DIALOGUING WITH AN EVOLUTIONARY AMAZON

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> Order is a rare island, it is an archipelago. Disorder is the common ocean from which these islands emerge. The undertow erodes the banks; the soil, worn, little by little loses its order and collapses. Elsewhere, a new archipelago will emerge from the waters. Disorder is the end of systems, and their beginning. Everything always goes toward chaos, and, sometimes, everything comes from it[2].

The considerations above, resume for me the characteristics of the complex formation of the Amazon Basin, the reality we are confronted with when we try to understand that so large region of the intertropical zone. It is because of this always changing complexity, wherein the forest and the rivers, people, animals and plants, jungle and a city with almost two million people live together in constant and vigorous interactions, that the Brazilian Oil Company (Petrobras) asked for a group of professionals the most part of them coming from the southeastern region of the country to help it to understand what pass there and to prevent the more the better a possible and terrible damage that could happen if the brute oil coming from a exploration field in the very heart of the jungle was thrown into the water of the Solimões River (as is the name of the upper Amazon in Brazilian Territory) at the moment of its transference from the oil tubes that comes from the oil field to the ships that will transport it the oil refinery in Manaus (the State of Amazon Capital)[3].

It is a long time several people, some of them teaching at Universities but others coming from the artistic and technological means, are proposing, under the coordination of

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[2] Serres, Michel – **Hermès IV** – *La Diistribution.* Paris. Minuit. 1977. *Apud* **ABBAS, Niran –** Mapping Michel Serres. Ann Arbor, Mchigan. The University of Michigan Press. 2005. p. 13.

[3] Nos dias atuais, oito anos após esta palestra oleodutos e gasodutos transportam ambos os produtos diretamente dos poços em Urucu, AM para a refinaria em Manaus.

a Brazilian Architect[4], some very creative projects and activities trying to surpass the traditional limits between art, science and technology. Among these projects there was one, called Amazing Amazon, a very big moving panel projected in a inflated dome wherein it could be seen and hear the Amazon River carrying earth and life from the Andes where it has its origins down into the Atlantic Ocean whose waters have to resist by several kilometers the advance of the river waters in a impressing phenomenon called pororoca (the sound produced by pororoca is so potent that it can be heard several kilometers from where it happens). The solid material Amazon brings with it will be deposed at the French Guyana sea coast augmenting its area of some square kilometers a year. Other program developed by that architect and some of his and his fellows, including me, is called Clothing Earth with Mind. It consists in putting an engineering manipulated protein simultaneously in three different gravitational situations one in a spacial shuttle making part of the Brazilian special program, other in some place of earth surface, and probably other in a centrifugal device under the effect a super gravitational force. The purpose is to observe possible changing of habits acquired by proteins, probably resulting of gravitational force variation. The choice of these experimental conditions resulted from the fact that the zipper of the protein that will be observed is sufficiently known in its very simple habits, so that it does not implies a great group of variables, permitting discriminate them in their behavior, and the gravity is a well controlled force in its variation every material body being equally subjected to it. Behind these projects, the evolutionary and semiotic theory is always present.

It was from the encounter of Petrobras preoccupations and the projects conceived and developed by the architect Wagner and his fellows that the research group called Cognitus Project took place. My present research on Existential Graphs, especially in its gamma part, that brought me here is one and only one of the theoretical resources we hope to be useful to the analysis of the data collected in the Amazon basin[5]. What we are expecting of Existential Graphs, I will talk a little about here. But first of all, considering

[4] José Wagner Garcia.

[5] A investigação dos Grafos Existenciais propostos por Peirce, como um recurso da lógica para se estabelecer correlações entre um estado do meio ambiente e o grau de risco dele decorrente prosseguiu-se com a tese de doutorado em engenharia defendida por Jorge Luís Vargas Prudêncio de Barros Pires defendida UFRJ em 2011 sob o título **Raciocínio Diagramático como Base para o Desenvolvimento de Conceitos** e com sua pesquisa de pós-doutorado junto ao departamento de Filosofia da UNESP – campus de Marilia ora em andamento.Esta pesquisa conta com auxilio financeiro da FAPESP e se desenvolve sob minha supervisão.

that the most part of the future readers of this text are not familiar with this logical theory, it would not be abusive to introduce a little explanation about it:

The Existential Graphs consists of three parts called by Peirce respectively the alpha, the beta and the gamma parts.

