Ontological-cognitive structures of the Metaverses

Prof. Dr. Luís Carlos Petry

PhD. in Communication and Semiotics , Researcher at PUCSP: Department of Computer and Graduate Program Technologies of Inteligence and Digital Design – PUCSSP – SP - Brazil. Email: petry@pucsp.br and alletsator@gmail.com

Abstract:

This paper aims to bring forth some ontological elements that we believe are fundamental to a wider philosophical basis of the Metaverses. We start from some indications presented by physical experiments which reproduce virtual environments in real time, searching for its eidetic-methodological relations with genetic epistemology and construtivism, showing that the structures of physical interfaces, which are founded in virtual experiments, dialoguing with the concepts of body, mind, projection, cognition, and other concepts, which are present in the possible formulation of an ontology of the virtual worlds and the Metaverses. We conclude the paper with the idea of the necessity to think the issue of the ontological fundamentation of cyberspace and its *metaverses.*

Keywords: *ontology, metaphysics, metaverses, topophilosophy, construtivism, ground.*

Introduction

Metaverse is emergent. Its affirmation allows for the structuring of omnipresent aesthetical-digital experiences. In a widening of the concept of hypermedia of Manovich (2001), *metaverse* may be thought of as the setting in motion of the Wagnerian concept of *Total Opera*, with the difference that its characters identify themselves with their audience. In this metacontext, the evolution and transformation suffered by the concept of interface, in the *metaverse,* we are oriented to think it as *digital life forms(01)*. On the other hand, it will be inside the discussion of the plastic foundations of the concept of *metaverse* that we find Louro and Fraga (2009) presenting a rich discussion about the *mathematical-technological art,* in which universes and physical-virtual experiences semi-permeable, open their doors for a reflection about the fundamental cognitive structures that would be working underlying *men-machines-world* systems, designating operational paradigms present in *games,* in *hypermedias* and in systemic projects of *metaverses.* Initially we will discuss a few concepts that we find appropriate to the formulation of a possible *cognitive-corporal* structure which has an ontological status inside the digital world and, above all, in the *metaverses*. Right after that, we will present six moments of occurrence and manifestation of those structures in current projects, related to the *emergence of the metaverse,* for then, finally, to advance upon our perspective, that puts the question of the possibility of thinking ontologically the foundations of the parallel worlds, called *metaverses.* We start with a monadic element: the three-dimensional patterns..

Three-Dimensional Patterns

In Louro and Fraga (2009) we find a mathematical-artistical reference to the three-dimensional patterns(02) present and active in the interactive environments, submitted to a logical structure of physics´s simulation and, manifesting themselves as *cognitive structures.* The component replicability, which manifests itself in the association between patterns, as basic structure of second order, tends the configuration of composite and/or complex structures in the spatial-threedimensional organization of interactive environments. A *pattern* is a structure capable of component replicability in the production of three-dimensional worlds, such as the *metaverses.* That´s what Louro & Fraga (2009, 3) tells us when they say that the study of the patterns *is in itself* a key element to the understanding of the growing of the three-dimensional structures on cyberspace. According to the authors, there are specific kinds of patterns which are directly related to the development and expansion of the three-dimensional structure and its transformation into a timeline. One of these cases may be found in the description of digital and physical experiments proposed by Fraga (2007). In those, we understand that the idea of *three-dimensional* patterns may convert in material and/or virtual objects to Fraga (2007). Such structures have as their goal to incite *unusual experiences* in their users from the concept of affective computation of Picard (2000)(03), since they provoke the suspension of the

rational belief of a single reality (sic). Be tactile or almost tactile, the experiences offer a prototype of the futurity of holography and the total immersive interaction metaverses suggest.

