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Transcurssive Logic as Method
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ABSTRACT
The purpose of this paper is to present the Transcurssive Logic as an auxiliary or complementary method of investigation. This approach differs from the general scientific method in which the research process begins or is sustained in the perspective from which the subject observes reality. This is undoubtedly the only way to highlight what has been so often proclaimed by objective science and rarely accepted, such as intuition and imagination (creation) that leads to finding an answer to small or large enigmas of our world. On the other hand, it will be evident that there is no other way to create new knowledge on a given issue. We present the different levels of approach to reality that must be 'passed' if we want to fully characterize this fabulous enigma that represents to investigate the frame of reference where our life unfolds.

Keyword: reality, creativity, research, Transcurssive Logic.

> "If we make that something spin,
> there will be algebra;
> If while turning it, we cling it to an idea,
> there will be algebraic topology;
> but if we besides relate it to a thought,
> there will be Transcurssive Logic."
> *Dante R. Salatino, 2017*

1.0 INTRODUCTION

In 2009, Transcurssive Logic emerged as a tool that allowed us to study the origin, acquisition and production of our natural language. In addition, it enabled the delimitation of an 'operating space', our psychic apparatus, to process, record and distribute the perceived and to give the correct answers that end up conferring full meaning to reality. Transcurssive Logic also, became a method of investigation and this is the aspect that we will develop in this article.

2.0 LITERATURE REVIEW

2.1 Reality, natural language and an alternative logic. (Salatino, 2008)

In this paper, we analyze the relationship between what we assume as reality and natural language. This analysis is done from the perspective of a new logical approach (in the sense that Peirce gives to the term). It tries to understand why the multiple and diverse studies carried out on language over so long do not tell us how it is that we can understand each other, when we try to communicate real facts that involve us and involve our interlocutor assigning to our words by convention, a common meaning. It is proposed the existence of a universal language that could integrate the psycho-bio-socio-cultural aspects of reality, trying to explain how the semiotic phenomenon, that is our natural language, is integrated (as a real manifestation) in the representation of reality.

2.2 Semiotic of the real systems. Semiotic analysis of the emergency psycho-bio-sociocultural as method of observation of the natural language. (Salatino, 2009 - Doctoral Thesis)

In this work, it is considered to be the study of the natural language from the observation. I tries to be able to determine, without conditionings, reality, rooting to the alive thing, to the subjective thing, what aspects of the reality of the man it is capable of reflecting and how it does it. The intention is to contribute a method that allows to discover laws that according to the subjective thing, allow a study of the production / comprehension of the language. This analysis is realized by means of an original tool of so-called Transcurssive Logic (logic of the sense) allowed, on the one hand, to tie the reality of the language to the whole reality and for other, to demonstrate by means of the abductive analogical method, the possible existence of a 'universal language'. It also, comparing the phylogeny of the nervous central system with the proposal for the language which remains firmly established the biological and evolutionary character of the natural language. From the semiotic of the psycho-bio-sociocultural that emerge it was possible to consider the subjective aspects of the symbolic human language, determinant at the time of understanding what is the language and in a derivative way, to demonstrate that the natural human language and inside him, the different languages which are a products of a genetic evolution that shows an evolutionary variability.

2.3 Psycho-bio-sociocultural aspects of human natural language. Introduction to the psychic theory of language. (Salatino, 2012)

This study of natural language, made from observation, to analyze the subjective aspects that give rise to language, and enabling their acquisition and comprehension. As such, it constitutes the first truly original theory appeared in the last 55 years, after it appeared Chomsky generative grammar (1957), with the difference that in this case, is supported also by an original logic, the Transcurssive Logic. This logic is based on a modification of the Günther's policontextural logic (1959), the first and only known tool to address the subjective aspects, or those of which it is not concerned the traditional science. This book also provides an introduction to the first scientific theory of the psyche, whose only precedent is the project conceived by Freud in 1895.

2.4 PSYCHE – Structure and Function. (Salatino, 2013a)

Although the ideas of Sigmund Freud may or may not be known, and even if you know them, not agree with them; his theory of the structure and functioning of the psyche is still, so far, the only existing one. It could be argued that this theory lacks adequate neurobiological support, and given the impossibility to prove it, cannot be accepted in the scientific field. From the above arguments,

the first is false, since as can be seen in PSYCHE, Freud was ahead by decades of several researchers of CNS, discoveries that were nominated or deserved a Nobel Prize. As to the second argument, it is half true because although not based its findings in laboratory experiments, he developed a plot so magnificent and finished, that with a suitable tool such as the Transcurssive Logic, it becomes pure science based on the important contributions of Rodolfo Llinás and Sigmund Freud. PSYCHE represents the first scientific theory about the structure and functioning of the psychic apparatus, able to contribute from a scientific perspective, to the foundations of psychology, psychiatry, psycholinguistics, cognitive sciences in general, philosophy in where always the 'mind' has been so important, and even to the same Psychoanalysis.

2.5 The Freud's Project (Salatino, 2013b)

In his initials works, Freud, makes a series of discoveries and fundamental contributions to the neurobiology and psychology, which he gives little or no diffusion. Several decades later, those same findings were reported by other researchers, that now, deserved in most cases, a Nobel Prize in Medicine. I give a detail of such findings, as the result of a personal and original investigation of Freud's life and work; at the same time, I compare with my theory of psychic structure and function due to more than 10 years of research that culminated in my PhD thesis, *Semiotics of real systems*, and a treatise on the psychic theory of human natural language.

2.6 Policontextural Logic. (Salatino, 2013 – Wikipedia)

It is Gotthard Günther's proposal to overcome the (true / false) dualism of the traditional logical universe, and thus to be able to project a polyvalent logic that admits new dimensions, among them, one that contemplates the subjectivity as expression of a particular relation between subject and object. This logic is one of the bases of Transcurssive Logic.

2.7 Fictions, only fictions. (Salatino, 2015a)

As a result of a protracted research, I immersed myself in a conceptual journey that showed me how distant our reality is from which science reveals to us using logical thinking, and even gives us the common sense. I have been able to show (Salatino, 2009, 2012, 2013) that the reality of events is measured in terms of the language that describes them. A non-inferential dynamic relational model, called Transcurssive Logic (TL), allowed me to discover new rules of game that arise when we dare to move outside our monocontextura (the binary universe that contains us); those that prevent a traditional observer from describing what happens in our reality using conventional rules. In this work and based on solid neurobiological knowledge (Salatino, 2013), we will review the psychic processes that support thinking, consciousness and language that allows us to communicate the facts, which for us are real; that is, we are going to speak scientifically about subjective reality and its justification.

2.8 The 2201 pages of a theory. The true story of Transcurssive Logic. (Salatino, 2015b)

This work represents, beyond the transcription of the notes taken during more than 12 years, while preparing my Doctoral Thesis and wrote my first two books, a double analysis of all the primary sources where I have nourished to carry out this arduous work. On the one hand, the analysis made at the time of formation, which left no room for personal criticism, but only to assume firm positions according to my proposal. On the other hand, to the current criticism from a Transcurssive Logic, which although not fully mature, is solid enough as to provide a different point of view in the analysis of the work of eminent characters who nourish the ranks of human knowledge. Among which are numerous philosophers, scientists of almost all branches of science, and especially all those who are directly or indirectly linked to the Cognitive Sciences, of which I highlight their achievements, but I am very critical at the time to consider its fundamentals. Notwithstanding its beginning of novelistic cut, this work contributes, in addition to a methodological guide in investigation, all a baggage of knowledge that makes to the formation of any scientist, and infuses an inquisitive spirit that transcends the good textbooks of the disciplines that are addressed, in order

to ensure that whoever reads it can build an epistemological stance of its own as strong and properly founded.

2.9 Music, Temporal Metaphor of Thought. (Salatino, 2015 – Research Gate)
Music, like all natural language, is a way of communicating our affections, those they say, as an unavoidable transcript of our subjectivity, about our desires and beliefs, our ideas and thoughts. As a language, then it is not possible to approach the music, but from the different systems that composing the subjective reality, because music is a possible manifestation, from her and for her. With this I want to emphasize that the musical behavior involves three domains: biological, psychical and social. In this article we will analyze from Transcurssive Logic (TL), the aspects that make music a real subjective manifestation of our thinking, one that is taken to 'flower of skin' every time we're listening, performing and composing a musical piece, whether instrumental or song.

2.10 Repeated implantation failure in oocyte donation. What to do to improve the endometrial receptivity? (Tersoglio, A. E.; Salatino, D. R. et al., 2015)
To determine the role of polyvalent endometrial treatment in patients undergoing IVF-ET who had recurrent implantation failure (RIF) in a program of oocyte donation (OD). The results were expressed in terms of live birth rate (LBR). Secondly analyze changes of endometrial leukocyte population evaluated by flow cytometer (FC) and histopathology. In this peer reviewed work Transcurssive Logic, was used for the first time in a natural science as a complementary research method, through a prospective study of a model-based control with analog abductive methodology.

2.11 Neurological and psychic bases of musical language. (Salatino, 2015c)
This work is based on the subjective nature of music, so any living being is sensitive to the fundamental and natural musical elements. The aim of the article is to show that music is a natural language that does not differentiate of our mother tongue, because both have experienced an evolutionary ontogenetic process parallel to the development and evolution of the nervous system. Its main contribution is the proposal of stage of ontogenetic development of musical language, which are addressed by Transcurssive Logic, a tool and a method suitable for analysis of subjective phenomena. The detailed knowledge of the basic and natural musical elements and its relationship with life, the affection and the coexistence has, on the one hand, educational implications, since the operation on each of these elements allows an education that favors the psycho-bio-sociocultural aspects that characterize the subjective reality of the human being. On the other hand, it has therapeutic implications. It has been shown that when listening to music, patients with various neurological and psychical disorders, emphasizing each of the basic elements that can influence various aspects of their disease.

2.12 On unconscious. (Salatino, 2015c)
In 1912, Freud unveiled for the first time his hypothesis about the existence of unconscious mental processes. It substantially modified the outlook from where, from there how we would study the human psyche. This finding led to the proposal of the structural division of the psyche (Ego, Id and Superego), while allowing to set the hallmarks of every psychic process from the beginning, so also was crucial to understand, that there, will remained indelible, the 'memories' of childhood, including the prenatal memories, that although in adulthood, apparently were forgotten, they were responsible for the conduct and manifested by particular behaviors. In this paper, we will review the specifics of the unconscious, but also we will see their relationships with thoughts, ideas, preconscious and consciousness. Finally, we will address the important relationships between the Id and the Unconscious, since at that early part of the psyche, lies, according to my theory (Transcurssive Logic), the psychic structure and the main subjective transformations, allowing that impulses and desires are expressed. Since an instinct expresses the vital commitment that man has with the libido, we shall see, in some detail, how and where libido originates.

2.13 The importance of symmetry. (Salatino, 2016)
Symmetry is a matter of great importance in physics and mathematics however poorly exploited. I was able to show, with other arguments and focusing on it from the Transcurssive logic, that the finding of a symmetrical structure underlying the various problems facing science, allow for a different method of investigation and also with a tool to help in education of science. Since it begins by isolating the fundamental elements that posed the problem in question and integrate them in order to arrive at the solution thereof, thus resulting in an explanation whose simplicity does not mean that it is absolutely rigorous and precise, since we do not use a single formula.

2.14 Beyond the Decisions-Making: The psychic determinants of conduct and economic behavior. (Salatino, 2017a)
The objective of this paper is to provide a useful tool to evaluate the impact of conduct and economic behavior in decision making. It is a research based on a theory of the psychic structure and operation with a marked neurobiological support. The use of a new method is introduced: the Transcurssive Logic, to investigate the subjective reality of which the economy forms part. This is corroborated the hypotheses suggested by Hayek in his treatise on Theoretical Psychology: *The Sensible Order* (1952), and they are foundation to the psychic processes that give rise to both the behavior as the conduct. It constitutes a basic contribution to Economic Psychology.

2.15 Treatise of Transcurssive Logic. Evolutionary origin of the sense in the subjective reality. (Salatino, 2017b)
Transcurssive Logic (LT) is defined as a tool, it is the only one that allows to deal with the evolution (passing) of the subjective aspects of any living being, including man, in which both the volitional and the cognitive aspects are covered . TL is a dynamic, non-inferential, quaternary and policontextual relational model that operates with ontological niches (continents) assembled according to a universal language structurally defined by a Group (as a relational entity) and functionally by a Galois Connection (as composition of opposites and complementary). This model is based on the change or transformation that emerges when the compelled components of subjective reality, that is, subject and object, are interrelated. This change or transformation occurs in two simultaneous levels: a) superficial and apparent of discrete nature and what we will call 'content', and b) the profound and hidden of a continuous nature that we will know as 'continent'. As a research method: it allows to relate the theoretical knowledge and the empirical knowledge, with its discovery and validation, in this way it is adapted to the scientific knowledge that is intended to be achieved, making possible the validation of what is discovered. At the superficial level it behaves as an analogical-abductive method, starting from the results, one searches for a conclusion or hypothesis, separating two levels of analysis: known or evident (superficial) facts and unknown facts (profound), from which they are assumed to behave similarly. At the deeper level it behaves as an analogical-adductive method, by bringing the two previous levels closer together, making them simultaneous, contrasting them against a model taken from everyday reality. The strategy implemented has as its substrate, to dispense with the frame of reference, to be able to form an (algebraic) group with the relationships between the fundamental elements that characterize the system under study. In this way, the syntax of a 'Universal Language' is achieved that allows to approach any branch of the science and of the humanities.

2.16 Beyond the Decision-Making II: Methodological Aspects. (Salatino, 2017c)
The objective of this work is to show that the determinants of conduct and subjective behavior that govern research in Social Sciences, especially in economics. Both the investigative process and the economy have at their base the same relational pattern that determines subjective reality. We used the method based on the Transcurssive Logic that is apt to investigate the subjective reality, of which the economy forms a part. Individualistic methodological proposals and the one based on unification are adjusted. It constitutes a methodological contribution in economics.
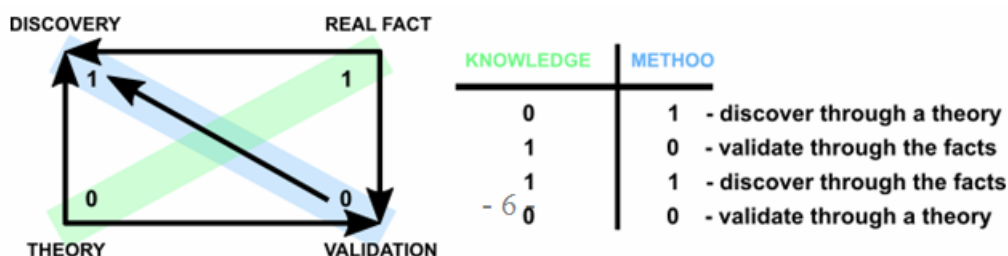
3.0 METHODOLOGY
3.1 The scientific method

The scientific method is the main producer of knowledge in science. Based on the empirical and the measurement, observation is subject to specific rules of reasoning. (Newton, 1997, p. 461) All research is defined by an 'object of study' and by a method that enables its analysis. The 'object of study' always has to do with some portion of the reality that is intended to study, since science is in short a way of observing reality. Transcurssive Logic is also a way of scrutinizing the real, but it does so from the perspective of the subject and not only from the obvious or apparent manifestations that the empirical provides us.

Its quality of 'scientific' is embodied in the following considerations: Scientific knowledge (the product to be achieved through research) accepts two variants: the abstract (based on theories) and the empirical (based on facts). The scientific method also supports a couple of options: validation and discovery. (Samaja, 2005, p. 41) Since a discovery is not equivalent to facts and validation is not to a theory, it is imperative to contemplate its 'logical product'. (Figure 1)

Fig. 1: Scientific investigation

KNOWLEDGE	METHOO	
0	1	- discover through a theory
1	0	- validate through the facts
1	1	- discover through the facts
0	0	- validate through a theory

The above scheme suggests that research always consists of a combination of procedures intended to discover something and procedures to validate what is discovered. Accordingly, we would not be lacking the scientific norm if we used a method that adapted to the scientific knowledge which we intend to achieve, provide us with the necessary tools to validate what we discover (diagonal in the scheme), which would be equivalent to 'discover through a theory' (code 01) as it happens, for example, with theoretical physics.

3.2 Transcurssive method

To address the real from human subjectivity, that is, to discover through a theory or validate it through a discovery, we must necessarily do without any frame of reference. The paradigm of this requirement is perhaps in the theory of relativity. Here, light does not rest on any system of reference, but at the same time, all systems of classical physics move in relation to it. In addition, it is the form that relativistic physics has for guarantee that all reference systems have zero relative motion with respect to light (second principle of relativity theory). (Salatino, 2017, p. 390)

The Transcurssive Logic (TL) operates with its method in the same way light do since having no 'reference system' couples the subjective reality to the objective reality or observed, both globally and in a restricted form according to the portion of it that we need to investigate.

4. FINDINGS & DISCUSSION
4.1 Subjective Reality

The subjective reality is the variation of the existence to which all living beings resort so that the materiality that surrounds it can be transformed into 'incarnate knowledge'. The foundation stone of all experience and, therefore, in the construction of a history. From there, life urges the subject with the periodic, almost endless passage of his story that less emphatically denies a real identity with a preconceived plan, than what is based on a belief, at the evolutionary extreme. Believing that is the

ultimate truth that gives the reality to a subject when a real fact makes sense; when he oozes the absolute certainty that allows him to survive despite his encounter and can change it by structure, with a clear intention to continue building. "In the most elementary circumstances the only truth is life." (Dante R. Salatino, 2017).

