observer of the social communication (to see also Marty, to appear).

3.3. Diffusion and distribution of knowledge in a network
It is clear that the introduction of the new cultural mass technologies (Levy 1990) by modifying existent canals and by creating again canals increases possibilities of agents, obtaining practically for every possibilities of a mediatized experience with most of objects. However this modification cannot generate a cognition of superior level (in the meaning of the lattice of the classes of signs) only if it is accompanied by elements that allow it, namely the put at disposal of legisigns of all types (there are six) allowing the elaboration of a rational knowledge of objects by means of "logical" interpretants. Indeed agents can create their own legisigns but, current conditions of the reception that isolate agents, have for consequence that laws that they elaborate spontaneously are rarely confronted with others, hence a certain epistemological solipsism.

In conclusion, note that the interest of the semiotic formalization of dynamic cognitive phenomenon that concerns the sociology of the cognition does not limit only to the reformulation in terms more or less sophisticated of observations noticing the common sense. Because one can, for example, sink in the complexity of the network and its subnetworks linked to groups, organizations and institutions so as to release properly semiotic characteristics of the different relations to knowledge of these social categories. Similarly one can think that some questions of the Distributed Artificial Intelligence could be a little clarified. It is necessary also to underline strongly that the model can complicate - by using, for example, the hexadic sign (Marty 1990: 201) according to the necessities of the research.

Notas:

1 That is highlight, for example, in this well known experience of psychologists in which a person mixed to a ten accomplices finishes by admitting, with all the other participants, that a round object is square.
2 One can consider that a cultural community and the bundle of its micro-institutions of the meaning are interdefined
3 Reflections of Peirce on signs were notably motivated by the research of an ideal notation system for needs of the logic.

Referencias:

Burch, R.W., (1992) *A Peircean reduction thesis and the Foundations of the Topological logic*, , Lubbock, Texas, Texas Tech University Press.
Herzberger H.G., (1981) "Peirce Remarkable Theorem" in *Pragmatism and Purpose*, 41-58. Toronto : University of Toronto Press.
Lévy, P., (1990) *Les technologies de l'intelligence, l'avenir de la pensée à l'ère informatique*, Paris, La découverte.
--- (1992) "Les systèmes à base de connaissances comme modes de transmission de l'expertise" in *Intellectica*, 1991/92, 181-214.
Lourau, R., (1970). *L'Analyse Institutionnelle*,Paris, Editions de Minuit.
Marty, R., (1990). *L'Algèbre des signes*. Amsterdam-Philadelphie ,
John Benjamins B.V.
--- (1992a), "Foliated Semantic Networks : concepts, facts and qualities" in *Semantic Networks in Artificial Intelligence*, Fritz Lehmann (ed.), 679-696. London : Pergamon Press.
--- (1992b), "Semiótica del texto : Niveles y pasarelas" in *Signa* 1, 107:131, Asociación Española de Semiótica.
Parrochia, D., (1993). *Philosophie des réseaux Paris* : Presses Universitaires de France.
Peirce, C.S., (1931-58), *Collected Papers*. Burcks W., Hartshorne H., Weiss P. (ed.). Cambridge, MA., Harvard University Press
Sperber, D., (1987), "Anthropology and psychology" in *Towards an epidemiology of representations*, Man (M.S.), n° 20, 73-89.

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