Logical Structures

Now, if we think that the *patterns* can also be seen as complex logical structures which are based in other elementary logical structures(04), in the fashion of a three-dimensional construct, they work inside the organized, rational perspective of a *figural collection* (Piaget & Inhelder, 1975) which constitutes into ons of the bases of the construction of knowledge, including scientific knowledge. As *logical blocks* conceived by Hungarian mathematician Zoltan Paul Dienes(05) in the 1950s, they offer and can be the support for a special type of interaction which has as a spontaneous, "non-intentional" result the forming of cognitive structures responsible by the production of knowledge. Every learning, be it in the mathematics or in life, involve physical-representational and logical processes (Piaget, 1970, 1976 e 1971). *To open a door,* for example, may be thought of as a puzzle able to reveal the structure of a present pattern, not only in the virtual environment, but also in the logical-physical processes which inhabit the mind of the subject of the action. The return or retrival of the experience lived by the users in the form of the description of their actions and intentionalities, in which they explain and describe consecutive steps of their action (*to open a door*, for example) reveals an operative structure in the mind that takes to itself the responsibility and conduction of behavior (Piaget, 1977). The constructivist approach harmonizes itself with the philosophical reflection in our example. That becomes clear when we remember that Wittgenstein (1994) indicated us that to describe a game is to understand a game, and, as components of a logical language game to be played in a countless number of ways, the patterns are those minimal elements of a cognitive structure that, in a game, participates in the phenomenon of understanding. So, if I know how to play *this* certain game, I can understand *this* certain game. But it will be only entering the playing of the game, amidst an environment formed by the myriad of patterns, that the bigger cognitive structure of understanding will come.

Ontological logic

Working as Leibnizian *Monads(06)* gifted of the most refined *entelechya* possible, the three-dimensional computational patterns(07) organize representational worlds whose ultimate hunger can be expressed via the *metaverses.* The idea of monad serves as the basis of the Leibnizian logical thought, Express in the *Charateristica Universalis(08)* namely the organization of a universal symbolic language that should be free of the plurivocity of the ordinary languages. The concept of *Charateristica Universalis* and its organization in a *lingua sive characteristica* would take a symbolic, imagetic aspect. Leibniz´s thinking followed, in its central theses, and it was widely developed by the German philosopher Gottlob Frege (1879) in the creation of the *Begriffsschrift,* the *Conceptography,* equally with visual aspects, and, aiming above all for the dynamic relationship between the vision of the totality of the page-image-assertion and its propositional components, which served as basis to first-order logic. More recently, an approach of the monadological thought was retaken, in 1993, by Michael Heim, in *The metaphysics of virtual reality*. Comparing Leibniz´s *Calculus universalis* (Heim, 1993) with the logical system currently present in the computers, he calls this conjunction, metaphorically, *Leibniz´s electric language(09).* The *Leibniz´s electric language* would emulate the divine intelligence, resulting in the possibilities of simultaneity and omnipresence, elements found in cyberspace, and, we say, in the *metaverses*. Even though Hein used the word *metaphysics* in the weak sense of the term, new-age like*,* to designate its pop, fun meaning(10), the implicit ontological aspects in the question of the monadological grounding of cyberspace [and the *metaverses*] present very rich, instructive indications(11) That´s the case with the summoning for the dialogue of the question with Heidegger, MacLuhan, and Marcuse. That is, a logical basis of cyberspace and the metaverses would have much to gain if thought in the light of an ontological grounding of the world and of the *Dasein(12).*

Another approach of essential importance for a critical reflection of cyberspace and *metaverses* and, indicating the possibility of its ontological grounding, may be searched with the help of the thinking of the American philosopher Andrew Feenberg(13). In the path opened by Heidegger and Marcuse, he defends that technology must be thought in its constitution of the extension of technical systems and of power in society, both in their outlook technocratic control as resistance to it. If on the one hand the naïve and technocratic technological thinkings arm themselves against public pressue, sacrificing values and ignoring necessities, on the other hand we see that a critical reflection of the question of technology (and here cyberspace and the *metaverses* enter) equally shelter other beneficial potential that should be better thought. Well, postulating the neutrality of technology would be naive then. Assumed as neutral technology converted in technocracy would favor some certain ends and would be oriented to block others. Besides, we could include in this aspect a harder search by spontaneous organizations