The structure arising from an incessant approximation of things to knowledge, decants its identity character towards the root that ends with the seeming diversity of the appearance. Subjective reality then manifests its dynamic foundation by fulfilling the unique function of legitimizing the identity between the union of apparent diversity and the separation of their coincidences. This dissolution of the classical principle allows to assemble and make lawful an opposition where before there was pure equality.

The antagonism raised is not exclusive as required by objective paraphernalia, but conservative as suggested by Hegel. Opposites, while complementary, do not share a common dimension, but a relational pattern of their own dimensions where the circumstance of participating in any one entity is equivalent to 'as if' they really were. This ambiguity, which is absolutely legitimate, depends on both the subject and the object so it offers greater options than the objective eventuality by regenerating based on error, totally unknown aspects of reality and projecting it as a 'universal language.'

The subjective reality has no relation to the religious, poetic and metaphysical worldviews posed by Dilthey (1949) in his 'Sciences of the spirit', nor with paradigms that are undergoing an update in an attempt to overcome the obsolescence of old schemes. It has to do with truths or beliefs, needs or desires that make us 'see', individually, a universe in which our life, our knowledge and our natural language are set. (Fig. 2).

Fig. 2: PAU of the subjective reality
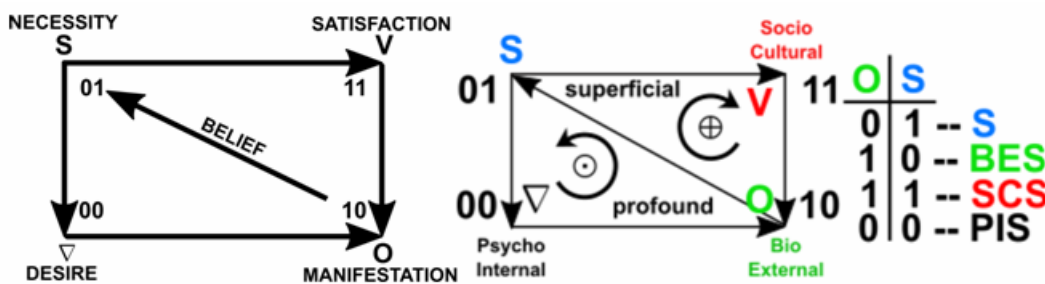
References: S: subject, O: object, V: evident transformation, ∇: not evident transformation, ⊕: XOR, ⊙: XNOR (equivalence), BES: Bio-External System, SCS: Socio-Cultural System, and PIS: Psycho-Internal System.

In Fig. 2 we see the interrelations that keep the fundamental elements that give base to the subjective reality. That is, the *necessity* (subject's patrimony) and its opposite and complementary, the *manifestation* of having fulfilled (or not) said necessity through the bio-external system (BES). The previous pair is mediated by another pair composed by *desire* (psycho-internal system - PIS) that demands the *satisfaction* of that need (sociocultural system - SSC). Complete this PAU (universal autonomous pattern) or syntax of this 'universal language', the *belief*, which is nothing other than the manifestation (response) that certifies that it has found meaning to a need. (Op. Cit., p. 191)

In order to satisfy a desire that is met with a basic necessity, its manifestation of coverage can be positive or negative.

Covering a necessity in a positive way gives rise to a belief that represents 'truth'. That is, to have found meaning to the demand coming from the environment and that is against the solution that demands the necessity.

There are, therefore, three truths: 1) the 'biological truth' that allows the subject to live and reproduce; 2) the 'psychic truth' that allows him to harmonize with the environment; and 3) the 'social truth' that empowers him to be considered by others. Desires and beliefs allow us to construct our psychic structure (Salatino, 2013, p. 181), that is, our history and determine how we approach objective reality.

4.2 Objective reality

The objective reality is that area where the object resides, its knowledge or its representation and the subject that acquires that knowledge or creates that representation.

Science by means of specific criteria of truth tries to find the coincidence between an affirmation and the facts to validate a knowledge that will indicate as objective. Other objective guidelines are under the protection of truth tables of logic or the correct mathematical formulations.

Whatever the case, there are different proposals to address this objective reality. One of them, perhaps the simplest to understand is the one made by Karl Popper through his 'doctrine of the three worlds'. (Popper & Eccles, 1993, p. 43)

World 1: the world of physical entities.

World 2: the world of mental states, including among them states of consciousness, psychological dispositions and unconscious states.

World 3: the world of the contents of thought and the products of the human mind.

Fig. 3: PAU of the Popper's World
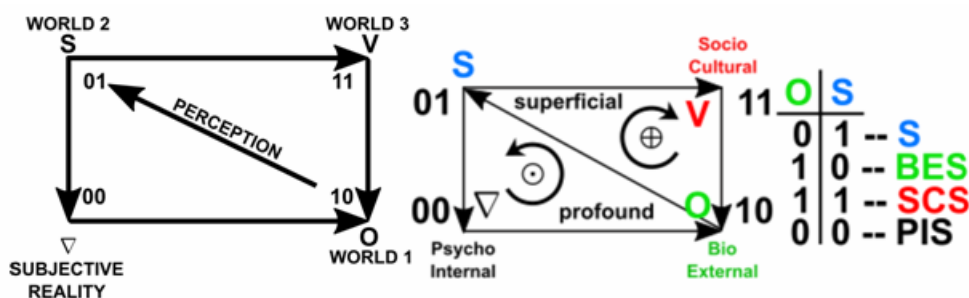
Figure 3 shows the relationships that, according to the Transcurssive Logic, hold the 'Popperian worlds.'

Popper theorizes about the 'worlds of knowledge' and thus may be expressed in the PAU, its 'objective pole' (superficial level) or that which accounts for the evidence. That is, the object of the knowledge obtained by him and the subject to which as a mere object, is assigned the acquisition of that knowledge. In this statement the subjective disappears. In the previous figure, we see that the codes that structure the PAU have the same table of assignments as in the case of subjective reality. In Popper's PAU, the profound level represents through ∇ is subjectivity that makes possible the obvious manifestations of our knowledge.

Another way to shape the objective reality as an object of study is the method of 'levels of abstraction'. Luciano Floridi (2017) defines them as a set of variables of a known type, intuitively representable as an interface, which establishes the scope and type of data that will be available as a resource for generating information. Through an 'abstraction level' an information agent (observer) accesses a physical or conceptual environment. These levels need not be hierarchical to be comparable to each other. They are interfaces that mediate the epistemic relations between the observer and the observed.

The precisions given in the previous paragraph allow the theme to be approached as a method from the TL. As a result the analysis of a system can obtain a model that takes into account certain levels of abstraction according to the purpose of the system studied. The method of abstraction (Floridi, 2008) is useful for specifying the meaning of 'indirect knowledge', that is

obtained by observation. It also provides a quantity of information according to the level of abstraction in which we are located, which will be greater the higher that level, which qualifies the information extracted from the system.

On the other hand, the levels of abstraction are the best 'antidote' against ambiguity and error. They force the theory adopted to support the analysis of the system to make explicit and clarify its ontological commitment, since they determine the range of available observables that allow to investigate the system under analysis and to elaborate a model that ends up identifying the structure of the studied system.

According to Floridi's proposal, a system that is analyzed at different levels of abstraction generates a model that allows us to identify a certain structure that can be attributed to that system.

Following strictly this scheme proposed by Floridi, we will elaborate the PAU respective according to the relational vision of the fundamental elements that propitiates the TL. (Figure 4)

Fig. 4: PAU of the level of abstraction
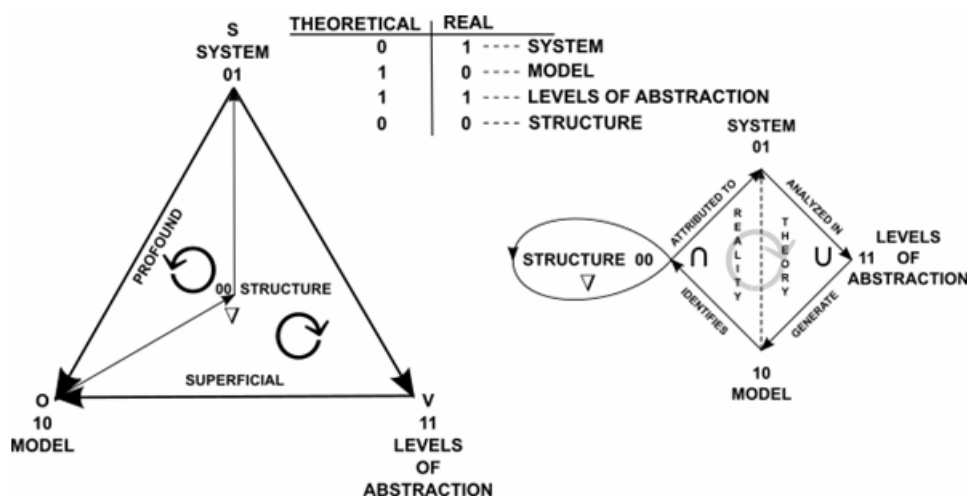
References: S: subject, O: object, V: evident transformation, and ∇: not evident transformation.

In the previous figure of PAU, the elements considered by the TL are fundamental to explain the operation of this interesting method. It is easy to perceive that the selected basic elements coincide fully with those proposed by Floridi; there are also certain relational dependencies that the original model does not show.

The interrelationships between system, levels of abstraction, model and structure determine two opposite and complementary levels that can be verified in the binary codes of each element, as shown in the table of assignments attached in the figure. There is a real element that represents the 'reality' to be studied: the system. A theoretical element: the model, which tries to succinctly represent the reality under study. A set of variables that define certain 'levels of abstraction' according to the system studied and that serves as 'mediator' between the real level and the theoretical level. Finally, the structure of the system studied is something that cannot be perceived so it cannot be classified as real or theoretical.

The superficial level is formed by the direct and obvious system-model relationship mediated by the levels of abstraction (logical union). This level constitutes what in scientific research is called 'theory'. It is a set of hypotheses that allows to make the model in function of the observation of the system under study.

Everything can end with the suggestion of a so-called 'theory' unless it is passed to the deep level which is determined by the indirect and hidden model-system relationship that allows disarming surface evidence and reassembling it in order to achieve maximum adjustment possible from the theoretical to the real (logical intersection). When this adjustment reaches the highest

degree of approximation we can affirm that the theoretical model has identified a specific structure that can be assigned to the real system under inquiry.

It may happen that despite having a stable and considerably reliable structure, in practice the information obtained does not agree with empirical observations. It is then that deep level fulfills another function, in addition to 'finding' the corresponding structure. This function is to 'accommodate' the interrelationships that were established between the model, the structure and the system, until there is a greater affinity between theory and reality.

Adjusting the 'structure', the fundamental basis of any system, allows not only the simulation of systems (black box method) which is nothing more than a rough imitation, but emulation (white box method) where we can to venture to sketch the underlying processes that would explain the functioning of the real system. This is where the subjective reality intervenes through ∇, which in the specific case of the Floridi model, represents the structure of the system analyzed.

An alternative way of approaching objective reality is represented by Van Fraassen's proposal. The American philosopher of Dutch origin Bas Van Fraassen, who specializes in the Philosophy of Science and Logic, defines symmetry as Noether (1918), but proposes it as a guide for the characterization of a scientific theory. He considers it as the main key to understanding the world theoretically constructed through a model (Van Fraassen, 1989).

Let us look at a generic example (Van Fraassen, Op. Cit., p. 259) (Figure 5)

Fig. 5 PAU of the symmetry
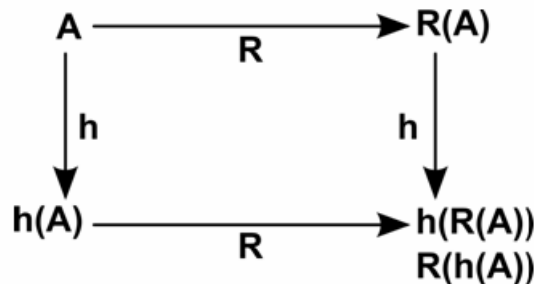
Van Fraassen tells us: if we have a rule (**R**) to solve a given problem (**A**), the application of that rule will output its solution (**R (A)**). But also, we have another transformation (**h**) that in applying it makes the problem, essentially, return to be the same. If a particular problem with an input **A** is modified by the transformation (**h**) becomes the problem with the input **h (A)**. In the lower right corner of the diagram we have two outputs: the original output transformed and the output of the transformed problem. But, if the two problems are essentially the same, then the two solutions are also the same. Thus, the symmetry requirement is satisfied: **h (R (A)) = R (h (A))**. The problem remains the same once you have found a solution. (Principle of invariance)

His contributions focus on projecting the concept of symmetry beyond physics or mathematics, attempting its application to any scientific theory, suggesting that 'similar problems have similar solutions'. On the other hand, it establishes as a method to individualize the features or relevant aspects of the solution, but does not specify how to do it.

This is the main requirement of symmetry; the methodology to generate arguments of symmetry. To put it another way: once the relevant parameters have been isolated, the solution consists of a rule (a function) that depends only on those parameters; which is to say that, from the methodological point of view, the object of study has been isolated. (Salatino, 2015).

The input **h (A)** is the one that makes possible the cycling source of the reflection symmetry of this group designed by Van Fraassen. This is where it should be the subjective contribution so that all this scheme that records a concrete objective reality, has a determining and reorganizing factor that justifies the dynamics of its evolution over time.

4.3 Bounded reality

No branch of science is exhaustive, but is dedicated to investigate a fraction of our reality. In fact, today this parceling is much more noticeable than in the 17th century, given the great quantity and quality of knowledge that we have achieved. Paradoxically, the problems of disconnection between these very diverse areas of research are not lacking.

However, the depth of knowledge acquired is not an obstacle, so regardless of the area in question, the scientific approach is always the same. The Transcurssive Logic has the method and the tool to make the above possible.

Isolating the essential or relevant structure of a phenomenon is equivalent to defining a group of transformations that once applied leave the problem, essentially, in the same situation from where it started (invariance). All these transformations are the symmetries of the problem. In TL, with the essential aspects, a group is formed (a logical-structural arrangement) that is called PAU (Universal Autonomous Pattern) (Figure 6), and the solution consists of a rule (a function) that depends only on these basic parameters.

Fig. 6 PAU of bounded reality
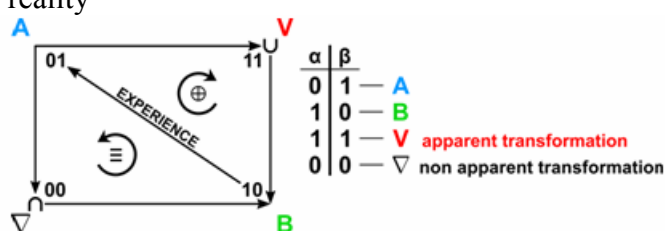
In the previous figure we see two essential aspects of any phenomenon (A and B) and the relations they keep together by means of two transformations: one superficial or apparent (V) and another hidden or profound (∇). The way we identify each of these elements is by individualizing some characteristic that is unique to each essential aspect (α and β). According to the resulting binary codes, we have that A is identified by having the characteristic β, but not the characteristic α.

In contrast, B is identified by having the characteristic α, but not the β; this is telling us that A and B are opposites with respect to the characteristics α and β, which are exclusive. Transformations are distinguished because the superficial (V) has both characteristics (α and β) of the aspects it relates (A and B), is what we call co-presence or organization, or what is evident in any phenomenon that is being observed.

The profound transformation (∇), on the other hand, shows a total absence of the characteristics that identify the aspects that it relates (co-absence or disorganization). As we see, as with the essential aspects (A and B), here the transformations T and T' are opposite; but in addition, both pairs are complementary, since, when added together, they give the apparent unity (11). This is nothing other than the obvious or superficial transformation (organization). Thus, is formed an opposition mediated by another opposition. (Galois Connection)

In the scheme of the figure, it is observed that between A and B there exists, in addition to the indirect relationship, mediated by a transformation that we have described, a direct relation between them that is shared by the two cycles that form. A superficial dextro-rotatory (in the clockwise sense) which represents the symmetries of rotation of the system and constitutes the 'objective pole'. A profound one of a counter-clockwise rotation which is an evidence of the reflection symmetries of our universal pattern and represents the 'subjective pole'. The opposite turns constitute another mode of complementarity that ensures the simultaneity in the operation of both cycles, where both the quantitative and the qualitative aspects of any real fact must be present at the same time.

Finally, so that the whole system is not just an inert structure, there must be a rule or function that sets it in motion. This rule ($\oplus$) allows shifting, superficially, to the right (quantitative or apparent transformation), making use of the characteristics that help identify each element of the system. Each of these elements occupies the place of its successor in the sequence, without losing its own identity (rotation symmetry), until the system returns to the beginning from where it left. With the above operation, we assume that we have reached the solution of the problem posed by the observable aspects of a real fact. At profound level, and as it could not be otherwise, the rule or function used is the opposite to the superficial ($\equiv$: equivalence), which allows to move to the left the elements of the system. Here, when the system returns to the original arrangement, after successive qualitative transformations, we obtain the complete solution to the problem (reflection symmetry). In short, it is this level, that of the aspects that characterize a phenomenon, the determinant of what shows us, in appearance, a real fact. What unifies the two levels is the experience that arises from solving a certain problem.