In an abridged way, it can be said that the Existential Graphs consists in a originally blank sheet, called Assertion sheet or Phemic sheet consisted itself in a graph, wherein all that is registered will be considered as existentially true. If the truth of what is registered into the sheet is denied this component will be circumscribed with a continuous circular or oval line, heet being this line called a cut. All that will be attributed to what is inserted in the sheet will be attributed with strict formal necessity and will be valid to all the universe of attribution. The part alpha of the Existential Graphs is limited to this logical domain. The beta part will consider this universal domain of attribution but also the cases when some attribution are restricted to the subjects taken in their particularity, in these cases a line of identity is inserted into the sheet of attribution limiting the attribution of some predicates only and specially to some particular subjects .

Both the alpha and beta parts work only with the strict logical necessity. The third part, named Gamma, will work in the realm of logical possibility and potentially con be extended to other logical modalities, so that Peirce's Logic, through Existential Graphs widens its domain to all the exercises of reason. And this amplification will be assumed with a very few graphic relational recourses.

We could ask why to work with Existential Graphs, specially its gamma parts, and more generally, why to make appeal to Peirce`s theoretical thought in such a project. Before a problem whose complexity surpasses his consolidated habits, I dare the best question would be: – Why not to make appeal to a so potent logic tool as Existential Graphs to make account of a so complex problem?

Abductive reasoning, as the drawing of hypotheses, that always implies risk, has always to follow principles and rules of economy of research. Besides the very first principle to be followed that the hypotheses are only sound if they produces conceptual consequences that can be tested by experience, and being sensible to the idea that seems to reason the more natural one –that proposed by Galileo and fully adopted by Peirce as *il lumen natural*, one of the most convenient proceedings is to chose a theoretic reference the

researcher is familiar with. It is also wiser to choose a more general and simpler theory to begin the research than a complicate one. Then, first try to work with such a theory, and only when it shows it to be inconvenient or insufficient, to find another or try to complicate a little more its conceptual framework. As for the most part of the members of the Cognitus group, and very specially for me, a Peircean theoretical framework was more familiar and better controlled, our first choice was to find in his writings the instrument for the data analysis and for the interpretation of the phenomena.

Peirce´s Philosophy as a whole and not only Existential Graphs is overwhelming present in several programs that composes Cognitus Project and offers the guidelines of the interpretation of Amazon Complex, including the water courses, flora, fauna, geological formations as well as the way people live in the riversides. We, the researchers, also, belong to this complex interpreting it, actuating in it, admiring it and being interpreted by all the others components. We are always searching for the more relevant interpretants of that living reality. For us, we are participating of an amazing learning process, wherein every element is interpreting its environment and acquiring new ways of living. So that Amazon Complex is being considered from a Peircean point of view as a semiotic phenomenon. Metaphysically considering, Amazon complex consists in an admirable example of the Law of Mind realization, mind and matter, there, being only distinct aspects of the same reality in a mutual interpreting process.

Data come from all kind of sources; several of them are being collected by decades permitting, for instance, to determine day by day at least from the very first years of the XX Century, the historical series of water level variation; images via satellite are also available of all the area with several grades of resolution and several kinds of images. Archaeological sites are being investigated, human and animal populations are being followed in their migratory movement all long the year, etc. Three very active programs (titled respectively, PIATAM I, II AND III) are actuating in the area under the auspices of Petrobras together with some departments of the Federal University of Amazon, improving periodic expeditions all along the rivers, knowing all the region with its people, animals, plants etc. Apart some other technical improvements and more refined researches, one of the most urgent problems to be solved is to integrate all the data, or the greater possible number of

them, in an operational representation in order to better understand that so dynamical complexity in such way as to making probable prognostics of its possible future states.