through all society (in and out cyberspace) in favor of a *democratization* of a wider and wider technology, which would mean thinking in new ways of privileging the values excluded by technocracy and make them concrete in new technical arrangements that walk together with social, ethical, ecological needs of human as a whole. It´s in this sense that a critique of the essence of technology can´t be dismissed, as well as a concern with dialogue and its use by communities of users inserted in *holistic design* modes(14). Such a transformation carries with itself the affirmation of need of a transformation from down top and from the inner layers to the outer layers of the systems in usage. That would mean opening the technological structures to the interests and discussion of the communities – a situation that have been more and more realized based in organized communities of Web users. That leads to a certain technical choice instead of other, or, as we got used to see in the last half of the 20th Century, a technical choice instead of another one, social, political or ecological, determined for its time a political, ethical, social, cultural, and ecological meaning without precedent.

So, if we identify here the necessity of a philosophical reflection that states itself as capable of realize a critical and constructive dialogue with the technical thinking, that means a reflection that take into account the product, from Leibniz to Feenberg-Heim, must be perceived as a methodological program of thinking the aspects that are the closest to human, in which the communities of subjects really navigate, interact, communicate, and produce their transformations. They are located, the way we see it, in the scope of cyberspace and in the emergent *metaverses(15).*

The reagent surfaces and the plastic body of aesthetical manifestation in the metaverses

From 2003 to 2008, we realized a research program in which the central theme was the ontological grounding of the interactive three-dimensional discussing some aspects that we consider that are related here with the approaches already presented. Initially, in Petry (2003), we presented the possibility of thinking the work of three-dimensional modeling for three-dimensional interactive environments, such as game engines and *metaverses,* as high-level reflective activities. In that moment, *modeling an object* would equal the act of *thinking the thing* as such, in its constitution of *digital thing,* which opened the possibility to think, from hermeneutical phenomenology, the beginnings of a thought that problematized the groundings of digital makings, designated by us as *topophilosophy.*

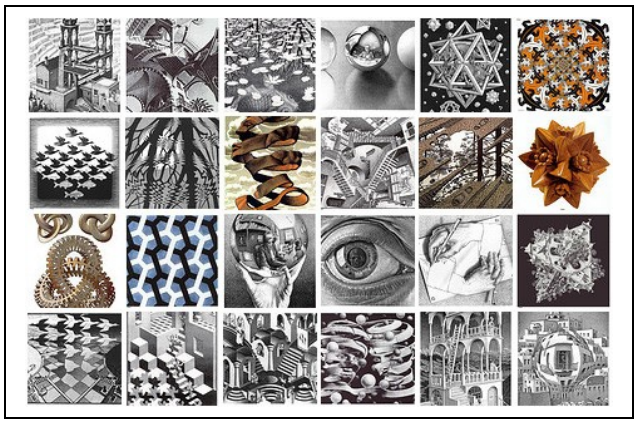
In our text, titled *Aspectos fenomenológicos da produção de mundos e objetos tridimensionais na hipermídia* [*Phenomenological aspects of the production of three-dimensional worlds and objects in the hypermedia*](Petry, 2006)*,* from the phenomenology of Heidegger and Gadamer, we located some aspects of the hermeneutical fundamentation of the concept of topophilosophy as the key concept for the understanding of the digital processes that bridge artistic and computational processes. In that case, we assumed that a methodological reflection about the theme of three-dimensional modeling would be necessary to a better understanding of the current digital phenomena who inhabited the Web, such as games, hypermedias, and metaverses. The starting point was the Heideggerian concept of *aesthetical experience* as an *Erfahrung,* a changing experience in the full sense of the term, as much for the author-artist as for the collaborative user and navigator of digital environments. The concept of aesthetical experience guided us to a reflection about the *building, inhabiting, and thinking* (Heidegger, 1994a), which offer the possible ontological circumscription for the idea of building objects and environments inside a given digital environment. Such as in the German word *bauen,* to build its home equals mixing the colors for a painting and, equally, the transformation of an object giving it a subjective determination beyond the condition of simple thing. In that moment, we put the accent in the interrogation about the plastic dominion of the artistic space, and the possibility of the logical and mathematical intervention partaking of the reconfiguration of the artistic experience(16). In this context, the aesthetical experience of the production (by the artist-programmer) adds up to the possibility of the aesthetical experience of immersion (by the digital argonaut), in the quality of the possibility of an imersion gifted with sense, as much as for the locutionary manifest by its hypermedia production as for the elements of what´s left unsaid, its illocutionary elements, revealed by the interactive character of the same (agency, cf. Murray, 2003) and, possessed by its interactor.