5. CONCLUSION

As we have seen, analyzing reality from the scientific point of view requires that at least three levels be explored: that of the 'subjective reality' that in this work is postulated as the sustenance and determinant of the other levels, which is based in a 'belief'. The "objective reality" is the level traditionally addressed by science and where you can choose different forms or theories from which to observe and measure the real, which is based on the 'evidence', and that of 'bounded reality' in which, is explored and valued. The object of study of an investigation, which is based on 'experience'.

The 'guiding thread': 'belief → evidence → experience' constitutes, in turn, an PAU that joins the fundamental elements of all research (Figure 7)

Fig. 7: PAU of the scientific research
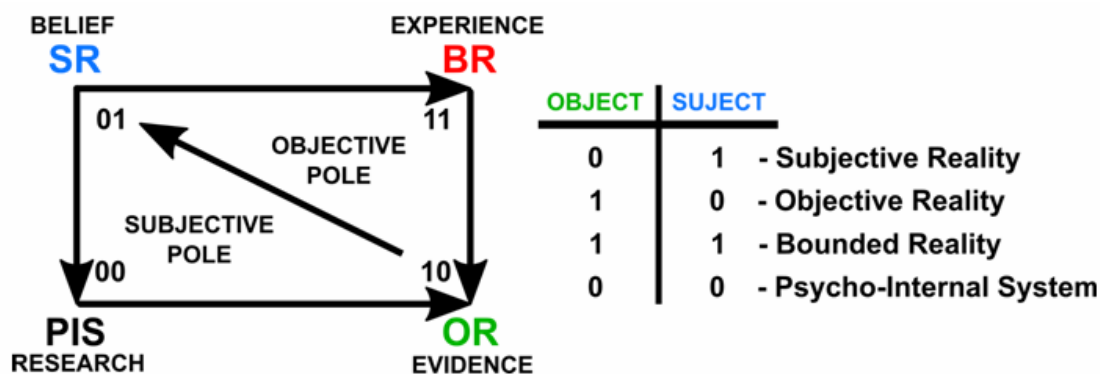
References: SR: subjective reality, OR: objective reality, BR: bounded reality, and PIS: Psycho-Internal System

Figure 8 summarizes everything analyzed. This scheme shows the dependence between the explored levels of reality. As can be seen, dependence is not hierarchical, but heterarchical (simultaneous) and fractal.

In addition, it is clear that all levels are based on their subjective pole, which is 'inherited' from the previous level. This provision emphasizes that all research is a dynamic and evolutionary process, where the subject that investigates and its domain are the main axis. However, this is not an impediment for this approach to be considered under any aspect, as scientific.

In this way, the Transcurssive Logic is outlined as an indispensable complement to any research process since it allows the creativity that usually accompanies any free thinker.

The traditional scientific method, without being obligatory nor an absolute guarantee of successful results, depends exclusively on the creative disposition, to be carried out. It would be of little use as a method if it were not possible to prosecute this creativity. The Transcurssive Logic allows the delimitation of the fundamental elements that intervene in any original approach that is made of reality. So that on them we can apply the rigorous process of analysis, organization of available material, ordering and critique of the ideas required by the current methodology, so that what is obtained is valid scientific knowledge.

We can conclude that, regardless of the level of reality we consider, there is always at the base a relational pattern, an invariant, a 'universal language'. These invariants (PAU^S) are independent of the point of view that we adopt to make an observation. They take the same form from any reference system.

A 'change', with the passing of time, ends up becoming a 'displacement' in a 4D hyperspace, where the structure is a permutation group and its dynamics becomes a Galois Connection.

Ergo, the invariants cease to be mere analogies to immediately transform themselves into facts, phenomena, and real processes.

Fig. 8: PAUS of the analysis of the reality
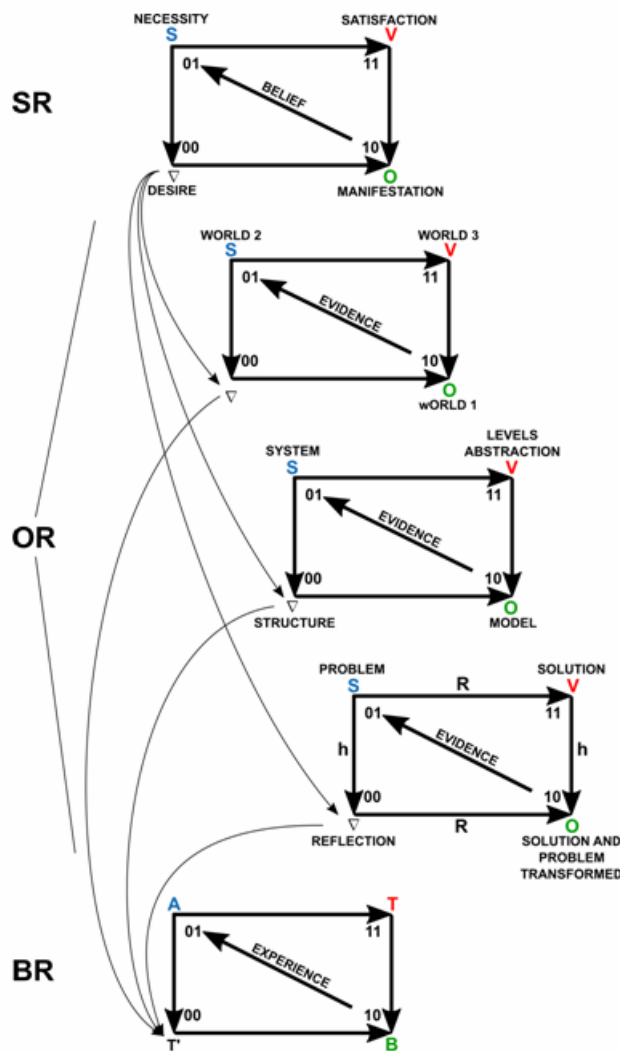
References: S: subject, O: object, V/T: evident transformation, ∇/T: not transformation, SR: subjective reality, OR: objective reality, and BR: bounded reality

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Subject and Time Movement in the Virtual Reality

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> "Time travels in divers paces with divers persons."
> William Shakespeare, *As You Like It*.

ABSTRACT
We aim to relate the time dimension to the functioning of ideology and language, which interferes with the constitution of the subject. The time dimension, as an anticipatory mechanism, dictates to the subject an artificial creation of reality. We understand the subject as the "basis" that guarantees the non-crystallization of this virtual reality due to the fact that subjectivity plays a dual role: that of disclosing subjection and that of disclosing its subversion, thus breaking the circle of idealism of the virtual reality. The meaning process in its constitution depends on the *movement related to time* and on the *point of origin of this movement* which will interfere with how emotion will be received and interpreted by the subject. This functioning is related to the logical value described by Mathematics: The subjective unfolding of a temporal instance leads to the recognition of a true logical movement in the meaning construction process. The time works as a "shift" of the *orientation to the knowledge,* establishing the "right order" of the interpretation and provides an "exact part of our thinking'". We discuss the existence of something external to the logical process that suspends predictable motions and lacks the synchronicity implied by the orientation of dominant ideology. It] installs the *verification* at the origin of the constitution of meaning: The "time for comprehending" that "breaks" the framework of anticipated time in the logical reasoning and opens the logical movement to a subject's judgment in situations.

Key words: Subject; Time; Virtual reality; Ideology; Logical reasoning.

1.0 INTRODUCTION

Emotion is a broad concept which is mixed with life itself; it is not restricted to thoughts. It is intertwined with temperament, personality and culture and influences the subject's ability to discern, consciously or unconsciously, symbols and meanings to arrive at a perception (Ostrower, 2008).

Faced with the need to understand emotion, we have placed the focus of this article on emotion as a *reality experienced by the subject*. In this way, our investigation falls on the *subject*, conceived as a place where "desires, interpretations, sensations, memory and meanings [are] related to the way [emotion] is received and interpreted" (Pimenta&Monte-Serrat, 2015, p. 984-985). It is in the subject that meanings are constituted, either by virtue of an ideology or by force of an "event" (as an underground meaning, contradictory to the dominant ideology) (Pêcheux, 2002, p. 9). The subject is the "basis" that guarantees the non-crystallization of emotion, just as ideology wants to make us believe. It is the subject who gives the displacement of emotion or meaning, supposedly crystallized by the game of power (ideology); it is the subject who opens the possibility for something new to happen.

Henri Laborit (1968) states that subjects are committed to two essential processes: that of memorization and that of association of elements. The richer our information storage, the greater our association of elements in the construction of meaning. These processes of meaning constitution depend on a *movement* that cannot be ignored: *the movement related to time*. Current technology, for example, interferes in the constitution of meaning and, consequently, of the subject's reality. When technology operates in virtual reality, there is an *acceleration of time* which reduces the subject's ability to reflect (Feldman, 2002, p. 12). Another example of time-related subject movement is asserted by Levine when he states that Frederick Taylor's efficiency engineering establishes that optimum standards for the times of each worker's every movement were clocked in order to not:

> "'waste' motions – such as talking, yawning, scratching one's head or any other "extra" movements - from the movements that lead directly to the production at hand. The precision of these measurements was eventually perfected to the level of ten-thousandths of a minute. Taylor believed that his method of scientific engineering, when applied with complete objectivity, would produce the perfectly streamlined "standard time" for every job." (Levine, 2006, p. 71)

Besides the movement related to time, another issue to be observed in the process of meaning constitution is the *point of origin of this movement*: the point which is *valued by the dominant ideology*. Levine (2006, p. 71) emphasizes that men and women are objectified and redefined in clockwork and mechanistic language to suit prerequisites and schedules which dictate efficiency. This functioning imposes *standardization and a new conception of time*; creates new priorities for the social order and goes beyond the public pursuits, entering private lives.

This article discusses the junction of these two factors - *time* and *origin of the movement* (ideology) which will interfere with how the emotion will be received and interpreted by the subject. The junction of these elements interferes in the *constitution of the subject,* keeping in mind that enunciation is a place where the subject is constituted and that a subject is conceived as effects of meaning between interlocutors within a socio-historical context (the subject is not something given beforehand, but he/she constitutes himself/herself in enunciation) (Elia, 2004). Consequently, we can observe a subject "reproduced" by virtual reality. He/she finds himself/herself in a situation where something within the "self" is excluded for something else to be "grafted" in this place. The consequence is that he/she begins to reproduce (as if mechanically) virtual reality. We can say that what we call real time undergoes an alteration giving place to virtual time. According to Feldman (2002, p. 14), this process introduces a movement directly into the subject's perception, that is, he/she "perceives himself/herself" as something virtual, distorting his/her own reality, and

diminishing his/her capacity for reflection and understanding: thus becoming a passive subject with predictable emotions.

2.0 DISUSSION AND ANALYSIS
2.1 The subject under effects of ideology and time - the role of logical reasoning
The role of ideology in the constitution of the subject cannot be ignored, since it interferes at the conscious and unconscious level of the subjects (Monte-Serrat, 2013). The subject under effects of ideology is constituted under the logical reasoning process, which overlaps the subject's interpretative actions and excludes the subject's interpretations filled with subjectivity. This kind of subject's enunciation becomes measurable and predictable (Haroche, 1992); the subject is constituted as determined by dominant ideology (Monte-Serrat & Tfouni, 2013a).

How does this ideological interference occur? Ideology interpellates (Althusser, 1999) the subject by promoting an anticipation (time) of meaning, under the domain of the logical reasoning wich structures language. There is a logical "power" in language that will establish the dominant meaning and the dominated meaning. The subject conceives the meanings, or rather, it is unconsciously constituted (he/she is interpellated by ideology, according to Althusser) (1999); his/her motivations are influenced by ideology. The logical "power" of language (Whorf [1942] 2017) causes alienation of the subject, who becomes oppressed without realizing that there is a process which conditions him/her.

2.2 Subject and time in the logical movement
The relation between the subject, time and language lies on understanding the functioning of the logical value as described in the Science of Mathematics. The subjective unfolding of a temporal instance leads us to recognize a true logical movement in the meaning construction process.

The background of this discussion is in the context of the Century of Lights, whose discursive production imposes "the" way to objective knowledge and provides us with the "autonomy" emerged (Kenshur, 1996, p. 526). The discursive production of the Century of Lights brings in it the imposition of the use of logical reasoning as "general patterns of reasoning, without reference to a particular meaning or context" (Ncert, 2017, p.247) to examine ways or processes of the subject's constitution. In other words, the relation between the subject's constitution and the functioning of logical reasoning has the time element as a "shift" of the *orientation to the knowledge*. How can time *guide the knowledge* and *the constitution* of meanings? Through language structure, as we shall see after understanding the functioning of logical reasoning in Mathematics.

2.3 Logical reasoning in Mathematics
The first concept of Mathematics that we need to understand is the concept of "proposition": "A proposition is a sentence which is either true or false (but not both)" (Eccles, 2007, p. 3). Some authors establish the difference between general statements and propositions: general statements "become propositions once a numerical *value* is assigned to *n*" (Sundstrom, 2017, p. 4).

In order to establish that a statement is true, we often write a mathematical proof, and in order to "establish that a statement is false, we often find a so-called counterexample" (Sundstrom, 2017, p. 3).

Math and Law, for example, in order to avoid ambiguities, have many common features: they both use and need very precise and sometimes intricate language (and applications or cases to illustrate the rules), and they both need proofs to make a decision or a ruling, or decide the veracity or falsehood of a statement or event. So for both areas, there is a need to focus on "what happens before we start a proof"; things like making "a conjecture beforehand as to whether the statement is true or false" and "this is often done through exploration" (Sundstrom, 2017, p. 3).

In order to know whether a given proposition is true or false, we need to observe how statements are using various logical connectives. Connectives combine simple statements to form new statements and the basic ones are: "*or*", "*and*", "*not*". The meaning of mathematical statements avoid ambiguities and must be precise by using "or".

Mathematics is concerned with establishing the truth of statements and "this is achieved by giving a proof of the statement. The key idea in most proofs is that of *implication*" (Eccles, 2007, p. 10). Eccles (2007, p. 10) defines proofs as

"a sequence of statements starting from statements we know to be true and finishing with the statement to be proved. Each statement is true because the earlier statements are true. The justification for such steps usually makes use of the idea of 'implication'; an implication is the assertion that if one particular statement is true then another particular statement is true."

"One of the most frequently used types of statements in mathematics is the so-called conditional statement" (Sundstrom, 2017, p. 5).

"Given statements P and Q, a statement of the form "If P, then Q" is called a conditional statement. It seems reasonable that the truth value (true or false) of the conditional statement "If P, then Q" depends on the truth values of P and Q. The statement "If P, then Q" means that Q must be true whenever P is true. The statement P is called the hypothesis of the conditional statement, and the statement Q is called the conclusion of the conditional statement [...]"

The conditional statement "if p, then q" ($p \rightarrow q$) can be expressed in different ways. Some of the common expressions are: a) "if p, then q"; b) "q if p"; c) "p only if q"; d) "p is sufficient for q"; e) "q is necessary for p" (NCERT, 2017, p. 252).

The results of these conditional propositions form explicit or implicit hypotheses. The process of demonstrating an outcome is based on hypotheses and, according to elementary reasoning, intermediate conclusions are obtained until the desired conclusion is reached: The demonstration, which constitutes a list of evidences of the veracity of enunciation – if the hypothesis is valid, then so is the thesis (Bianconi, 2017). Sometimes, making a demonstration suggests moving backwards (from the thesis to the hypothesis), looking at the hypothesis as an intermediate conclusion, and then writing in the right order of mathematical language. This "right order" of mathematical language is a kind of necessary certainty with regard to mathematical propositions which *anticipates* the concept of a systematic mathematical interpretation.

Establishing the truth of mathematical statements depends on starting from other mathematical statements known to be true (Eccles, 2007, p. 16): "The deductive method [...] proofs began from certain 'axioms' or 'postulates' which are viewed as self-evident truths [...] and which most people would consider to be obvious facts".

The axiom engenders an increasing order of instances within the logical process so as to be integrated in a conclusion. The axiom assumes the function of basis or "floor" on which the mathematical deductions were constructed. "In constructing the logical deductions from this axiom, the conclusion will only be true if we take into account the constraints imposed by the axiom", as stated by Cabella in a personal interview.

When we take probability into account, a possibility in time is called an event, and as long as an event has non-zero probability, then it can happen, even if remotely. If the probability is about flipping a coin, for example: yes or no (Heads or Tails), it is a matter of "when". In other words, over time one of the events will happen, and a head, for instance, could show at the first time the coin is tossed, or it could show at the tenth time. It may also depend on how straight or crooked is coin flip. So, a Head or a Tail is certain to show over time.

Kenshur (1996, p. 532-533) states that since the seventeenth century, there has been a tendency to take "probable knowledge" as "knowledge indeed" to get on with scientific work, causing a distancing from epistemological doubts. This position has shifted the uncertainty of the "fact" to the uncertainty of "when".

The way Mathematics serves as a "model for rational inquiry" (Encyclopaedia Britannica, 2017) in the sciences has consequences "to the reliability and extensibility of rational thought itself". So, mathematical education "provides a rich array of mental patterns and the habit of looking for instances where they are applicable". It also provides an "exact part of our thinking'" (Levitt, 1996, p. 47-48), establishing "the truth of the statement" and "the steps of the logical argument by implications" (Eccles, 2007, p. 21).

2.4 Logical reasoning in Language

According to Whorf ([1942]2017), "the linguistic order embraces all symbolism, all symbolic processes, all processes of reference and logic", turning the mind into the "great slayer of reality"; he states that "the patterns of sentence structure that guide words are more important than the words themselves".