Four programs are being improved to give account of this task. One of them works self-organization theory based in general theory of systems; other is implementing a topological computational program that in a dynamical way putting together the several programs in neighborhood proximity when someone enters by one of the programs. Being all the programs developed along the time, both their relations changes all the time. A third program is constructing a bio-engineering transformed bacteria in order to more efficiently compute the date obtained in the researches. The fourth program, and is precisely in it that the study on Existential Graphs lies, intends to construct formal tools for to represent in a computable way the several data considered as qualities of feeling and not as irreducibly informational ones.

The choice for Existential Graphs as the logical tool to process the data was based not only on the fact that all the research adopts as its guidelines Peirce´s theoretical thought but also because it needs to formally work in a multimodal logic including pre-propositional relations. The relations that are being searched for do not consist only in assertive propositions, but includes signs of strict possibility. The intended predictive character of the conclusions cannot be restricted to variables represented within an atemporal framework but must include the possible evolutionary states of the Amazon complex due to the geological youngness of its formation and the dynamism of the waters, the forest and all the living organisms including humans living in and of them. Qualities, facts and regularities must be represented and the interacting elements in a reciprocal interpretation are not only human beings producing symbolic discourses but all kinds of signs determining the conduct of this miriad of elements. The better is to draw the greatest number of all the possible conclusions by the collection of premises. So that working upon a topologic diagram, as the Existential Graphs, we hope to have a better chance of, always in a fallible and provisory way, to represent that reality. There is a Peirce´s manuscript[6] that taking the Existential Graphs system as an example, considers the very general nature of

[6] Ms 793:2-6 included. Cf. ROBIN, Richard S. – **Annotaded Catalogue of Papers of Charles S. Peirce.** Wochester, MA. The University of Massachusetts Press. 1967. P. 99.

Sign, including all kinds of semiosis and not the specially the human one. There we can read the following sentences:

> For the purpose of this inquiry a Sign may be defined as a Medium for the communication of a Form. It is not logically necessary that anything possessing consciousness, that is, feeling of the peculiar common quality of all our feeling should be concerned. But it is necessary that there should be two, if not three, quasi-minds, meaning things capable of varied determinations as to forms of the kind communicated.
> As a medium, the Sign is essentially in a triadic relation to Object which determines it and to its Interpretant which it determines. In its relation to the Object, the Sign is passive, that is to say, its correspondence to the Object is brought about by an effect upon the sign, the Object remaining unaffected. On the other hand, in its relation to the Interpretant the sign is active, determining the Interpretant without being itself thereby affected.
> But at this point certain distinctions are called for. That which is communicated from the Object through the Sign to the Interpretant is a form; that is to say, it is not like an existent, but is a power, is the fact that something would happen under certain conditions. This form is really embodied in the Object, meaning that the conditional relation, which constitutes the form is true of the Form as it is in the Object only in a representative sense, meaning that whether by virtue of some real modification of the Sign, or otherwise, the Sign becomes endowed with the power of communicating it to an Interpretant. It may be in the Interpretant directly as it is in the Object, or it may be in the Interpretant dynamically, as behavior of the Interpretant (this happens when a military officer uses the sign "Halt!" or "Forward March"! and his men simply obey him, perhaps automatically) or it may be in the Interpretant likewise only representatively. In existential graphs the Interpretant is affected in the last way; but for the present, it is best to consider only the common characters of all signs which is communicated from the Object, through the Sign to the Interpretant as a Form. It is not a singular thing; for, if a Singular thing were first in the Object and afterward in the Interpretant outside the Object, it must thereby cease to be in the Object. The Form, that is communicated, does not necessarily cease to be in something when it comes to be in a different thing, because its being is the being of a predicate. The Being of a form consists the truth of a conditional proposition. Under given circumstances something would be found. The Form is in the Object one may say entitatively, meaning that that conditional relation, of consequence upon reason which constitutes the Form is literally true of the Object. In the Sign may or may not be embodied entitatively but it must be embodied representatively, that is, in respect to the form communicated, the sign produces upon the Interpretant an effect similar to that which the Object would under favorable circumstances.