That´s when the problematization of the *plastic body* in the modeling of three-dimensional characters was put to us as one of the aspects of the ontological question about cyberspace and the *metaverses*. In *O ciborgue e a arte da hipermídia* [*The cyborg and the art of hypermedia*] (Petry, 2007), dislocated to the context of the digital environments and the question about the new modes of being of the *Dasein,* our research has found its expression in the avatars and characters of the digital universes *metaverses(17).* in the form of three-dimensional cyborgs who inhabited the poetic worlds of the *Quantum Opera AlletSator(18).* If, from the advent of postmodernity, we started to face new modes of being of *Dasein,* it´s similarly to expect that, in the plane of digital art, such new forms the modes of being come to manifest

themselves. That´s the case of the construction and manifestation, into the plans of interactive worlds the inhabit cyberspace, avatars and cyborgs, taken as digital entities or, as Heim would say (1993), the *cyber entities*.

Finally, when we published the text *A im@gem pensa: aspectos quânticos da imagem cibernética*[*Im@ge think: quantum aspects of cyber image*] Petry (2008), we beagn a systematic project of an organized discussion of the ontological foundations of cyberspace. In this publication we present the possibility of understanding the synthesis image, that is, the digital image produced by and with 2D and 3D computational resources, as a *cognitive object.* It´s in this way that we are always taken to think the ontological-cognitive structures of the digital universe in which metaverses live as homes of the *digital Dasein.* In order to illustrate some ideas initially sketched here in the context of a research in progress, I will discuss four examples in which the idea of patterns is presented and indicate, in the light of the concepts articulated here, the conceptual value of those digital works. Finally, I will make some notes about two important metavers projects, both of which, opening space in its *Open Source* organization for academy research, fulfill the sacred mission of science taking us to new worlds of understanding.

The first example I wish to present comes the works in drawings and litographs of the artist [1] Maurits Cornelis Escher (1898-1972), known in the whole world as M. C. Escher(19), in imaginative sculptorial productions and lithographs:



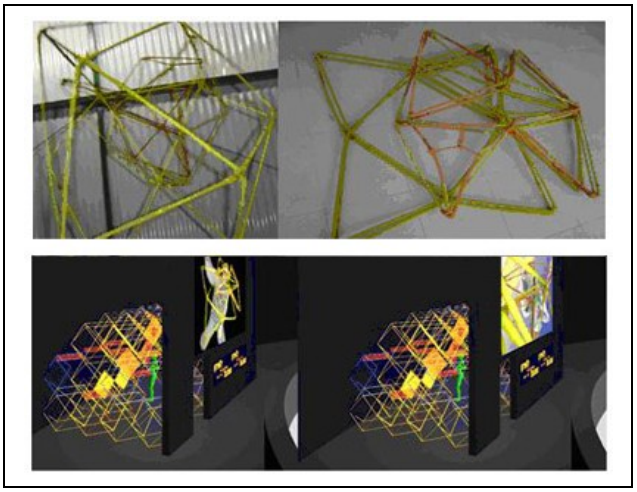
The artistic theme of the patterns in Escher is at the same time recurrent and deeply imaginative. Countless are the works that relate Escher´s art with mathematical reasearch and imaginative intuition(20) The Web paper *The Mathematical Art of M.C. Escher (1997-2009)(21)* shows relations between Escher´s art and mathematical imagination, inside which the (1) *regular division of the plane* (*tessellations*), the (2) *polyhedron,* the (3) *essays in simmetries* and the (4) *shapes that intersect planes* are identified here in our approach with the concept already presented of *pattern.* In Escher´s case, the *patterns* present themselvses as imaginative-artistic structures that has mathematical and three-dimensional potentialities(22).