Understanding logical reasoning in language is associated with grammar. According to Derrida (1967, p. 71), grammar has the task of determining what must be true for the "representamen" used by science to make sense of it. Logical reasoning has the role of a formal science that will establish the truth conditions of representations, that is, with respect to scientific intelligence, logic has the role of determining the laws according to which a sign will give rise to another sign or determine the way one thought will determine another thought. The author (Derrida, 1968, 74) replaces semiology with grammatology, stating that the latter does not exist in fact, but has a right to existence, because its place is determined in advance. *The logical movement: standardization and anticipation*:

> "The time recorded induces punctuality by impressing the value of time on each individual [...] There is nothing so fatal to the discipline of the plant, nor so disastrous to its smooth and profitable working as to have a body of men irregular in appearance, who come late and go out at odd times." The new time recorders promised to help "weed out these undesirables." (The International Time Recording Company Catalog,1914, In Levine, 1997, p. 68-69).

"Time dimension" is related to the functioning of ideology and language as *anticipatory mechanisms*. We observe time as something that interferes with the constitution of the subject and not as a means of keeping track of the hours to synchronize human activities. Our interest lies in *what remains as desirable of the discipline* that time imposes on individuals, better saying, the existence of a society which allows to be dictated by an artificial creation. Jeremy Rifkin (1987, p. 1) described a human being as a "time binding" individual whose "perceptions of oneself and of the world are mediated by the way we imagine, explain, use, and implement time". This phenomenon can be understood as an ideological effect "to gain social control by imposing a new rhythm of collective life" (Zerubavel, 1977, p. 870). Rifkin (1987, p. 5) states that artificial time frames human consciousness with temporal deprivation, leading men to accept politics as "a spatial science [...] about to be considered as a temporal art".

The concept of ideology that we use is equivalent to an illusion, false consciousness in the paradox of being enslavement to itself (Marx & Engels, 2005). Pêcheux (1988) states that something fundamental of ideology refers to the *evidence placed beforehand* and that has the central and organizing role of *constituting meaning* and *constituting the subject*. The ideological effect is to deprive individuals from the capacity to reflect on their conditions of existence, possibilities of choice and resistance. The individual interpellated by ideology (according to Althusser, 1999, interpelation is the process which calls out people and offer them a particular identity) stresses the notions of feelings, sensitivities and subjective goods, for fear of not knowing how to work on the complexity of objects that originate in what is virtual and intangible (Haroche, 2003).

3.0 CONCLUSION

Ideology gives rise to a paradox that inhabits the subject who believes in the fact that "the real value of work lies in the strength of self-denial" (Abe, [1991]2017). There is something tragic in the structure of the subject that resembles a beat between real reality and virtual reality (Monte-Serrat & Tfouni, 2017). The interpellation mechanism makes the subject believe, at once, that he is autonomous and free and, at the same time, that his freedom is entangled in economic or social determinations. Pêcheux (1988, p. 255) brings a warning about the possibility of resistance and revolt within the process of subjection, since ideology exists "under the modality of division; it only takes place in contradiction". The ideological dislocation and the unpredictable interrupt the perpetuation of the repetitions of the ideological ritual (Monte-Serrat & Tfouni, 2017). There is something external to the logical process (the latter being closely linked to the process of ideological interpellation) that suspends predictable motions and causes the lack of the synchronicity which is implied by dominant ideology. This new process installs the *verification* at the origin of the constitution of meaning, *substituting the certainty* of the anticipated meaning regulated by the ideological process of subject interpellation.

Subjectivity is a place that plays a dual role: that of disclosing subjection and that of disclosing its subversion, thus, breaking the vicious circle of idealism and interrupting the tragic fate of the subject that is captured by ideological interpellation. This can be observed in the acts of enunciation related to idealism that is beyond the subjects, which dictates the meaning of statements towards a certain direction, bringing a "fetishism by attributing the extraordinary virtue of 'correspondence'" (Monte-Serrat & Tfouni, 2013, p. 3) between what one says and what is determined by dominant ideology: the subject finds himself/herself in an illusion of autonomy in his/her own enunciation/interpretation.

There is a paradox in this functioning which reveals itself as a power of the pulsation between meaning imposed by ideology (virtual reality) and meaning originating in the subject (real reality). In other words ideology objectifies meaning and, on the other, such objectified meaning can vacillate with the inclusion of a *time for comprehending*, which interrupts the process of ideological interpellation. Time for comprehending is not supported on a meaning given previously (as it happens in logical reasoning). Time for comprehending is something that "breaks" the domain of paradox functioning; it is something of another order, something that is outside the framework of anticipated time in logical reasoning. The "time comprehending" causes a suspension in the "time causality" (anticipation) of the meaning and gives space to a "temporal modulation" which opens the logical movement to a subject's judgment.

It so happens that a subjective reflection that grows in the very logical movement exists. If the ideological process acts in *speech*, we can see a subjective reflection in *silence* which does not follow the logical structure of language; if there is a scheduled time for events, we can observe that time is "measured also by heartbeats, the rhythms of drowsiness and sleep, the recurrence of hunger, the menstrual cycles of women, the duration of loneliness" (Lightman, [1992] 2004, *apud* Levine, 2006, p. 81). Lightman states that:

> "Time is a stretch of nerve fibers: seemingly continuous from a distance but disjointed close up, with microscopic gaps between fibers. Nervous action flows through one segment of time, abruptly stops, pauses, leaps through a vacuum, and resumes in the neighboring segment." (Lightman, [1992]2004, apud Levine, 2006, p. 48).

The subjective reflection can also be in the "waiting" which links the present to the future. It is what St. Augustine called "the present of the future." (Levine, 2006, p. 122). Waiting is a special instance of using time ... it is "undistilled silent language speaking when words will not suffice" (Levine, 2006, p. 124). "The waiting period is not just a delay to be endured in order to reach the right moment. It is respected as the very creator of that moment" (Levine p.198). According to Levine, waiting is a "new point of view... lasting insights, those that continue to make a difference in how I live my life (Levine, 2006, p. 221) without an abundant helping of "shoulds" and "musts."

...“As Miles Davis said, 'Time isn't the main thing. It's the only thing.' How we construct and use our time, in the end, defines the texture and quality of our existence." (Pinker, 1994, p. 209)

It is essential to understand that the subject and time movement occur in the pulsation between "time causality" (anticipation meaning given by logical reasoning) and "time of comprehending", between virtual reality and real reality, and it is paramount to understand that the subject can:

"hold fast the time! Guard it, watch over it, every hour, every minute! Unregarded it slips away, like a lizard, smooth, slippery, faithless . . . Hold every moment sacred. Give each clarity and meaning, each the weight of thine awareness, each its true and due fulfillment." (Mann, 1959, *apud* Levine, 2006, p. 207)

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The Map and the Universe
The Work of Maurits Cornelis Escher from a Cultural-Historical Approach

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ABSTRACT
The purpose of this work is to investigate the use of mathematics in the work of Maurits Cornelis Escher (1898-1972). From a cultural-historical approach, a periodization is proposed; it consists of four phases, each of which reveals the different conceptions that the artist assumed in the application of mathematics for the elaboration of his engravings, woodcuts and drawings: in the form of a utility instrument; in as much principle ordaining / syntactic; as a germ of the artistic form; and as the main means of representation. This classification is a contribution, as it offers a look at his creative life through a sense approximation. It incorporates a section with an examination about the meaning of the images and artistic objects from the Transcurssive Logic (LT). Finally, we presented some emerging discussions and final reflections.

Tyger, Tyger, burning bright,
In the forests of the night;
What immortal hand or eye,
Could frame thy fearful symmetry?'
William Blake. Songs of Experience (1794)

1.0 MAPS AND TERRITORIES

Walter Benjamin (1938) maintained in his childhood memories that the best way to know a city was to get lost in it. Some people, he adds, even if they do not have an accurate map of the labyrinth, glimpsed clues that allow them to reconstruct the path of the urban forest.

In a similar way, from ancient times, the sages tried not to wander blindly. To locate themselves and understand their position (Egyptians, Chaldeans, Hindus, etc.), they analyzed the regular movement of the stars. Subsequently, in the cultural environment of classical rational thought, the early Greek philosophers deployed arguments about the fundamental principle of all elements. The Pythagoreans, for example, argued that the number was the key to the regular harmony of the universe, where each figure corresponded to a musical note (Gomperz, 2000, Martinez, 1973).

Subsequently, Alfred Korzybski (1994), conceived the idea that the map is not the territory, just as a word is not the object it represents. In his semantic analysis, he identified three additional features: 1) A map cannot represent the whole territory but only a parcel of it; 2) Each map also includes everything that helps the mapping of a territory, including the analysis of psychology and the philosophical and ideological substratum of the map maker (his assumptions and presumptions, his technical skills, his vision of the world, etc.).); 3) Maps have the feature of being self-reflective, since as an "ideal" one should include a map of the map, in a successive and infinite fractal repetition. In addition, he argued that languages, as systems of formulation, are maps and only maps of what they pretend to represent (Korzybski, 1994: xvii). This awareness led to the three premises of general semantics that can be extended to various languages (artistic, mathematical, etc.).

From the perspective of cultural history (Bonnell and Hunt, 1999; Hunt, 1989), Escher's work, in a metaphorical sense, is an attempt to aesthetically represent, through symbols, allegories and artifacts, the map of the universe. In this sense, his engravings, drawings and woodcuts are beautiful reflections, at times disturbing, of the geometric order that is imposed on the perception of a subject immersed in that complex reality - although not irrational - that he tries to represent and understand. The concept of culture includes the study of mentalities, ideologies, symbols and rituals, in relation to both the high culture and the popular. The system of symbolic and linguistic representation of a society is understood through culture. We must add that the theme of "representation" has long been recognized as the central problem of cultural history. One of its questions can be posed in the following way: what is the relation between a work of art (painting, novel, etc.) and the world it pretends to represent? (Bonnell and Hunt, 1999: preface; Hunt, 1989, 16-17).

2.0 ART AND MATHEMATICS: AN APPROACH TO ESCHER

Mathematics is a formal science, with an ambiguous relation to the world. It begins and develops in its early stages with exclusively practical purposes: counting, measuring, arithmetic operations. However, it is later discovered that they also facilitate the systematic study of natural phenomena (Berlinghoff and Gouvea, 2004) and provide models of representation of emerging patterns in nature (Novak, 2006).

While sciences would be impossible to imagine without the support of mathematics in its formalization, there is no general agreement on the epistemological condition of mathematics. It is so that many schools of thought have reached different conclusions, mainly on the correspondence between mathematical entities and objects of the universe. Are these mathematical entities real or ideal, empirical or the result of our mental operations, proper to intuitions and potential human cognition or simple fictions? For example, for Kant, it is our very perception that structures reality

in this way. In other words, only what is reflected as reality in our mind obeys the mathematical rules; but nothing can be known from the outside world, only some phenomenal aspects, always insufficient, partial and scarce (Eilenberger, 1986).

However, since Pythagoras, as an emblematic figure of geometric knowledge, mathematics has become one of the highest expressions of human imagination in the effort to understand the ultimate structure of reality (Cucker, 2013). It is clear from the reference made by Iamblichus (1818) that at its deepest level, reality is of mathematical nature. For Pythagoras the first essence was the nature of numbers and proportions which extend through all things, according to which everything is harmoniously disposed and properly ordered.

Other authors have insisted on the aesthetic dimension of mathematics, perhaps due to the inherent harmony emanating from the construction of axiomatic systems, theorems, and demonstrations. It has even been claimed that the precision of formal definitions and deductions carry some beauty. In the words of Gian-Carlo Rota (1997), the conquest of beauty distinguishes mathematics from the rest of the sciences.

Robert Kaplan and Ellen Kaplan (2003) are a key reference on intellectual and aesthetic pleasure in mathematics, since they published on the discovery of zero and the finding of irrational (algebraic / transcendent) numbers. Besides, H.S. Coxeter (1999) should be remembered for the diffusion of his essays on the perfection of geometry; to Heinz-Otto Peitgen and Peter Ritcher (1986) for his analysis of the quasi-perfection of fractals in complex dynamical systems and to Ulianov Montano (2014), who developed an aesthetic theory of mathematics. We must also mention the influence of scientists Henri Poincaré and Geoffrey Hardy on the artistic world, especially the first, since Escher used the 'Poincaré disk model' of hyperbolic geometry to establish the patterns of his series 'Circle Limit' (Dunham, 2007; Coxeter, 1979).

The arts have frequented and used, since ancient times, tools related to mathematics (Cucker, 2013, Capecchi et al., 2010). As Lynn Gamwell (2016) points out, mathematicians and artists have long sought an understanding of the physical world presented to them and abstract objects they know only with thought. A broader work would require a reference to the philosophical ideas that drive the discipline (Platonic idealism, intuitionism, constructivism, structuralism, etc.) and of a cultural and intellectual history, in order to recover the semantic itinerary of mathematical concepts and socio-historical contexts in which they have been expressed by artists (measure, proportions, perspective, infinity, fractal dimensions, symmetry, geometric configurations).

The relationship between mathematics and the arts can be seen from the 'inspiration of two-way'. For instance, the link between geometrician H.S. Coxeter and artist Escher shows a reciprocal influence and fertile combinations of complementary perspectives (Coxeter, 1980; 1979). Undoubtedly, mathematics have encouraged the development of the arts in various ways. The visual arts, on the other hand, have collaborated in the generation of mathematical formulations through the aesthetic representation of theoretical and instrumental paths, and even, they have advanced with their intuitions to the proposal of new scientific hypotheses. For example, relations between relativistic physics, deep psychology, and art (cubism, surrealism, etc.) are notorious.

An example of the synergy between science and art is revealed by Escher, who was one of the plastic creators, designer and illustrator, who has better graphically reflected modern mathematical and topological thinking. The mathematical interest of Escher, leads the artist to discover in the mathematics the ultimate structure of reality.

The Dutch artist intuitively agreed to some mathematical ideas that aesthetically seduced him and allowed him to understand the logic of patterns, regularities, symmetries, and repetition of motifs, as he observed them in the intricate Euclidean plane of mosaics and tessellations of Granada (Schattschneider and Emmet, 2003; Critchlow, 1999). The impact of Islamic culture on Escher cannot be overemphasized. Although he had already traveled the peninsula during the 1920s, it was during his trip to Granada in 1936, stopping several days to contemplate the wonders of Andalusí art, that Escher was excited by majolica of the Alhambra and the set of the Nazari palaces, all of which generated a permanent effect on his work, particularly on his tessellations. (Abas, 2010). This

aesthetic discovery will allow you to move from the elaboration of natural panoramas and mountainous villages to mental landscape.

3.0 PHASES IN THE WORK OF ESCHER

There are a lot of studies on Escher, who stop with fascination in the analysis of their skill in drawing or of their skills in engraving. Schattschneider (2010) asks: "How (Escher) did it?", and with this question tries to reproduce the attitude that arises with all plainness and disbelief before the astonishment that produces his work.

However, this work has already been developed by many authors especially by geometers who have sought to elucidate the scientific foundations of their work (Abas, 2003, Coxeter 1979, Emmer 2006, Hart, 2017 and Schattschneider 1990; 2003; Schattschneider and Emmer, 2003). For this reason, the contribution of the present article is to inquire on the orientation and reasons of such a trajectory. The different perceptions on the artistic production of Escher raise the problem of the "reception" of the works of art. We argue that excessive emphasis has been placed on its use of geometric techniques and on mathematics as an instrument.

According to Bruno Ernst (1976), Escher employs figures of mathematical inspiration in three primordial areas: a) The structure of space (landscapes, world comprehension, mathematical bodies and abstract forms); b) The structure of the surface (metamorphosis, interlaced figures of birds and fish, cycles and approaches to infinity); c) The projection of three-dimensional space in the plane (traditional pictorial representation, perspective and impossible figures).

Another classification of his work, indicates that the evolution in the tracing of Escher's creative production comprises the following stages:

I - *Realistic Phase or Mathematics as an Instrument (1922-1937)*

It is characterized by the representation of landscapes, still lifes and self-portraits. It starts with panoramas of small towns in Italy and Mediterranean coasts, and then revives them at various times. The most famous works are: "*Castrovalva*" (1930), lithograph representing a small city of Abruzzo; "*Still Life with Mirror*" (1934); "*Hand with reflecting sphere*" (1935), "*Three Spheres II*" (1946), and "*Three worlds*" (1955).

In these works, M. C. Escher uses mathematics as an instrument because the mathematical mechanisms allow him to reproduce, alter and falsify perspectives, depths and proportions. In this, the uses of geometry applied since Giotto (1266-1337) are carried to an end. Here, the instrument refers to the set of techniques that allow you to do the works you imagine. He becomes a good craftsman. He has learned from Piero della Francesca, Giotto, and the architectural master Alberti, etc.

Escher enlists the help of mathematics and strength until he finds the forms he seeks. But the conception of the work appears as prior to the application of the mathematical device. Mathematics is definitely outside the work of art, like the other utensils used in its design and elaboration.

II - *Phase of metamorphosis or mathematics as pragmatic (1937-1945)*

The essence of representations is the transformation of the two-dimensional into three-dimensional, of figures that change in other figures, of optical and geometrical illusions. The more representative works of this period are: "*Metamorphosis I*" (1937), "*Day and Night*" (1938), "*Doric columns*" (1945), "*Magic mirror*" (1946), "*Drawing Hands*" (1948).