Existential Graphs, their three parts included, offer the opportunity of working not only with the assertive propositions and with predicate calculus but also with multimodal

representations. The difficulty found of working with these three aspects together did not follows, it seems, from its formality but from the exigencies of always moving the sheets of assertion (the sheet wherein the diagram is scribed). Peirce, somewhere, lamented he could access an apparatus able to work with moving constructions. Nowadays, certainly, we do have access to such an apparatus.

Taking as a operational basis the Sheet of Assertion – or Phemic Sheet – and by constructing graphs upon it, it becomes possible, by means of formal layers, one over the others, to obtain, by abstraction, necessitating forms from the assertions originally and potentially posed by the sheet when it was empty. In a first moment, negation and conjunction functors represented by topological graphs permit to operate with all the propositional functions. It consists of the alpha part of Existential Graphs – or, as I say, of the first layer of the relative logical construction. Introducing, the less the better, some other graphs and rules, like lines of identity, including, in Peirce´s words lines of teridentity, it becomes possible to operate with logical quantifiers and with universes of subjects and predicaments, the later consisting in the platonic world of ideas, or possibilities. This more restrictive layer, being the beta part of Existential Graphs. Finally, in a third layer – the gamma part of Existential Graphs -, introducing a few other graphs and rules, as several sheets, one over the other, as well as the recto and verso of the sheet of assertion, it is permitted to work not only with assertions but also with other modalities as the possibility, Tinctures and other devices enlarges the logical modalities that can be operated with as any other logic, that a have notice can do. By the use of colors covering all a surface or making a ring around a cut, Peirce, not intending to list all of the possible modalities that can be dealt with, denumerates more than ten of them.

The iconic character common to all diagrams becomes more exposed, I could say, in a graphic and topological way of constructing them than in an algebraical or linguistic way, as Sun-Joo Shin demonstrate so well in his book *The Iconic Logic of Peirce's Graphs*[7]. We know by Peirce that all signs are iconic or includes icons in order to represents its object to an interpretant. The Form presented in the above quotation confers to iconicity this essential character in all semiosis. But the more symbolic and encoded being a sign the less

[7] Shin, Sun–Joo – **The Iconic Logic of Peirce's Graphs.** Cambridge, MA. & London, UK. The MIT Press. 2002.

it can exert its original spontaneity. If we are working with graphic topological signs it is easier to see the relations that are being established between the constructive elements as well as the all the gamma of possible new constructions, so apodictic being them as their premises[8]. So it will depend only of the interpreter`s interest the choice of the way the diagram will be read and the consequences that will be elected. The same diagram will permit several conclusions, all of them formally necessitant. As a hipoicon: a conventional e general form perceptively sustained upon a n-dimensional figure, isomorphic to the relations entitatively supposed to be present in its object but as oabstract as to be able to represent assertions but any kind of modal relations. Being also able to represent in a space-temporal succession actual and possible of evolutionary stages, because, first because mere possibilities precedes space and time, and second, because of its intrinsic temporary multidirectional equally permitted ways of interpretation. For instance, it seems convenient to consider the importance Peirce conferred to temporal relations in Logic, the restrictions he put to improving them being exclusively of operational and conceptual nature. In Lowell Lectures of 1903, Lecture 4,[9] after considering the Graphs a very appropriate form of introducing temporal relations in logic, Peirce claims that time is an important variable in deductive process when, very often, error appears, but, mainly, when we have logically to distinguish what in the present we effectively know from what we have sufficient reason to be confident to know but in the future[10]. This last distinction, it seems to be the one, we have to handle with, once trying to make prognostics of the possible future stages of the Amazon complex in its evolutionary process of constant transformation.

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[8] **Collected Papers of Charles S. Peirce. Vol. 4 § 531.** Ed. by Charles Hartshorne and Paul Weiss. Cambridge, Ma. Tehyr 1belknap Press of Harvard University. 1931/76.

[9] Ms 467 :20-36. *In* ROBIN, Op.Cit. p. 60.