The second example I would like to bring here is given by the work in [2] sculptorial projects which take into account the organic replicability of the sphere, by artist Tomas Saraceno(23). We observe that the dialogue between the sphere and the ropes that sustain them forming conical cords is worked inside the spirit of a *pattern* that made possible the demonstration of a sculpture that dialogues between replicability and organicity. Here, the sign of the mandala present in the works of Saraceno presents a possible experience at tactile immersion, in the fashion proposed by Fraga (2009), when she speaks of three-dimensional, stereoscopical and interactive simulations, referring to what is being produced in virtual realities in cyberspace. In the case of Saraceno´s work, similarly analyzed by Louro & Fraga (2009), everything leads us to believe that the artist seeks to fulfill a kind of return of the digital to the physical installation, producing the same paradoxical impact we experience with the objects described by Fraga (2009), as we can see in the image below:

Well, the thinking and making of the artist seeks to dialogue with the concept of cyberspace. In her words: “Like continental drift at the beginning of the world, the new cities will search for their positions in the air in order to find their place in the universe . . . [this structure is] capable of imagining more elastic and dynamic border rules (political, geographical, etc.) for a new space/cyberspace” .

Image and representation here join forces in a collaborative fashion in order to produce an aesthetical experience and a plastic body, such as what we observed previously, as well indicate the pertinence of Fraga´s thinking (2009) when she describes the process her own analytics of creation: “during the process, I analyze constantly the non-causal connections which emerge as sincronical events, in relation with dreams, mental images, and *insights*, as cited above, and I transform them into conditions and action, so I can do things (Heidegger, 1988)”.

That´s in this sense that it´s called to our attention the [3] work dedicated to the associative dialogue between the eidetic-transcendental forms in empirical and virtual compositions which show themselves as ambient-objects by Brazilian artist Tânia Fraga(24). Fraga (2009) shows us the possibility that *scattered data during the creation period* can emerge in a work that, at the same time present sincronicities that result from logical operations, as well as are organized as demonstrations which produce paradoxical aesthetical experiences. As sparse bubbles, emerging and floating in the logical-creative active imagination of the artist, they organize themselves as liquid, mobile thoughts that, in their results of manifestation and presenticity (*Anwesenheit*), shows themselves as flexible patterns(25).



Well, the basilar structure presented above in Fraga´s work is the triangle. We can´t avoid to observe that this basilar structure, here described by us also as a pattern, is a minimal building structure of every three-dimensional shape produced by the 3D modeling softwares. The three-dimensional world is founded upon the variable and mutant harmony of the triangle, in idea that makes us develop all the reflection to the ontological indicators presented by Heim to cyberspace: the eidetic-transcendental forms defined by Plato and, in our case, by the eidetic-transcendental figure of the triangle(26).

Well, the triangle is the organizing matrix of the live-action experiment [4] *Hyposurface(27),* presented by its authors as a system of exposition in which the surface of the screen makes physical movements from forms, information and the interaction of subjects

A visit to the several videos featured by the *Hyposurface* team shows us the possibility of aesthetical-plastic manifestation, in which the metamorphic-chromatic wall not only presents articulated images from the triangular pattern, as it also capable of sinestesically involving the users of the interaction.