Escher begins to use mathematics to dictate the syntax of works and generates the contents with formulas: appear repetitions, iterations, conversions, mutations. The artist has become a mathematical researcher (Schattschneider, 2010). It seems to interpret, in an embryonic way, Galileo's statement that nature is written in mathematical language.

This conception leads him as an artist to precision, being carried away by the dictates of mathematics. This means, in addition, that the initial concept is executed according to an imposed logic, in which the author relies blindly. In the construction of the artistic object, Escher accepts the

mathematical mandate, so that the forms, dyes and relations between the represented entities respond to an external and rigorous pragmatics.

III - *Phase of dichotomies or mathematics as metaphysics* (1946-1956)
Escher explores unconventional points of view and experiments with new methods and techniques to represent perspectives, depths, vanishing points and convergence, mainly in prints in fractal dimensions and with perspectives. The parallel existence of physical and abstract objects evidences the dichotomy that the artist discovers between manifest reality and mental constructs.

In Escher's paintings and drawings many abstract entities, purely mathematical and dissociated from the representations of reality emerge. Escher is again one, but now the conflict is between modes of representation. It does not reach a synthesis, and it is forced to look for new (non-conventional) points of view. Without systematic philosophy, though he thinks through visual images, the artist discovers that there are entities that can be and are fully described by mathematics.

The works representative of this phase are "*Other World*" (1946), "*Smaller and smaller*" (1946), "*Gallery*" (1946), "*Crystal*" (1947), "*Stars*" (1950),"*Convex and Concave*" (1955), "*Print Gallery*" (1956), "*Ascending and Descending*" (1960), "*Waterfall*" (1961); and a series of Moebius tapes, etc.

IV - *Phase of approximations to infinity or mathematics as universe-world* (1956-1970)
These works use a concept of hyperbolic geometry and fractal principles. It can be seen that the more Escher immerses in technical problems, each work tends to reveal the more from the artifices of its construction. Thus, the work flows from formal norms and rules, from the mathematical recipe that sustains it, and reality (what the artist once considered to be real) vanishes.

Escher asks himself: "... this work belongs to the realm of mathematics, or to the realm of art?" The answer is in his works. He is no longer interested in using mathematics to do his work, and he does not want to express himself in mathematics; the universe (and not just its world, the restricted world of its art) is mathematical, mathematics is the ultimate reality.

Significant works of the period are "*Three Spheres I*" (1945), the series of *Circle Limit*, in particular "*Circle Limit III*" (1959), "*Path of life III*" (1966), "*Metamorphosis III*" (1969).

The creativity in the work of Escher according to the Transcurssive Logic
According to Transcurssive Logic, human creativity emerges from the common substrate that constitutes the fundamental aspects that underpin subjective reality. This 'universal language' indicates: what are the aspects of behavior that once integrated by the cognitive, appear on the surface as a determined behavior (Salatino, 2017, p. 278).

In turn, creativity can be equated with a true language, where the 'universal language' of frank biological rootedness would behave as its 'syntactic aspect'. A natural language (Salatino, 2012) that characterizes the affections that strengthen both the volitional and the cognitive in our psyche, would act as a 'semantic aspect'. Finally, a conventional language enabled for communication in the sociocultural environment, would support its 'pragmatic aspect'.

The 'backbone' of generic language representing creativity lies in the close relationship that exists between the deep elements of its three components (Salatino, 2017, pp. 279-280). That is, experiencing or the visceral organization of knowledge through the 'universal language.' The intuition or affective integration of the three basic elements through the 'natural language', and 'creating' or social projection of feelings and motivations are combined with the help of conventional language. Figure 1 records this subjective approach and its application to the stages of Escher's artistic production

Fig. 1- PAU of creativity in Escher.
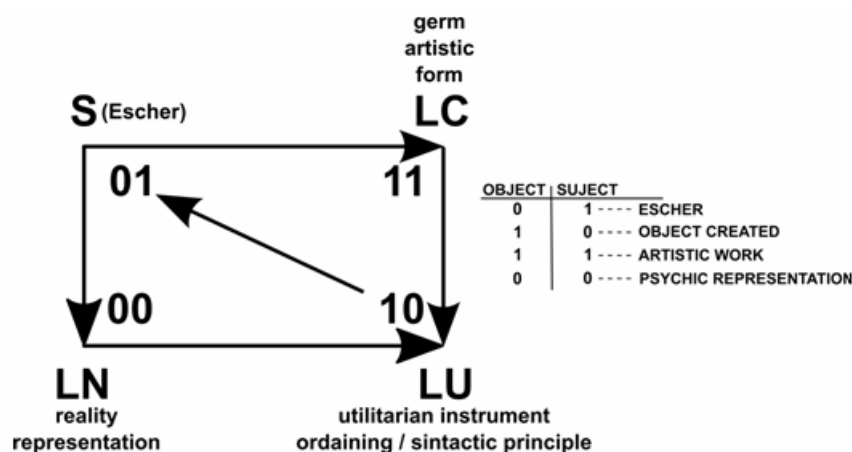
References:
S: subject – LC: conventional language – LN: natural language – LU: universal language

4.0 DISCUSSIONS ON THE ESCHER'S LAST PHASE

In the last stage of Escher's work, Mathematics no longer only facilitates the representation of reality but became the substantial structure of the universe as a reflection of an "implicate order" (in the semantics of David Bôhm, 1980).

Escher's works anticipate theories such as Max Tegmark's 'Mathematical Universe Hypothesis' (2014), which plainly states: "*Our external physical reality is a mathematical structure*" and present some unknowing resonance with the perspective on the 'universe geometric 'of Penrose (see Huggett, 1998).

Whatever the descendants or the coincidences of their legacy, Escher's vision is a return to neo-Pythagorean conceptions (perhaps with Neoplatonic components). Here infinity is a plausible idea, although it is never reached in phenomenal reality. With these concepts closes the cycle initiated by the school of Crotona 25 centuries ago, where it is affirmed that there is nothing that is not mathematics. Or perhaps, better expressed: everything that exists can be thought with mathematical methods. Thus, it can be said that the ultimate purpose of his works was to expand the 'doors of perception' (Aldous Huxley), to model aesthetic expressions that represent the mathematical mapping of the universe.

But, Escher goes even further. The artist has seen the higher order of the universe, he has glimpsed the key of that knowledge, the figure of the structure. The pictorial works of this phase are an attempt to capture the "truth" of this vision. In part, it is the symbolic dichotomy presented by Danto (1973), between artworks and real things. Escher expresses this contradiction through aesthetic language, despite understanding (or precisely because of) that the senses perceive always partial and laboriously. As Blake wrote: "*In the infinite void, but tied to the earth by its narrow perceptions.*" (William Blake. *The Book of Urizen*: Chapter IX, v. Four). Escher intuited - in the lexicon of Alfred Korzybski - that the map, that is, the language (artistic or mathematical) is not the territory, it's just a representation of it.

For these reasons, the work of art, although it reaches the canons of beauty, is ultimately a "failure." At this point, a deeper philosophy is accessed, as the author becomes aware of the limits imposed by external physical reality to language and cognitive ability (Penrose, 1999).

5.0 CONCLUSION

I. An approach to Escher's work from cultural history facilitates the reconstruction of the process by which mathematical ideas intertwine with the visual arts. This approach also reflects the possibilities of a "reasoned" history by identifying the intersections between geometric objects, mathematical concepts, works and philosophical genealogies.

II.   Escher's artistic production combines a set consisting of impossible constructions, geometrical paradoxes, space structure, imaginary worlds, metamorphoses, symmetries and tessellations, etc. These areas are reflected in a series of disturbing beauty, which allow the author not only to play with optical illusions but to challenge the usual modes of representation.

III.   Escher 'transfigured the commonplace' (Danto, 2003), by illustrating with (from) his artistic images that the structure of reality is deeper, complex and diverse than that which is imprinted by the 'veracity' of sensory processes and the "normal" discernment of the outside world.

IV.   Escher's relationship with mathematics changed in the different phases of his work, from a period where they play an instrumental role to another where they are the key to make the essential order of the cosmos intelligible. Escher intuited the mathematical structure of the universe and tried to represent this idea through his artistic production. In its last stage, mathematics (the map) constitutes the ultimate structure of reality (the universe).

V.   From the perspective of the TL, Escher's work interpellates: what is actually perceived? Moreover, how does the subject perceive and represent the reality (geometrical) in which he is immersed (and at the same time trying to understand)? From this point of view, the creativity that in Escher is an eminent manifestation, gives answer to these questions from the intuition and the experience of life.

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Implantation Failure

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ABSTRACT
The purpose of this paper is to show the usefulness of an alternative scientific argument based on Transcurssive Logic in the natural science, such as medicine. The auxiliary methodology was applied to determine the role of a polyvalent endometrial treatment in patients suffering from 'repeated implantation failure' in an ovodonation program. Secondly, this paper analyzes changes in the leukocyte endometrial population. We proposed a way of systematizing the process of embryo implantation and of scientifically addressing the repeated failure of implantation through adduction. This paper considered the dynamics of the natural and altered biological process and are evaluated the empirical results, beyond statistical findings. (Tersoglio & Salatino *et al.*, 2015).

Keyword: In vitro fertilization, Repeated implantation failure, Research methodology, Transcurssive Logic.

1. INTRODUCTION
This paper addresses an important aspect of reproductive health, such as infertility affecting 15% of couples and where 40% of are attributed exclusive female factor. We analyze infertility caused by repeated implantation failure that cannot avoid a viable natural pregnancy and the failure of assisted reproduction methods.

We give some details on normal gestation, especially related to immunity. The immune system is a set of innate biological structures and processes that help an organism to maintain internal balance, adapting to external aggressions and combating internal aggressions.

The innate response occurs when a foreign agent or an alert signal is identified by 'pattern recognition receptors' (Medzhitov, 2007). The defenses of the innate system are not specific, and although it is the dominant system of protection in most organisms, it does not confer lasting immunity.

Immunological recognition and signaling between cells of the immune system is in charge of a molecular complex called the 'human leukocyte antigen' (HLA). The ways in which it is transmitted from parents to children constitute a system called 'histocompatibility complex', used to distinguish the own from what is not.

The embryo presents a 50% difference in its ability to modify the HLA-related immunological behavior of the pregnant mother. Since the mother only recognizes half of the embryonic tissues, it would be possible for the presence of a specific immunological reaction by rejection, with the death and expulsion of the embryo. However, this usually does not occur, because the mother develops some immune tolerance towards the product of gestation. This tolerance is a consequence of the production of certain immunosuppressive factors (substances that prevent the rejection of foreign tissues) that act in the uterus.

Following the proposal made by the Transcurssive Logic, we propose a possible scenario where nesting of the embryo in the uterus can occur. (Figure 1).

Fig. 1: PAU of implantation
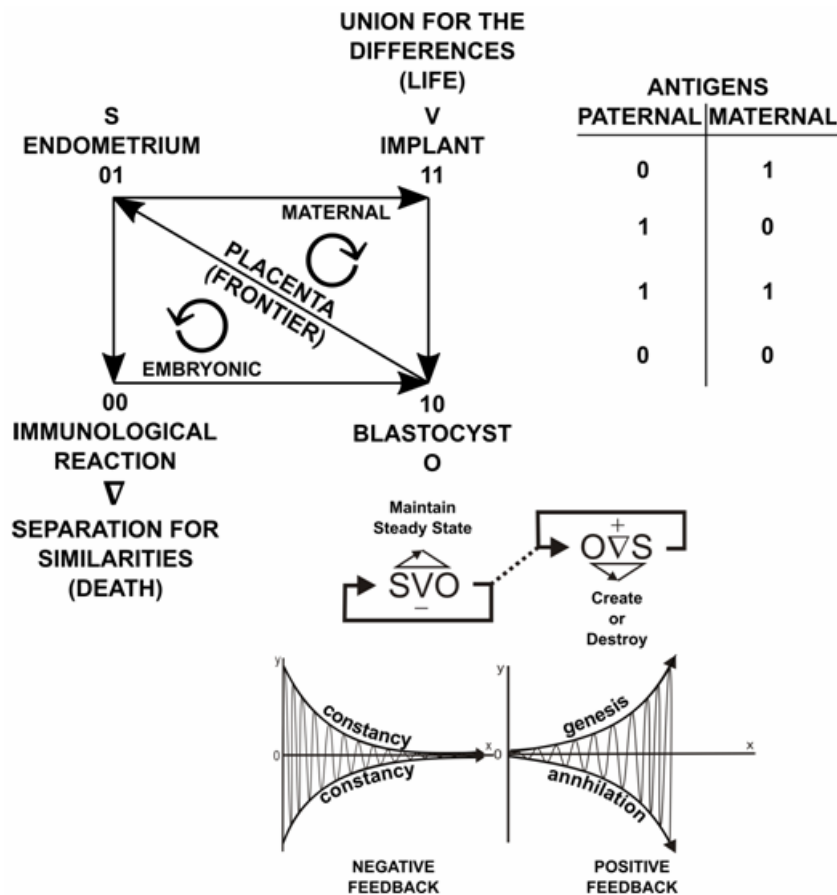
If we analyze the codes of the PAU (Universal Autonomous Pattern) (Salatino, 2017) in Figure 1, we see that the presence of paternal and maternal antigens defines the situation in which fundamental elements involved in the implantation are found. Thus, the endometrium is

characterized only by maternal antigens (01). The blastocyst is represented by the paternal antigens (10). The implant is determined by the relational confluence of the two previous ones (11). On the other hand, the immunological reaction that can harm the embryo does not depend on the genetic contribution of either parent, but on the release or non-release of immunosuppressive substances in the uterus (00).

Embryo implantation is performed if tolerance to maternal-fetal differences is achieved. Repeated superficial cycles (dextrorotatory) given by the relationships between the endometrium and the blastocyst allow the development of nesting and also the placenta. Its fundamental mechanism is negative feedback (error correction), which, as shown in the previous diagram, tends to a steady state.

When these accumulated differences reach a certain threshold, the maternal immune system is put into operation, which tends to eliminate the 'foreign object' represented by the implanted embryo. For the blastocyst two alternatives emerge: a) adapts and increases its complexity according to the new requirements (tolerance of similarities: uterus and blastocyst are organic tissues) now protected by an immunosuppressant, or b) dies (is expelled) achieved a balance by not recognizing the mother (intolerance of similarities), not even their own antigens, which are considered to resemble the invading agent (paternal antigens). This, by not being tolerated, leads to the liberation of the blastocyst, or the death by detachment from the embryo.

The mechanism that activates the whole process is a positive feedback, which as we see in the scheme, allows either creation (genesis) or annihilation (destruction). If the blastocyst dilemma is solved favorably, that is, if the profound cycles (levorotatory) given between the blastocyst and the endometrium by an immunological reaction are solved by morphogenesis, everything begins again. The superficial cycles are resumed, but now with a more complex blastocyst that has to face new challenges, even to new immunological 'defiance'.

Among new organs developed is the placenta. It constitutes the functional limit that separates, but at the same time it unites the maternal or proper (that integrated during the superficial cycles), of the considered embryonic or foreign (incorporated in the profound cycles). This organ behaves like an active unit of double identity, since simultaneously it means distinction and belonging and therefore, at the same time, opening and closing.

A filter that lets pass (nutrients, oxygen, hormones, etc.) but at the same time brakes (harmful substances). In it, the union and separation concur. Functionally it is a 'bridge' between the mother (the superficial) and the embryo (the profound), that if gestation continues its course will become a fetus. It allows the existence of a contexture or protected area before the defensive immune aggressions of the mother.

2. LITERATURE REVIEW

1 – "*Semiotic of the real systems. Semiotic analysis of the emergency psycho-bio-sociocultural as method of observation of the natural language.*" (Salatino, 2009 - Doctoral Thesis).
In this work, it is considered to be the study of the natural language from observation. By which we can determine, without conditionings, his reality, his rooting to the living thing, to the subjective thing, what aspects of the reality of the man is capable of reflecting and how it does it. The intention is to contribute a method that allows the discovery of laws that according to the subjective thing, allow a study of the production / comprehension of the language. This analysis employed an original tool called Transcurssive Logic (logic of the sense); on the one hand, to tie the reality of the language to the whole reality and for other, to demonstrate by means of the abductive analogical method, the possible existence of a 'universal language'. We also, compare the phylogeny of the central nervous system with the proposal for the language, remains firmly established the biological and evolutionary character of the natural language. From the semiotic of the emerging psycho-bio-sociocultural, it was possible to consider the subjective aspects of the symbolic human language, a determinant at the time of understanding what is the language and in a derivative way, to demonstrate that the natural human language and inside him, the different languages, there are a product of a genetic evolution that show an evolutionary variability.

2 - *Repeated implantation failure in oocyte donation. What to do to improve the endometrial receptivity?* (Tersoglio, A. E.; Salatino, D. R. et al., 2015)
We determine the role of polyvalent endometrial treatment in patients undergoing IVF-ET who had recurrent implantation failure (RIF) in a program of oocyte donation (OD). The results were expressed in terms of live birth rate (LBR). Secondly, analyze changes of endometrial leukocyte population evaluated by flow cytometer (FC) and histopathology. This work, used for the first time in a natural science the Transcurssive Logic as a complementary research method, through a prospective study of a model-based control with analog abductive methodology.