[10] Beginning at the page 34 of the above referred manuscript Peirce says

" In order to recognize error in our system of graphs, we shall be obliged still further to introduce the idea of time, which will bring still greater difficulties. Time has usually be considered by logicians to be what is called "extra-logical" matter. I have never shared this opinion. But I have thought that logic had not reached that state of development at which the introduction of temporal modifications of its forms would not result in great confusion; and I am of that way of thinking yet. The idea of time really is involved in the very idea of an argument. But the fearest complications of logic would be involved in so far taking account of time as to distinguish between what one knows and what one has sufficient reason to be entirely confident of. The only difference that there seems to be room for between there two is that what one knows, one always will have reason to be confident, while what one now has ample reasons to be entirely confident of once may conceivably in the future, in consequence of a new light, find reason to doubt and ultimately to deny. Whether it is really possible for this to occur, whether we can be said truly to have sufficient reason for entire confidence unless it is manifestly impossible that we should have any such new light in the future is not the question."

As the Cognitus program involves diagnosis and prognosis since it intends to verify not only what actually happens or had happened in the complex consisting of the Amazon basin with its dynamism but also to represent the possible future states of that complex evolutionary formation, time must be considered as a dependent irreversible variable and not as in a Newtonian physics as an independent and reversible one. Chance also must be considered, in a true learning process that needs to interpret its own experiences in order to determine one's conduct. The possible, the actual and the general are, so, always present and equally important, to be represented. The possibilities resulting of eventual experiences – as a significant pouring of oil in the waters, and/or the extension of area invaded by the waters in its seasonal up and down movement, being considered what can be inferred from the rhythm of maximum and minimum height of the waters nor only of Amazon but also of Rio Negro (Black River) that coming from the north hemisphere, presents a different regimen than the first, must be constantly considered and compared with the data obtained from historical series of the level of the waters%..is movement, etc. Therefore, Existential Graph intermodal logic, duly improved with the disposable computational resources, seems to be a helpful theoretical and operational tool, consistent with the phenomenological and evolutionary Peirce´s doctrine to interpret in a reasonable way these complexity.

For Peirce, one of the biggest challenges found for artificially computing multilevel intermodal and progressive logic or semiotic functions was to improve programs that could proceed into hypostatization, through abstraction and substantiation of data. In a text of mine, presented in Amsterdam in a workshop on Semiotical Machines[11] it seemed to me that although there was no theoretical restriction to such a operation by a machine, I didn't know any algorithm able to do that. And this multilevel operation seems to be imprescindible to give account of true inferences, mostly when is being considered could not be reduced to a L1 language, as arithmetic can be. Learning supposes inserting ideas in the Universe of Discourse permitting by this way to predicate ideas of ideas and so producing true habits of conduct. Turing, in fact, said how much he would be happy if a machine could learn! I will not say that nowadays we have at our disposition machines that

[11] See http://www.inm.de/kip/SEMIOTIC/silveira_article.htm/. Há uma tradução do texto sob o título Algumas Considerações sobre Máquinas Semióticas do Ponto de Vista da Filosofia de Charles Sanders Peirce. Texto publicado em GONZALES, Maria Eunice Quilici e Mariana Claudia Broens (orgs.) - **Encontro com as Ciências Cognitivas Vol. 2**. Marilia, SP. UNESP – Faculdade de Filosofia e Ciências. 1998. P. 113-130.

genuinely learns, but, perhaps, we have access to some computational programs, like Web semantics and others – that proceeds in a very similar way. And more, as Cognitus among many other research groups intends to improve biological computers, perhaps this process will be, not in a so large future, at hand.

Concluding, I could say that, at present, I cannot offer any warrant of the success of this enterprise, and I say it to my fellows of the Cognitus project all the time, but if the wisest way of proceeding is to take the risk using the most promising conceptual tool we have in hand, I hope Existential Graphs will play the role we are expecting it will do. At least, if despite of being carefully improved it would not present so good results, I hope that, by exclusion, a significant benefit were made for the advance of knowledge.

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