Every example, from [1] to [4] may be taken as effective demonstrations of *reagent surfaces* in which the *plastic body* puts as *aesthetical manifestation* that may inhabit the *metaverses*. That´s the case of the Open Source metaverse projects [5] *Project Wonderland* and [6] *Croquet Consortium(28).* As wonders of the human intellect of the digital age, *Wonderland* e *Croquet* present themselves as possibilities of collaborative development between researchers around all our geodesic and cognitive sphere. They have the capacity of realization of the ontological forethoughts indicated by us, both formally as well as from the aesthetical experiences denoted here from Escher, Saraceno, Fraga, etc.

Conclusion

World is everything that is the case..., but if the world doesn´t have an ontological grounding, it can only count as something that has no meaning for no mind. The ontological foundation of the *metaverses,* in the form of a

Mathema capable of transmissibility and reasonability becomes necessary and urgent. It´s in the precise sense that the present text has been developed: to alert for the importance of the ontological fundamentation of the *metaverses,* which shall be subject of discussion of the communities of developing and participating minds. Our modest example of the patterns, as logical-cognitives structures that are part, not only of the mental life and of nature, inhabit the space of the plastic body of the *metaverses*. As such, they open the door through the question of the ontological grounding of cyberspace and the *metaverses,* path that demands time and a work process non-determined *a priori.* A path that points out questions that in the current present moment, as in the saying of old Heraclitus, *neither reveal nor hide, but indicate.*

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NOTES

(01) Taking, for instance, also in the path of Manovich (2006), this idea is an extrapolation of the formulation of Wittgenstein´s language games (1994) as *life forms.* Such context of production of several digital life forms can be found in Leão(2005), Fraga (2007), and Prado (2007), for example.

(02) *Pattern:* from the French "*patron*", which, for its turn is derived from one of the meanings of the word "father" (*pater*). It designates a kind of recursive theme that incides upon objects or events. This word has several meanings, being used in computer science, art, psychology, psychoanalysis, etology, mathematics, among other sciences. The *patterns* are complex replicable structures that tend to organize a predicable (in meaning) structure, such as recursive algorithms (computer science), repeating images (art), behavioral schemes (psychology), compulsive repetitions (psychoanalysis), approaching rituals (etology), Golden Ratio (mathematics). Repetition, cycle, frequency, organization, manifestation, and transformation are some of the logical principles inherent and active in the *patterns*. The most basic examples of patterns that can be presented are the fractal structures of nature, such as Kepler´s *Snowflake* (Stewart, 1996).

(03) A review of the points of view of researcher Rosalind Picard was written by Causa, E. & Sosa, A. (2007), and it´s available at: http://www.proyecto-biopus.com.ar/textos/Computacion_Afectiva_Y_Arte_Interactivo-Emiliano_Causa-Andrea_Sosa.pdf

(04) Even a *pattern* is guided by rules, be they of association, permutation, et cetera, inasmuch as a curve is formed by a succession of points oriented (by an interval) from a given center. As we will say further in this paper, even language games have rules which determine their existence.

(05) See author´s website: http://www.zoltandienes.com. This Hungarian thinker developed the called logical blocks, and, in his site, we can find examples of applications between mathematics, art, and games. See, for instance, the text *Mathematics as an Art form: an essay about the stages of mathematics learning in an artistic evaluation of mathematical activity,* in the section *Zoltan Dienes' Mathematical Games.*

(06) *Monad:* key concept in Leibniz´s metaphysical philosophy, which designates the simple substance – from the greek μονάς, μόνος, which may be translated as "unique" or "simple". As such, the monad is a constitutive part of the composite, being itself without parts, therefore, indissoluble and indestructible. The modern concept of *pattern* hás a parental relationship with the Leibniz *Monad*.