3 - *Treatise of Transcurssive Logic. Evolutionary origin of the sense in the subjective reality.* (Salatino, 2017)
Transcurssive Logic (is defined as TL): a tool, it is the only one that allows us to deal with the evolution (passing) of the subjective aspects of any living being, including man, in which both the volitional and the cognitive aspects are covered . TL is a dynamic, non-inferential, quaternary and policontextural relational model that operates with ontological niches (continents) assembled according to a universal language structurally defined, by a Group (as a relational entity), and functionally by a Galois Connection (as composition of opposites and complementary). This model is based on the change or transformation that emerges when the compelled components of subjective reality, that is, subject and object, are interrelated. This change or transformation occurs in two simultaneous levels: a) superficial and apparent of discrete nature and what we will call 'content', and b) the profound and hidden of a continuous nature that we will know as 'continent'. As a research method: it links the theoretical knowledge and the empirical knowledge, with its discovery and validation, in this way it is adapted to the scientific knowledge that is intended to be achieved, thus, making possible the validation of what is discovered. At the superficial level, it behaves as an analogical-abductive method. Starting from the results, one searches for a conclusion or hypothesis, separating two levels of analysis: known or evident (superficial) facts and unknown facts (profound), from which they are assumed to behave similarly. At the deeper level it behaves as an analogical-adductive method by bringing the two previous levels closer together, making them simultaneous, contrasting them against a model taken from everyday reality. The strategy implemented has as its substrate, to dispense with the frame of reference, to be able to form an (algebraic) group with the relationships between the fundamental elements that characterize the system under study. In this way, the syntax of a 'Universal Language' is achieved and allows us to approach any branch of the science and of the humanities.

3. MATERIAL AND METHOD
We will deal with the repeated failure of this mechanism in ovodonation. In 2015, 75 patients with repeated implantation failure in ovodonation were studied. (Tersoglio, Salatino *et al*, 2015.) In this paper, the conditions that an endometrium had to meet were addressed in order to make the implant successful, the most important factor in these patients was endometrial receptivity. In order to achieve this objective, it was necessary to exclude the embryonic quality (assuming as optimal, according to international criteria) as the only predictor of implantation and pregnancy. Only two elements were considered relevant: 1) the need for an adequate endometrium that would allow implantation and 2) the therapeutic availability to correct those parameters that impair its quality.

The theoretical scenario where the research was framed has to do with the immunological aspects put into play at the time of implantation. The observation and analysis of the embryonic conditions for a successful implant only contributes, a small part to the explanation of the implantation fault. This assertion is based on a superficial and apparent observation, which quickly accredits the simple empirical rule 'cause - effect' and allows to formulate 'objective laws' that may have *a priori* some opportunity to be true.

The justification of the study was to try to find some principle expressed in terms of immunological mechanisms (hidden) that could take into account a fundamental factor in the implantatory equation: the endometrium.

We developed as a central hypothesis the possibility of increasing successful ovodonation results if the alterations detected in the endometrium were corrected through specific therapeutics. As a secondary hypothesis, the endometrium is proposed as the most important factor for a successful implant.

The main objective of the study was to analyze morphological and functional changes in a population presenting 'repeated implantation failure' (RIF) through a study of the endometrial lymphocyte population. This was done before and after specific treatment. The results were compared in those cases where a clinical pregnancy was obtained that culminated with a live birth. (Ibid, p. 47)

As secondary objective of this investigation was the possibility of establishing a set of techniques necessary to make a correct diagnosis of the situation and to be able to establish a suitable treatment to correct possible alterations.

If only the hypothetical-deductive method had been adhered to in this work, we could say that it was a case-control study, ambispective, and quasi-experimental. However, as the abductive method was used as adjuvant, we can say that it is a prospective control study based on a model.

The abductive method (created by Peirce (1878), enlarged by Samaja (1999) and completed by Salatino (2009) which Salatino called *adduction*) is the one indicated when an investigation starts from the results, as in the present case, and the interest of the study is centered on a particular element of the system being analyzed. Here, that element is the endometrium.

Using traditional methods there is no way to isolate an aspect to analyze its behavior, without altering the whole system and stop responding to the rules already established and accepted for its operation.

Since abduction, the immune response in the endometrium has been transformed into a 'hidden model'. From this model we need to find some unknown facts of its behavior, starting from known facts (the results).

The main purpose of the study was to study the behavior of the endometrium in cases of RIF in ovodonation, having ruled out any intra and extrauterine alterations that could be the cause of RIF or spontaneous abortions.

In order to assure the above, a strict selection of the patients was carried out, in order to ensure a homogeneous population. This selected population is compared against a control group. This group is not chosen by any inductive method, but according to a theoretical model of normal function corroborated by biopsy and bacteriological analysis done to the donors.

'Isolating' the endometrium means, that all pathologies involving failed pregnancies have been excluded. In addition, those cases in which, although the transferred material (embryos) was of the first quality, according to international standards, the RIF persisted.

We do not discarded the cases of endometritis (80%) , which after specific treatment and normalization of the altered parameters, were included and submitted to embryo transfer. The following schemes (Figure 2) tell us about the details of the auxiliary method employed in this research.

Fig. 2: Methodological PAU[S]
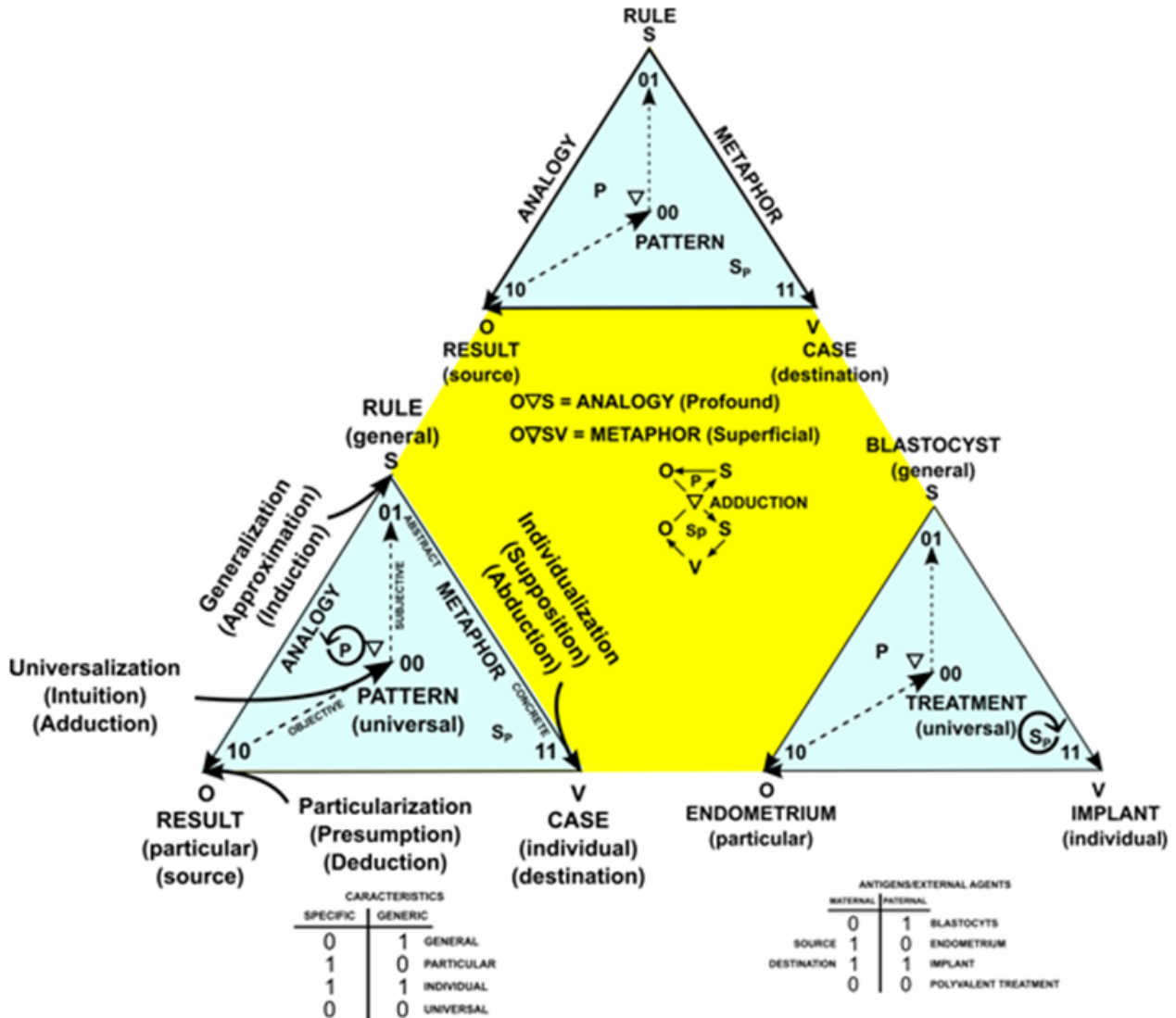
The triangle (yellow) of the scheme composed by triangles at their vertices is intended to determine the methodological integration used in the research analyzed. This generic PAU raises as a rule: "The immune reaction evidenced by an increase in NK (Natural Killers) lymphocytes leads to RIF". Pretreatment results show an increase in a leukocyte sub-population. The case tells us that these cells can be NKe (endometrial); therefore, failure in the 'implant', having ruled out other causes, depends on the immune reaction produced in the endometrium.

The upper (light blue) triangle speaks of the abductive approach (Salatino, 2009) whose codes emerge from the table of lower left assignments; that is, **rule** (01) belongs to the *general*, the **result** (10) refers to the *particular*, the **case** (11) responds to the *individual*, while the **pattern** (00) is the *universal* implicit in the particular. (Salatino, 2017)

The left (light blue) triangle shows the integration of all the modalities of scientific argumentation that have been taken into account in the research work, whose codes correspond to the same table of assignments above. In addition, it indicates the phenomena of generalization, individualization, particularization and universalization associated with the processes of approximation of induction, hypothesis of abduction, presumption of deduction and intuition of adduction (Salatino's abduction), respectively.

Pierce's abduction tells us about the separation between the known and the unknown. The adduction of Salatino refers to the approximation, until to the simultaneity of these two aspects in a fact, a phenomenon or any process.

Finally, the lower right (light blue) triangle presents the final model used in the research, which seeks a projection of praxis over theory through successive approximations. The table of assignments based on the antigenic contribution of the parents, individualizes with a code the elements that participate in this model: the blastocyst (01) the *general* that depends on the father, the endometrium (10) the *particular* that depends on the mother, the implant (11) the *individual* dependent on both parents and the *universal* (00) that does not depend on any of them, but on the intervening physician. (Ibid, p. 262)

4. FINDINGS & DISCUSSION

The scheme discussed above, in addition to providing methodological aspects, serves as a 'tool' to 'find the hypothesis' that we seek; that is, the treatment that corrects the alterations. After the treatment, it is used again to make empirical findings (the achievement of pregnancies and live births) that fully justify this form of scientific argument. When we talk about hypotheses, we are referring to what guided us to establish a treatment that corrected the endometrial alterations.

Obviously, the contribution of the auxiliary method employed in this work is only epistemological. Its sole purpose is to approach objective reality (implantatory failure) through a set of known variables in order to investigate the existence of some unknown or hidden variable that may be responsible for the results. (Salatino, 2017, p. 273)

As a consequence of this type of analysis of a system, a model can be obtained that takes into account certain levels of abstraction according to the purpose of the studied system. (Floridi, 2008) Strictly following the scheme proposed by Floridi, is elaborated an PAU (Salatino, 2017) according to the disposition of the fundamental elements suggested by TL. (Fig. 3).

Fig. 3: PAU level of abstraction
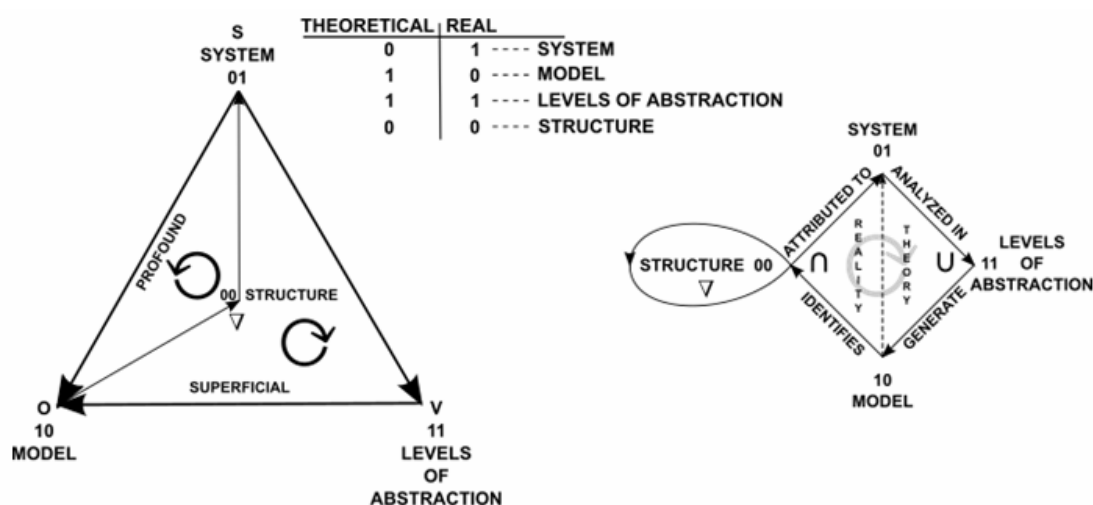
As shown in Figure 3, a system analyzed according to different levels of abstraction, generates a model (based on a certain theory). The implementation of the model allows identify a structure, which if the empirical evidence corroborates, can be assigned to the system under study. This model, in this work, is proposed in Figure 2.

The study of Tersoglio & Salatino et al. (2015) guided by the previous elaboration showed, among other things, that the multivalent treatment established in the live birth group significantly decreased the amount of lymphocytes and NKe in the controls. In this way, it was possible to demonstrate the reversibility of the histological changes, both ultrasound and immunological by means of an appropriate treatment in the RIF group, being able to modify the immunological state of the endometrium and thus obtain a live births rate similar to normal.

5. CONCLUSION

The findings in the above-mentioned work demonstrated the reversibility of endometrial histologic changes, both in the ultrasound and immunological studies in a group with RIF that underwent polyvalent treatment. Such treatment was able to modify the immunology and endometrial histology to obtain a significant live births rate.

The previous results were doubly corroborated, on the one hand, from the statistical methods usually used in these studies (op. cit.), and on the other hand, by the 'isolation' of the object of study that was made possible by invoking the methodological principles provided by the Transcurssive Logic (TL).

It is important to emphasize that this research was the first of its kind, and where the method suggested by the TL was applied. This indirectly confirms that this methodology, originally applied in linguistics, constitutes a legitimate scientific method for dealing with humanistic subjects or those fields of study that belong to the social sciences, as well as to assist the hypothetic-deductive method proper to the natural sciences.

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Minimum Sample Size Method Based on Survey Scales

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ABSTRACT

The objective of this paper is to introduce a new sample size calculation method based on the type of response scale used surveys. The current literature on sample size calculation focuses data attributes and distribution. There is no prior research using response scale as the basis for minimum sample size calculation. This paper fills that gap in the literature. We introduced a new minimum sample size calculation method called *n* (n-Star)* by using the Monte Carlo iteration as the basis to find asymptotic normality in the survey response scale. This new method allows us to achieve up to 95% accuracy in the sample-population inference. The data used in this study came from the numerical elements of the survey scales. Three Likert and one non-Likert scales were used to determine minimum sample size. Through Monte Carlo simulation and NK landscape optimization, we found that minimum sample size according to survey scales in all cases is $n^* = 31.61 \pm 2.33$ (*p < 0.05*). We combined four scales to test for validity and reliable of the new sample size. Validity was tested by NK landscape optimization method resulted in error of $\Phi(\hat{z}) = 0.001$ compared to the theoretical value for the center of the distribution curve at $\Phi(z) = 0.00$. Reliability was tested by using Weibull system analysis method. It was found that the system drift tendency is $\lambda = 0.00$ and system reliability $R = 1.00$.

Keywords: Sample size, Monte Carlo, NK landscape

1. INTRODUCTION

Sample size calculation is a fundamental requirement for research. The function of minimum sample size is to produce (i) fair representation of the population where sample statistics could be used for population inference, and (ii) efficient means for population studies. The first requirement helps minimize bias. The second requirements helps in resource conservation. Minimum sample size answers the questions of "how much data is enough?" (Boen and Zahn 1982, pp. 120–121). Inadequate sample may evidence inferential errors of both Type I and II (Freiman et al., 1986; and Thornley and Adams, 1998).

The objective of this paper is to provide an improved method for minimum sample size determination. Existing methods for sample size calculation remain inefficient due to higher and variable in size of the required sample. The variation may come from the pilot sample (Taylor and Muller, 1995; Muller and Benignus (1992). For example, the Yamane sample table ranges from 83–400 (Yamane, 1967). Kish (1965) recommends 30-200 samples. Sudman (1976) recommends 100 samples. These variations in sample size requirement came from data attributes (Wright, 1997). Data with different attributes requires different sample size.

This paper looks for a unified minimum sample size based on the type of survey scales. The new method proposed by this paper consists of two steps: (i) use the numerical elements of the survey scale to run Monte Carlo simulation and obtain N iterations, (ii) calculate minimum sample size through using the log of the Monte Carlo iteration adjusted for NK landscape optimization (Kaufman and Levin, 1987). This approach is simple and efficient in comparison to other methods available in the literature. In prior literature, minimum sample size had been calculated based on data attributes and distribution. In this paper, we calculated minimum sample size by using the survey scale. This approach is a new contribution to the literature.