(07) *Computational Patterns: in Brazil, they are discussed in Computer Science as logical patterns or computational patterns from the idea of Design patterns. In that sense, see: VLISSIDES, J., GAMMA, E., JOHNSON, R. & HELM, R. (2005). Padrões de Projeto: Soluções reutilizáveis para o software orientado a objeto. São Paulo. BOOKMAN C.Ed.*

(08) An example of the configuration of the *Characteristica Universalis* in the Web may be seen in Wikipedia: http://en.wikipedia.org/wiki/Characteristica_universalis

(09) According to the words of the philosopher: "Leibniz´s "electric language*"* operates by the emulation of divine intelligence. The divine knowledge has the simultaneity of omnipresence and, so that it can establish the Access divine to things, the global functions of the matrix interconnect, by means of a net in a kind of a current eternity, between the gaps of all language. Due to the access that does not necessarily need to be linear, cyberspace, in a first moment, doesn´t require a jump from one position to another in an orderly fashion. Science fiction writers have often imagined how it would be traveling at the speed of light. One of those writers, Isaac Asimov, described this travel as a "jump through hyperspace". When, in his fiction, a ship reaches light speed, Asimov states that it performs a special kind of jump. At that speed, it´s impossible to follow the discreet points of the distance traversed by it." (Heim, 1993, 95-96).

(10) See the interview with Heim about this point to Geert Lovink in 1994 in http://www.thing.desk.nl/bilwet/TXT/HEIM.INT

(11) As written by Heraclitus: *The lord of the Delphi Oracle neither reveals nor hides, but indicates.*

(12) Here we have in mind the workd of Heidegger, Marcuse, McLuhan, Heim, and Feenberg – in their productive elements for us to think an ontology of cyberspace and the metaverses.

(13) Feenberg is concerned about the possibilities of a philosophical reflection of technology. The philosopher must dialogue with science, not just react to it or discuss it naively. In *Critical Theory of Technology* (2002), he tells us that the philosophy of technology walked a long way since Heidegger and Marcuse. Even though the thoughts of those philosophers are inspiring, the task of finding answers to our problems and current questions must count with our own ability to think and create, without resort to previous formulas which were connected to modes already overridden by the socio-historical evolution of capitalism and of technique. So, he says: "Critical Theory has, above all, dedicated itself to interpret the world in the light of its potentialities. Those potentialities are identified by serious studies about what exists. The empirical research can, in this way, be more than a collection of facts and can shape a discussion of our times. The philosophy of technology can unite

these both extremes – potentiality and the effectiveness – rules and facts – in a way with which no other discipline can rival. It will be bold enough to face prejudice from disciplines that confine research and study in narrow channels and, thus, may open perspectives to the future". (Excerpt from Feenberg. A. (2002). *Critical Theory of Technology*. Oxford University Press).

(14) See the cases of the big communities of *metaverse* production gravitating around the engines *Croquet* and *Project Wonderland*, inside which the discussions, needs and works of the community of users that determines the *Open Source* ways of usage of technology.

(15) This methodological path is much more similar to another one, indicated by the German philosopher Karl-Otto Apel (2000), when he says that we should think the transformation of philosophy from Descartes to Husserl.

(16) More specifically, I came to the conclusion that it would be closer to art that we could find and locate truth, but, on the side of normal science, we would only have to count on method, systematization of the preconceived project of world. In this way, the appropriation of space in the spacialization of the artistic making leads man to inhabit, inside which to spacialize is to locate things, that is, to put him/herself beside them and there undertake an operative understanding, but not a machinical understanding. That would be the transit space of a possible topophilosohical reflection, in its due rigeur.

(17) If the definition of cyborg shelters a hybrid composition between the ***human corpus*** and the ***corpus of the technique,*** that means that we are dealing with a hybrid figure that, as inhabitant of both world at the same time, cannot belong exclusively to none of them. In that case, maybe the cyborg should be thought as an ***"in-between".*** Maybe that is its most interesting characteristic, and, at the same time, most enigmatic. To belong to the world of flesh puts it partially in co-participation of every passion of the flesh and, as belonging to the world of cybernetic technique, it puts him~her in part beyond a vast number of not fulfilled possibilities. Here, the Nietzschean ***superman*** is always remembered with a certain terrifying proprietyand, to a certain extent, scary. Many are those who feel compelled to assign the concept of cyborg to the pure dominion of ***dystopia,*** this situation of reflection that sees the destiny of man in a tragic consummation and adverse to any utopia and hope. But we can´t ignore that the possibility of technique that suggests us the idea of cyborg presents this possibility of hybridism to man. It presents initially into the world of the suplencies of the medications cited previously, both when they modify our states or even when they make us live longer than we deserve. It presents this possibility still when it affirms itself so strongly in the aid of prostheses to modern man, liberating him of suffering and potentializing its way of being in the world and also his pleasure. Here, the ***plastic body*** stated by Heidegger, in the ***A época da imagem do mundo*** structures in a transformation of the technique that takes him to postulate his ***cybernetic body,*** his ***I-cyborg.*** So, this ***I-cyborg*** is, certainly, a ***I-hybrid,*** a kind of "between" a before and a ***maybe after*** or, as we maybe say now along with Nietzsche: ***between man and superman (übermensch).***

(18) *AlletSator* is a Project of an interactive quantum Opera that is in its final development phase in a research group gathering researchers from Brazil and Portugal, among them Pedro Barbosa, Rui Torres, Rogério Cardoso dos Santos, and this author. Web address/wiki: www.telepoesis.net/alletsator/wiki. The wiki contains a vast methodological material of the group´s work and indicates its sources and image libraries that can complement this exposition.

(19) See an geral vision form: http://www.mcescher.com/, publicado e mantido pela *M.C. Escher Foundation* e pela *The M.C. Escher Company B.V.*

(20) An interesting list can be harvested from within the official website, in http://www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Escher.html.

(21) Of author unidentified , from: http://www.mathacademy.com/pr/minitext/escher/index.asp

(22) In this case, Escher says: "In mathematical quarters, the regular division of the plane has been considered theoretically . . . Does this mean that it is an exclusively mathematical question? In my opinion, it does not. [Mathematicians] have opened the gate leading to an extensive domain, but they have not entered this domain themselves. By their very nature thay are more interested in the way in which the gate is opened than in the garden lying behind it". In: http://www.mathacademy.com/pr/minitext/escher/index.asp

(23) The work of the artist Tomas Saraceno can be seen in: http:// www.core.form-ula.com/2009/03/22/profile-tomas-saraceno/ - Access in 2009/03/16

(24) Described and presented in: http://www.cibercultura.org.br/tikiwiki/tiki-read_article.php?articleId=53 Access in 2009/03/17

(25) Says the artist and thinker: "The ability to detect connections between entre scattered data during the creation process is a faculty difficult to explain in words, because it results of nebulous sensations. These are sensations that occur like spars bubbles, emerging and floating in the mind, and that finally flow like intelligible ideas. I denominated as "to think liquid thoughts" (Fraga, 2003: 301-308) this faculty that leads to successive agencings of possibilities. It allows me to explore frontiers, agglutinating the logic thought – linear, fragmented, analytical, precise, and disciplined – with sensorial thinking – non-linear, synthetic hich presents itself as blocks, as perceptive totalities – with free and apparently indisciplined emotions and sensations. During the creation process, numercial data – with its functions, relations, and logical operations – are intermingled with the flexible patterns of sincronicities" (Fraga, 2009).

(26) In Plato´s *Timeus*: "In the first place, it´s obvious for everyone that fire, earth, water, and air are bodies, and that every body is solid. Every body is limited by surfaces and every rectilinear surface is composed by triangles".

(27) Available in: http://hyposurface.org/ Acesso em 2009/03/17]

(28) *Project Wonderland* can be accessed in: https://lg3d-wonderland.dev.java.net/. *Croquet Consortium*: http://www.opencroquet.org/.