2. LITERATURE REVIEW

According to the literature, minimum sample size for social science research should be 30 – 200 (Kish, 1965, p. 17). Three criteria are considered when determining sample size: the level of precision, the level of confidence or risk, and the degree of variability in the attributes being measured (Miaoulis and Michener, 1976). There are several approaches to calculating sample size.

One approach to minimum sample size determination is to categorize the type of data into continuous and non-continuous probability. For continuous distribution data, the minimum sample size may be determined by:

$$n = \frac{4\sigma^2}{\alpha^2} \tag{1}$$

where $4 = (1.96)^2$ for 95% confidence interval; $\sigma =$ estimate standard deviation obtained by $\sigma = [(\bar{X} - \mu)/Z]\sqrt{n}$ from which $\mu = (\bar{X} - T(S/\sqrt{n}))$; and $\alpha =$ error level, i.e. for 95% CI, the error level is $\alpha = 0.05$ (Cochran, 1963).

For discrete data, the minimum sample size determination may be obtained by:

$$n = \frac{4pq}{\alpha^2} \tag{2}$$

where $p =$ Laplace Rule of Succession or $p = (s+1)/(n+2)$, and $q =$ probability of failure or $q = 1 - p$ (Cochran, 1963).

A second approach to minimum sample size determination is based on the population size. The population may be finite or non-finite. For finite or known population size, the Yamane method may be used (Yamane, 1967, p. 886). The Yamane equation is given by:

$$n_y = \frac{N}{1 + N(\alpha^2)} \tag{3}$$

where N = population size, and α = error level. This approach may not be appropriate where the population size is unknown or unstable. A second method for distribution-based sample size determination is known as non-finite population approach. The Yamane method had been criticized for its unreasonable assumption of normality because some data may not be normally distributed, i.e. stock market data (Officer, 1972; Fama, 1965; and Teichmoeller, 1971).

The non-finite population approach for sample size determination is given by:

$$n = \frac{Z^2 \sigma^2}{E^2} \tag{4}$$

where Z = critical value at a specified confidence interval, i.e. 1.96 for 95% CI; σ = estimated standard deviation; and E = standard error defined by $E = \sigma / \sqrt{n}$ (Cochran, 1963, p.75). This method requires the taking of pilot sample. The size of n increases as the size of the pilot sample increases. For instance, where the pilot sample size is 10, the minimum sample size is 13; if this test sample size is 20, the required minimum sample size is 27. As the test sample increases to 30, the minimum sample size may be as high as 80. Due to the instability of the minimum sample size result at various pilot sample sizes, this approach is not reliable.

In our earlier writing, we introduced the n-Omega method where the minimum sample size for non-finite population is obtained by:

$$n_\omega = \sqrt{\frac{(n_1 / 0.01) - (n_1 / 0.01)}{2}} \tag{5}$$

where $n_1 = \left((\sigma^2 n) / S^2\right) \div df(\alpha)$ and n = pilot sample. This non-finite population method produces a minimum sample size of approximately 30 counts (Louangrath, 2014; pp. 141-152).

This paper introduces a new method for calculating minimum sample size based on the type of survey response scale. This approach differs from what had been discussed in the literature because we focus on the survey scale as the basis for calculating minimum sample size. This approach is of interests to researchers in social science because it is simpler and more practical. It is simpler because it relies on the type of scale used in the survey; thus, there is no need outside pilot sample. By using the survey scale as the basis for the calculation, objectivity is ensured. The new method is practical because it is easy to understand.

3. DATA

The data used in this paper comes directly from the content of each scale. No outside data is not necessary. There are four scales selected for the study. These scales are categorized into two types: Likert and non-Likert. Likert scales include (1,2,3,4,5), (1,2,3,4,5,6,7) and (1,2,3,4,5,6,7,8,9,10) (Likert, 1932). Non-Likert scale is (0,1,2,3).

Despite disagreement in the literature over the question of whether Likert scale is quantitative or qualitative (Jamieson, 2004; and Norman, 2010), we treat Likert and non-Likert as quantitative data. Likert scales do not contain zero. Thus, they could only be subjected to continuous distribution testing (Abramowitz and Stegun, 1972). Non-Likert scale, on the other hand, contains zero. Thus, discrete and continuous distribution may be used for testing non-Likert scale or scale containing zero value. The ability of the data set to allow the type of probability analysis is not a small issue for purposes of hypothesis testing. A data set that allows both discrete

and continuous distribution testing affords the researcher the flexibility and varied tools for hypothesis testing. The information obtained from such a data set is more extensive compared to the inflexible data set allowing only continuous distribution testing.

Table 1. Data characteristics of response scale commonly used in survey

Scale Type	Randomness	Skewness	Kurtosis
(0,1,2,3)	0.40	0.00	(6.12)
(1,2,3,4,5)	0.40	0.00	(3.47)
(1,2,3,4,5,6,7)	0.27	0.81	(3.81)
(1,2,3,4,5,6,7,8,9,10)	0.14	0.67	(2.96)

4. METHODOLOGY

Four response scales are used for our synthesis of minimum sample size calculation. The rationale for using these scales are that (i) they are common scales used in social science research, and (ii) the scale becomes the basis for statistical analysis in summarizing the data. The four types of scales used in this paper are Likert and non-Likert types. The Likert scale consists of (1,2,3,4,5), (1,2,3,4,5,6,7) and (1,2,3,4,5,6,7,8,9,10). The non-Likert scale is (0,1,2,3). The elements of each scale is subjected to Monte Carlo simulation to find the number of iterations in order to see normal distribution.

The Monte carlo simulation begins with a supposition that given a set of observed values: $X_i : (x_1, x_2, .., x_n)$ where n is the total observations. We are presented with a question: "if n is the initial observation set, what is the minimum sample size $E[n]$ in order for n to fairly represents the population $N?$" in order to answer this question, the following information is required: (i) maximum, minimum, and median, (ii) Monte Carlos' iteration counts, and (iii) pre-specified error level.

From the observation set $X_i : (x_1, x_2, .., x_n)$, it is necessary to determine the descriptive (maximum, minimum, $\overline{X}$ and S) and inferential statistics (μ and σ) of the set. We now have four pieces of information: maximum, minimum, median, arithmetic mean and estimated mean. These four items are designated as $W_j : (w_1, w_2, w_3 \text{ and } w_4)$. The set W_j is used to determine the number of iterations under the Monte Carlo method (Metropolis, 1987; pp. 125-130). The Monte Carlo number of iterations may be determined by:

$$N = \left(\frac{3\sigma_w}{E} \right)^2 \tag{6}$$

where $E = ((\max - \min) / 2) \div 50$. The minimum sample size is obtained simply by:

$$n^* = 0.23 \left(\left| \frac{\ln(N)}{Z_{nk}} \right| \right) \tag{7}$$

where N = Monte Carlo iterations, and Z_{nk} is the NK landscape simulation for optimization (Kaufman and Weinberger, 1989) obtained from:

$$Z_{nk} = \frac{F(X) - 0.50}{\sqrt{\frac{1}{12n}}} \tag{8}$$

The term $F(X)$ is the mean value of the cumulative distribution function (CDF) of $\ln(N)$ for each survey scale type.

5. FINDINGS & DISCUSSION

We examined four types of scales used in survey. Using the survey response choice as the basis for Monte Carlo simulation to obtain the number of iterations (N), the minimum sample size is about 31.61 ± 2.33 (Table 1). This number is consistent with the literature advocating minimum sample size to be 30 (Israel, 1992; Smith and Wells, 2006) where the properties of the central limit theorem are manifested (Agresti and Min, 2003)

Table 2. Minimum sample size under log Monte Carlo iteration method

Type of scale	N	$\ln(N)$	$F(Z)$	OPT	n
(0,1,2,3)	158,548	11.97	0.1251	(0.10)	29.08
(1,2,3,4,5)	281,864	12.55	0.2912	(0.10)	30.48
(1,2,3,4,5,6,7)	634,195	13.36	0.6410	(0.10)	32.45
(1,2,3,4,5,6,7,8,9,10)	1,426,938	14.17	0.8870	(0.10)	34.42
				Mean	31.61
				Standard deviation	2.33

One common method of determining minimum sample size based on the data distribution: $n = (Z^2\sigma^2)/SE^2$, produces greater variance for the final sample size. For the four scales, the minimum sample size ranges from 20.02 to 91.40 or 46.90 ± 31.99. This old method is both unreliable and inefficient (Table 2).

Table 3. Minimum sample size according to the type of survey

Type of scale	N iterations in Monte-Carlo Simulation	Minimum sample size	
		Log Monte-Carlo	$n = (Z^2\sigma^2)/SE^2$
(0,1,2,3)	158,548	29.08	20.02
(1,2,3,4,5)	281,864	30.48	27.78
(1,2,3,4,5,6,7)	634,195	32.45	48.40
(1,2,3,4,5,6,7,8,9,10)	1,426,938	34.42	91.40
		Mean	46.90
		Standard deviation	31.99

5.1 VALIDITY TEST

Validity is the test for precision. In order to pass validity test, the residual must be kept at minimal. In this study, the tolerance level for residual value was kept at 1% or requiring the proposed method to achieve 99% accuracy. The result of the calculation under the new minimum sample size calculation is the observed value. The expected value for the sample size is obtained through a log maximum likelihood method which is given in two steps: Step 1:

$$\ln L(X) = \sum \left[\left(\frac{X_i \ln F(Z)}{n-1} \right) + \left(\frac{(1-X_i)(1-F(Z))}{n^2-n-1} \right) \right] \tag{9}$$

With the estimate obtained in (9), the expected value for the minimum sample size is obtained through:

$$E[X] = \frac{1}{n-1} \sum \left[\left(\left(X_i - \ln L(X_i) \right) - \left| \frac{A}{n-1} \right| \right) \div n \right] \tag{10}$$

where $A = \ln L(X)$ in (7). The percentage probability for the precision under this method is: $Z = (31.61 - 27.98)/2.33 = 1.56$ with the corresponding $F(Z) = 0.941$ or 94.10%.

Alternatively, validity may be tested by using NK landscape simulation for optimization. The local optimum equation under NK Landscape simulation method:

$$OPT_{loc} = \frac{F(X) - 0.50}{\sqrt{\frac{1}{12n}}} \tag{11}$$

where $F(X)$ = average of percentage probability ($\Phi(x_i)$) among observed values, and n is the test sample size. The decision rule is that the lowest optimum point is the most efficient. The observed optimum is compared to the expected value at:

$$\mu + \sigma \sqrt{\frac{2\ln(K+1)}{K+1}} \tag{12}$$

where μ = expected mean of $F_i(x_{i,k})$, σ = expected standard deviation of $F_i(x_{i,k})$, $K = N - 1$, and N = sample size. The theoretical optimum is:

$$OPT^* = \frac{F(\hat{X}) - 0.50}{\sqrt{\frac{1}{12n}}} \tag{13}$$

where $\hat{X} = \mu + \sigma \sqrt{\frac{2\ln(K+1)}{K+1}}$ for which $1 << K \leq N$ (Weinberger, 1991). The result of our calculation shows that $OPT_{loc} = 0.001$ and the theoretical value beyond which precision is loss: $OPT^* = 0.40$. The target is 0.00 or the center of the distribution curve, the three scale combined as a unified method for sample size determination came near the target at 0.00 with an observed value of 0.001. Precision under this approach is 99.98%.

5.2 RELIABILITY TEST
Reliability test requires that the proposed method be reproducible. Reproducibility means that series of subsequent tests must show consistent results. Consistency is defined as minimal variance within the series. This reliability is achieved through:

$$R = 1 - CDF \tag{14}$$

where $CDF = 1 - \exp(-x/\eta)^b$ where x = point for evaluation; $\eta = exp(a)$ or re-scaled of the y-intercept; and b = slope of the linear equation $Y = a + bX$ obtained through a time function QQ-plot (Weibull, 1951) with observations values: (29.08, 30.48, 32.45, 34.42). The stability of the stable is defined by the potential shift of the probability reading. This shift potential is obtained by lambda:

$$\lambda = \frac{CDF}{1 - PDF} \tag{15}$$

Under this reliability test method, The most reliable scale is the non-Likert scale type (0,1,2,3). Among the various sample sizes obtained through the four different scales in this study (29.08, 30.48, 32.45, 34.42), lambda is 0.67 with system reliability of 0.37. Among the four scales, (0,1,2,3) is the most reliable. The corresponding minimum sample size is 29.08.

Table 4. System analysis for scale reliability

| Scale Types	CDF	PDF	$\lambda = \dfrac{CDF}{1 - PDF}$	$R = 1 - CDF$
(0,1,2,3)	0.00	0.12	0.00	1.00
(1,2,3,4,5)	0.34	0.11	0.39	0.66
(1,2,3,4,5,6,7)	0.47	0.11	0.53	0.53
(1,2,3,4,5,6,7,8,9,10)	0.58	0.11	0.66	0.42

5.3 EFFICIENCY TEST

In sample size determination, efficiency is defined as achieving minimum sample size with the least resource utilization, i.e. minimal calculation steps, and shorter time. We define efficiency as "smaller sample" size in achieving the objective. Our objective is to provide a means to obtain minimum sample size that allows fair representation of the population. Efficiency is calculated as: $E = 1 - (I / O)$ where I is input or the sample size under specific type of survey scale and O is out put or the population size N.

Table 5. Efficiency of sample size relative to population size

Population: N	E1: (0,1,2,3)	E2: (1,2,3,4,5)	E3: (1,2,3,4,5,6,7)	E4: (1,2,3,4,5,6,7,8,910)
500	0.94	0.94	0.94	0.93
1,000	0.97	1.00	0.97	0.97
1,500	0.98	1.00	0.98	0.98
2,000	0.99	1.00	0.98	0.98
2,500	0.99	1.00	0.99	0.99
3,000	0.99	1.00	0.99	0.99
3,500	0.99	1.00	0.99	0.99
4,000	0.99	1.00	0.99	0.99
4,500	0.99	1.00	0.99	0.99
5,000	0.99	1.00	0.99	0.99
6,000	1.00	1.00	0.99	0.99
7,000	1.00	1.00	1.00	1.00
8,000	1.00	1.00	1.00	1.00
9,000	1.00	1.00	1.00	1.00
10,000	1.00	1.00	1.00	1.00

The asymptotic tendency of the efficiency of the sample size as the population increases is shown in the figure below.

Fig. 1: Efficiency trend for each sample size determined by various scales
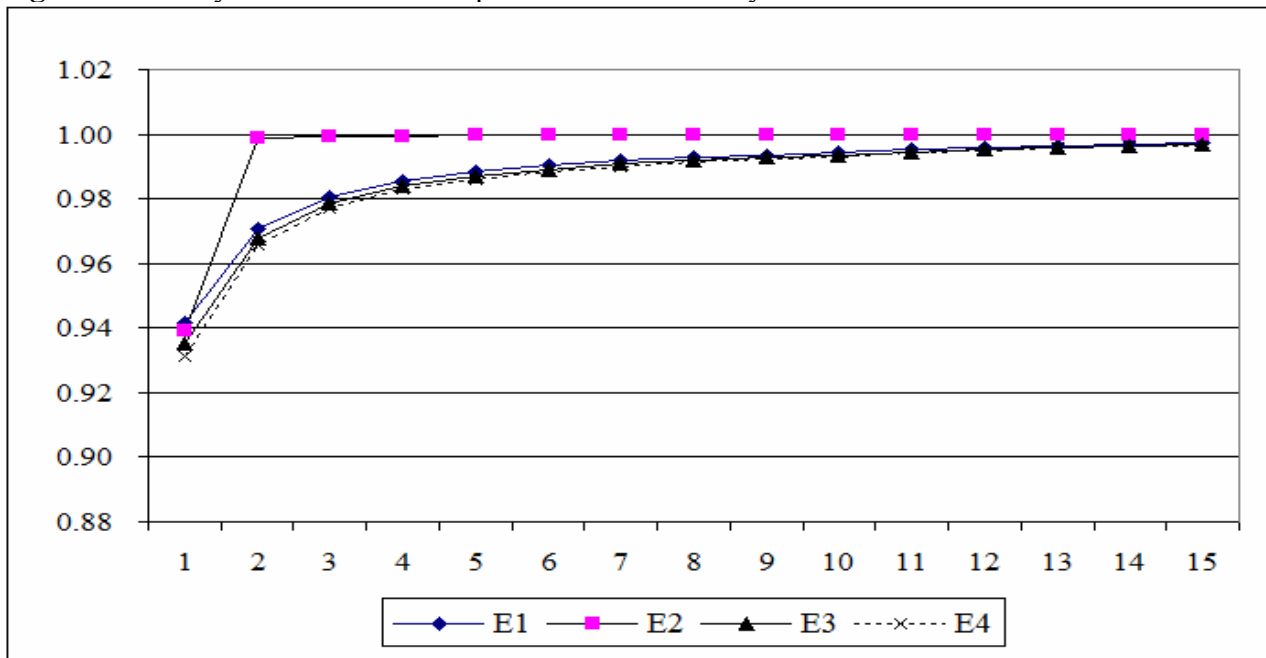
6. CONCLUSION

The new minimum sample size determination method proposed by this paper could obtain an efficient size and could overcome potential bias. Efficiency was achieved through Monte Carlo simulation method. Where other method based the sample size on the error level, this new method based the sample size on the iteration counts under Monte Carlo simulation. It is efficient because the new method has shorter procedure to calculate and, thus, it saves time and resources. The new method overcomes potential bias by maintaining asymptotic normality through the used of the Monte Carlo iteration, which represents the number of repeated measurement to achieve asymptotic normal of a given data set. This new discovery is a contribution to the field because it is an efficient and reliable means for sample size determination.

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Quasi-Tautologies: The Case of the Birch Moth

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ABSTRACT
The purpose of this paper is to analyze quasi-tautological statements which would provide few information about reality and, therefore, would be difficult to refute. The method employed was to analyze the birch moth problem: (i) comparing two epistemological positions and (ii) investigating a functional pattern of Transcurssive Logic. It was found that quasi-tautologies arise by unlinking a statement from the rest of its theory. In addition, it was found that the deductions of the systemic epistemological position and that of the Transcurssive Logic coincide. The result enables Transcurssive Logic as a powerful method of inquiring into reality.

Keyword: quasi-tautology, theory, evolution, enunciate, Transcurssive Logic

1.0 INTRODUCTION

There are authors who claim that, in certain empirical theories, there are expressions difficult to refute because of their low empirical content, and they are quasi-tautologies or quasi-empty laws or symbolic generalizations or guiding principles. Such expressions would be found in theories such as Darwin's natural selection, Newton's mechanics, electromagnetism, or quantum mechanics as the most named by contemporary epistemology.

The noted practice is shared by authors of different currents, such as Ernst Mach of Empiriocriticism in "Historical-Critical Development of Mechanics" (1949, [1883]); Karl Popper's "Critical Rationalism in Objective Knowledge" (1982 [1972]); Thomas Kuhn of Historicism in "The Structure of Scientific Revolutions", (2004 [1962]); and the semantic conception, in the

structuralist version of C. Ulises Moulines in "Metascientific explorations", (1982) and Jose Diez Calzada and C. U. Moulines in "Foundations of Philosophy of Science", (1999).

It should be remembered that a tautology literally says the same thing twice. In a broad sense they are, or logical forms such as 'raining or not raining', or definitions such as 'singles are those who are not married'. Tautological expressions do not say anything about reality and, therefore, are not refutable (Popper, 1980, p. 292). On the other hand, quasi-tautological statements would be difficult to refute because they have very little empirical content, because the information they give about reality is very scarce. This would be precisely the case of 'survival of the fittest' what this work is about, which is another way of naming Darwin's theory of natural selection.

In contrast, the authors of this work argue that the quasi-tautological character of the expressions mentioned is a consequence of isolating them from the rest of the theory to which they belong. The theoretical support of this position is found in: the properties of information; the linguistic and systemic character of the theories introduced by Hilbert; the epistemological holism of Duhem and Quine; and the analysis of the situation made with Transcurssive Logic. Then, to exemplify their point of view, we present the case of the moth (nocturnal butterfly) of the birch, signaled by Popper for 'survival of the fittest'. This case was chosen because of its notoriety in current epistemology.

The objective of this work is to analyze the positions of Popper, Kuhn, Diez Calzada and Moulines that support the existence of quasi-tautologies. Then, it is shown that the selected case of 'survival of the fittest' becomes refutable, if one accepts the views of Agazzi, Frege, Hilbert, Masuda, Duhem and Quine, and the Transcurssive Logic (Salatino, 2009). The contribution of this work is to show that the Transcurssive Logic has a power comparable to that of the logical-linguistic used in situation analysis.

2.0 LITERATURE REVIEW

In this paper, we characterize the positions that determine the existence of quasi-tautologies and those that do not support it. Among its defenders are notorious figures of diverse epistemological currents, like Mach, Popper, Kuhn, Moulines. While the authors of this work argue that quasi-tautologies arise from isolating statements of their theory and support their position in the ideas of Hilbert, Duhem, Quine, Masuda and Transcurssive Logic. The confrontation of both positions is made using a case of industrial melanism.

Quasi-tautologies generate questions such as: What is their role within an empirical theory? What kind of informational content do you provide? Some authors assign a role related to the practices of the user community of theory. Thus, for Mach, for example, they are definitions; Popper considers them elements of metaphysics that guide research, as is the case of 'survival of the fittest'. Kuhn and the structuralists of the semantic conception, Moulines and Diez Calzada, argue that these are schemas, which are only refutable when applied to a particular case where they acquire a specific form, as with Newton's second law or Ohm's law, for example.

There is no doubt that in theories that are expressed mathematically, such as mechanics, thermodynamics, electromagnetism, to name the most known, mathematical tautologies and the empirical content of them are complementary. Moreover, when Popper (1991, p. 312) treats refutation as a criterion of demarcation, he argues that the division between metaphysics and science is not categorical, and in order to face the transition between them he resorted to quasi-tautological utterances, which would be difficult to refute because of their scarcity empirical content.

Natural selection explains evolution by 'survival of the fittest'. The expression was coined by Herbert Spencer and states that animals that do not adapt to their environment perish, and those that survive are those that are well adapted.

Popper, in "Objective Knowledge" (1982, p. 73, p. 223) argued that this formula was almost tautological, since 'well adapted' was equivalent to 'surviving', consequently applying the corresponding substitution results 'those who survive survive' which is a logical triviality and not an empirical theory. However, Popper (1995, pp. 256-258) in his lecture "Natural selection and its

scientific status", pronounced in 1977 at Darwin College of Cambridge, retracted and acknowledged that his previous valuation was incorrect and stated that it was a metaphysical criterion to guide the scientific research. The conference was compiled by David Miller on Popper Selections. (1995 [1985]).

Other authors, such as Kuhn (2004, 280-282), Moulines (1982, 88-98), Diez Calzada and Moulines (1997, 314) speak of symbolic generalizations, guiding principles, quasi-tautologies or quasi-empty laws, which function as definitions or as expressions of a pure mathematical system shared by members of a scientific community. They are abstract formalisms, empty expressions of meaning or empirical application that can be expressed in symbolic form, such as Newton's second law or Ohm's law. They may also be enunciated in natural language as "action equals reaction" or "the chemical combination occurs according to constant proportions of weight". These function in part as laws, and also as definitions of some of the symbols they display.

Faced with these positions, the authors of this work argue that the quasi-tautology condition comes from the decision to isolate, a statement from its theory to analyze, refute or validate it. When it is isolated it functions as a definition or a mathematical expression with little empirical content - and for that reason - it is difficult or impossible to refute it. However, if they remain within the theory they have a very significant empirical content, as it is to be demonstrated here.

The position indicated is based on the following reasons: 1) Gottlob Frege warned in §62 of The Foundations of Arithmetic, [1884] that "Only in the context of a proposition do words mean anything." David Hilbert, in his work Foundations of Geometry, 1899, extended Frege's criteria from the proposition to the theory. Consequently, each term used in theory is implicitly defined by the combination of the axioms of theory, thus, signaling the systemic and structural condition of the theories. While Evandro Agazzi (1978, 101-103) emphasizes that in a broad sense, scientific theories are languages to describe knowledge of certain areas of reality.

In keeping with the arguments put forward, Duhem (1906, 301) argued that "…in Physics an experience can never condemn an isolated hypothesis, but refutes the whole theoretical set." Whereas Williard Quine (1962, 76-78) in his 1951 article, Two dogmas of empiricism argues that given a set of propositions, the meaning of each proposition depends on the whole set. For that reason, the meaning of each cannot be considered separately.

Moreover, if it is accepted that an empirical theory is an information system oriented to know certain aspects of reality, then it retains the inherent properties of information, including that which holds that it is indivisible because it can only be used as a single whole , according to Joneji Masuda (1984, 96).

3.0 METHODOLOGY

Supported by the TL, the method used in this paper is based on: A) economic facts, because they belong to the social sciences, depending on the subjective reality and not on the objective reality that frames traditional natural science; B) the basic elements that intervene in the definition of the fact or phenomenon analyzed must form a relational pattern; C) the minimum pattern thus formed must form a group to demonstrate the presence of symmetry (Salatino, 2017); That is, it must give evidence of the conservation and invariance of the fundamental laws governing the fact or phenomenon being studied; And D) the ontological projection of the developed scheme emphasizes the presence of a common relational pattern (Salatino, 2009) that chains different apparently unrelated real facts.

Natural selection is a difficult theory to test, but there are some experimental tests, such as industrial melanism, that show how selection works with several species of Lepidoptera (Popper 1995, 257). Darwin discovered it in the birch moth (Biston betularia). During the day, this nocturnal butterfly rests on tree trunks and branches covered with gray lichens and the butterfly is camouflaged with the birch, since their wings are marbling and clear. There are also dark moths called 'carbonaria', to distinguish them from the typical form.

Michael Majerus, in his Springer Science paper (2008), "Industrial Melanism in the speckled moth, Biston betularia: An Excellent Teaching Example of Darwinian Evolution in Action" exposed research by Bernard Kettlewell in the mid-1950s; *see* (Figure 1).

Figure 1. Biston Betularia

The first specimen of carbonaria moth was discovered near Manchester in 1848 and was a rarity. However, in 1895, 95% of birch moths were carbonaria, and by 1898 the proportion was 99%. The same process affected about two hundred species of urban areas and was also observed in Westphalia and in the vicinity of Hamburg.

It should be noted that dark moths existed before the industrial revolution. But since they stood out from the clear background of the birch trees, the birds easily located them and ate them. This situation reduced the population of the melanic forms and consequently the mutated gene could not be imposed. Then, with industrial pollution, the bark of the birch trees grew darker. With that change, clear speckled moths contrasted with the dark background of the trees, allowing the birds to locate and eat them easily.

Kettlewell studied the phenomenon in Dorset and Birmingham during 1955 and 1956. He conjectured that the obscure specimens already existed prior to industrialization and corroborated it by inspecting ancient collections of speckled moths. Then, to test the Darwinian interpretation of the phenomenon, he performed experiments, such as feeding moth caterpillars with leaves contaminated with soot and other industrial wastes. It had no effect since it only reproduced clear moths. The experiment discarded in this way the food as a factor of change.

He then performed crosses that proved that the inheritance was Mendelian. Clear and carbonaria moths were then marked in a ratio of three to one and released in a forest contaminated with soot. After a few days, the ratio changed to a ratio of one clear to six darks. In a forest without contamination, both types of marked varieties were released in a ratio of one to one. In a lapse similar to that of the other group, they were captured in a ratio of two clear moths by one dark.

In addition, it was found from observations throughout Great Britain that birds ate the moths that stood out most prominently on the trunks: the carbonaria survived more in environments contaminated with soot and less in the natural ones, and with speckled moths the opposite occurred. In conclusion, birch moths adapt by mimicking the environment to survive, whites in natural forests and carbonaria in forests contaminated with soot (Majerus: 1999, 637-649). In addition, it should be clarified that since the 1960s several decontamination activities began in England. For this reason, the present birch forests once again had a clear tone. The carbonaria declined and the speckled moths predominated again.

In the opinion of the authors of this work, the expression 'survival of the fittest' is only a label that identifies a theory. The label informs that a process and the attribute of an object are related in that theory. For that reason, it is practically irrefutable because it only informs that two things are related. But, it is convenient to keep in mind that in this theory, 'survival' and 'fit' are

relational terms that are linked to reproductive cycles and to the ecological niche, which are tacit on the label. Consequently, if the expression 'survival of the fittest' is complemented by these implicit elements, an explanation of the facts is obtained, such as that obtained by Kettlewell.

In fact, when Duhem and Quine's thesis, the condition of the theory as a structured whole and the indivisibility of its information, are taken into account, the theoretical elements of the expression 'survival of the fittest' arise and a description that is refutable because it has empirical content. In short, and from an empirical point of view, the surface structure of the expression 'survival of the fittest' seems tautological. However, it ceases to be so when it is analyzed under the deep structure that sustains it, because the tacit elements are manifested, with which the evident expression loses its appearance of logical triviality or metaphysical criterion.

4.0 FINDINGS & DISCUSSION

It is appropriate to show that the result obtained from this problem can be achieved using an analysis from the point of view of the Transcurssive Logic. It is important to clarify that Salatino (2017, pp. 231-233) distinguishes two types of universal autonomous patterns: a) structural ones that are those where their two levels represent a single system that must interact with their environment, and b) the functional ones that allow the analysis of an assembly of two or more structures that alternate in their functions.

Functional PAUs use one type of operations called 'hybrid'. These special operations apply to more than one dimension, for example, for two variables would have two operations represented by the symbols '→' and '←'. The latter represent the hybridization between the exclusive disjunction (⊕, XOR) and the equivalence (⊙, XNOR), which means that both operations are applied partially, one for each column. It should be noted that the exclusive disjunction.

It is enough to apply one or another hybrid operation to the elements involved each in turn: 00, 01 and 11 in the right-hand turn (D_X), and 00, 10 and 11 in the left-hand turn (L_V).

Figure 2. Evolutionary PAU
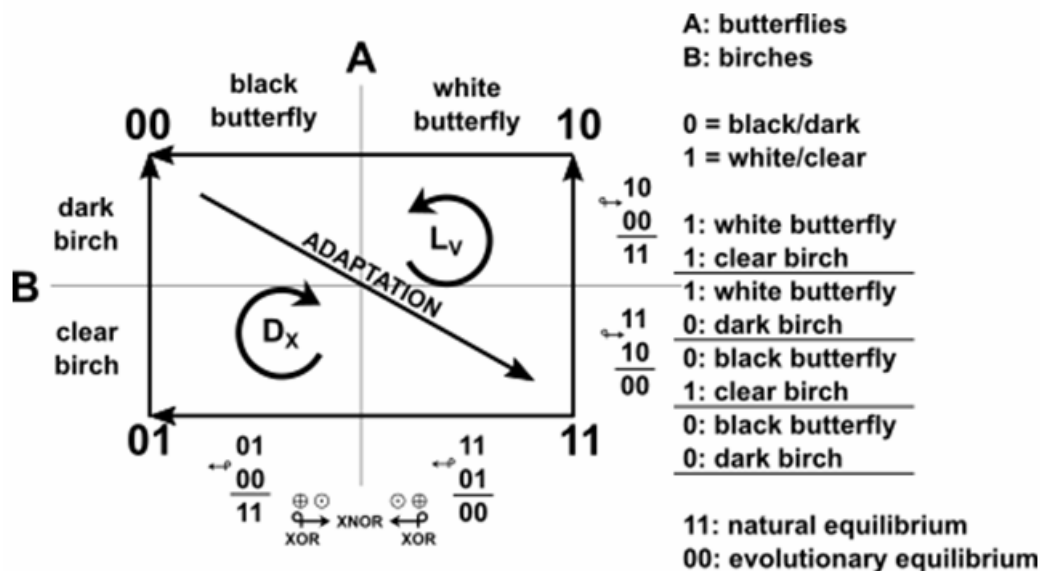
These hybrid operations make it possible to solve the Biston Betularia case. In this case, the subgroups constituting reality levels represent speckled moths in clear birches in natural balance (11) and carbonarias moths in dark birch trees in unstable equilibrium in a polluted environment (∇ (nabla) = 00). The intermediate situations of adaptation, prior to achieving stable natural equilibrium or the unstable equilibrium of the pollution, correspond to codes 01 and 10.

We start from a situation on a natural equilibrium situation of speckled moths that slept on clear birch logs (11), as was the case in Manchester in 1848. As pollution increased, an intermediate imbalance occurred. The typical Biston Betularia population, which is clear, diminished because the

night butterflies slept during the day leaning on the trunks of dark birches by pollution and were devoured by the birds, since their silhouette contrasted with the trunk where they were supported (10). The adaptation process led to an evolutionary equilibrium situation of the melanic form that slept on obscure trunks (00). In Manchester, in 1898, a mutation had been observed towards Biston betularia carbonaria, whose predominance was 99%.

The opposite situation to the previous one is the one that is verified today, since the results of the processes of decontamination that England realized, from 1960. At the beginning of the decontamination, the equilibrium situation was of dark moths that sleep mimetized on trunks of birches obscured by pollution (00). As the decontamination progressed, the birch trees lost their obscured bark and replaced them with the natural ones that are clear. Consequently, the population of the Biston betularia carbonaria went into a situation of imbalance of dark moths that sleep on the clear birch trunks (01), leaving no mimetic protection against the birds. Then, with the reproductive iterations and the activity of the birds, the carbonarias diminished and returned to dominate the speckled and clear moths, reaching again the natural balance that existed in Manchester in 1848. At the moment, in the forests that were contaminated, dominate the sleeping speckled moths mimicked the trunks of clear birches (11).

5.0 CONCLUSION

The way by which the evolutionary balance is reached does not matter. In that sense, at least theoretically, it is possible to return to the natural balance after of a new adaptation. The dynamics of this whole evolutionary picture can be reproduced by means of the respective operations represented in Figure 2, remembering that this scheme represents a functional PAU, where two entities, in this case, butterflies and birches, contrast.

It can be concluded that the results on the quasi-tautologies obtained through the logical-linguistic analysis are coincident with those that the functional PAU of the Transcurssive Logic throws out. Moreover, the latter allows us to objectify the stable, natural or contaminated states, and the intermediate situations of transformation between them. In addition, the result achieved with the Transcurssive Logic reinforces the idea that a theory is enriched with its forms of representation, because it allows us to introduce other communicative manifestations.

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INTERNATIONAL JOURNAL OF RESEARCH & METHODOLOGY IN SOCIAL SCIENCE

VOL. 3, NO. 3	JUL - SEP, 2017	QUARTERLY JOURNAL	ISSN 2415-0371

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INTERNATIONAL JOURNAL OF RESEARCH & METHODOLOGY IN SOCIAL SCIENCE
ISSN 2415 – 0371

OFFICE OF THE EDITOR-IN-CHIEF

ISSN 2415-0371