

1 A final mathematical conjecture?

"Will we someday understand time and space and all the other features that distinguish Physics — and existence itself — as the similarly self-generated organs of a self-synthesized information system...Someday we will complete the mathematization of physics and derive everything from nothing, all law from no law...Give special attention to one and another deductive axiomatic system which is able to refer to in-self, one and another *self-referential deductive system*. No laws ... Only a *principle* of organization which is (no organization) at all would seem to offer itself... Such a loop as this: Physics gives rise to Observer-participancy; Observer-participancy gives rise to Information; and Information gives rise to Physics.

How come existence? Can we ever expect to understand existence? How come "one world" out of many observer-participants? If and when we learn how to combine bits in fantastically large numbers to obtain what we call *existence*, we will know better what we mean both by *bit* and by *existence*... Surely someday, we can believe, we will grasp the central idea of it all as so simple, so beautiful, so compelling that we will all say to each other: Oh, how -could it have been otherwise! How could we all have been so blind so long! "[0]

1.1 A logical connection to *the whole*

Lewis Carroll [1] places Alice in front of a mirror, and while holding an orange in her hand she is interrogated:

Carroll: First I want you to tell me in which hand are you holding the orange.

Alice: In the right one

Carroll: Now look at the mirror and tell me in which hand is the girl in the mirror holding the orange.

Alice: In the left one

Carroll: How can you explain that?

The little girl wondered: ...

Alice: If I were on the other side of the mirror it would not be true that the orange would still be on my right hand, I would already be in that second world...

Carroll: Great, Alice! That is an excellent answer!

In the whole of Mathematics there is a common structure: the specular image. For instance, in Logic, a demonstration of *reductio ad absurdum* seen on a mirror in the shape of a bit:

$$P \rightarrow Q \quad || \quad \sim Q \rightarrow \sim P$$

In a similar manner, we can visualize the initial Axiom of complex numbers

$i^2 = -1 \rightarrow i = -1/i$ we can put this expression in the following way:

$$+i+1 \parallel -i-1$$

We see here two mathematical examples of hidden “paradox” and we have been careful enough as to express them in the way that *Alice answered to Carroll*.

These three cases are structures that are replicated on themselves, in a counter-reflective and self-referent manner, almost symmetrically. Carroll’s *specular* subversion – which astounded Da Vinci so much- is conceived as interaction. The mirror does not deform anything, but it rather reverses it in a counter-reflective way, and what it reverses is relative to which side of the mirror are you looking through. It can be interpreted as the two possible worlds that originate an existence. This metaphor of the mirror is perfect and contemplates the totality of possibilities that we will see next in terms of physical and biological theories.

What connection with the dynamic systems is there in this phenomenon that seems universal? Let us begin at Physics.

2 How to unify Physics? (with bit counter-factual entities)

One of the permanent hopes of humanity has been to find a wide vision that allows us to understand the world.

In Physics we have two fundamental theories: Quantum physics and Relativity. The most promising approaches with the aim of unifying them have been developed as the String theory and the Non-commutative geometry theory. From these approaches, the String Theory model becomes more evident with our proposal. Let us why see in very simplified terms.

Up until recently years there was not only one formulation for the string theory, but five: Type I, Type IIA, Type IIB, heterotic SO(32) and heterotic E8. These theories were completely independent from one another. However, at the beginning of the year 2000 [2], it was found that they were actually closely related through a net of dualities. The most important amongst them are T Duality, duality under interchange R -compactification radio- and its reciprocal:

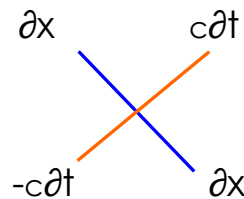
$$R \leftrightarrow 1/R$$

Together with these, there was also Duality S – the duality between weak and strong coupling- Thus, for example, Type IIA and Type IIB are T-duals, which means that they are actually both equivalent descriptions of the same theory. In the same way, heterotic SO(32) and heterotic E8 are also T-duals, and Type I and heterotic SO(32) are S-duals and they are different ways to explain essentially the same phenomenon. This is exactly consistent with what happens in the description and morphology that make Relativity and Quantum compatible.

2.1 Relativity (within macrophysics)

In the physics of space-time relativity there is a Lorentzian variety (of void curvature) that is used to describe the physical phenomena within the frame of Einstein's special relativity theory. Let us take this mathematic expression of the invariant, where x and t denote the generic coordinates of space and time.

The mathematic invariant of relativity formulated by Minkowski is $\partial s^2 = \partial x^2 - c^2 \partial t^2$, or according to a diagonal counter-reflection scheme:



For mathematics in this invariant to be algebraically consistent, they must have the negative sign that appears in the previous expression of the square module (invariant) of space-time or in the diagonal of the matrix. This negative sign contributes a unique and special possible metric that must be bear in mind when representing these two aspects. Algebra shown in this representation is about the infinite repetition of a pair of counter-reciprocal duals, a mutual causality that is repeated within space and time. The separation of space and time is a counter-factual fact.

The study of the concept of time, from a physical point of view, did not prove that it actually existed. Was it an illusion of the brain? The perception of time was believed to be only psychological; up until now, there was not any convincing scientific explanation about what time was, how it "worked" or in function of what. Overall, the opinion was that time was a sort of ambiguous physical phenomenon that –although conscious of changes or movements of reality- actually has a physical reality foreign to the material; it exists morphologically and reciprocally.

In this case the perception that space changes are contrary to the forward movement of time is consistent to, for instance, our perception of time and space when we travel.

A superior physical concept and a type of union build from these two counter-factual variables is Velocity; a physical shadow of the space that has been gone across, and the time that has been counter-reciprocally used and valued in the dominant physical dimension of space –the non-dominant variable always goes by as a reciprocal number.

$$V \equiv +x^{+1} \wedge -x^{-1} \equiv x * 1/t \rightarrow V = x / t$$

The macro-physical universe is integrally composed by a fundamental entity: a unity of two counter-factual parts: space and time.

At this point it is pertinent to quote Hermann Minkowski [3]: *"The vision of space and time that I want to set has arisen primarily from the foundations of experimental physics, and it is there where its strength lies. It is that radical. From here it derives that space on itself and time on itself are doomed to vanish in mutual shadows and only one kind of union of both will preserve an independent reality"..."the whole Universe seems to solve in lines similar to this world and I could anticipate by saying that in my opinion, laws of physics can find the most perfect expression such as reciprocal relations between these forms of world"*

In this relation, as we perceive, there is nothing about the principle of uncertainty. There is rather complementariness between canonically conjugated dual parameters, or the Complementariness outlined by Niels Bohr and which neither Einstein nor Dirac were capable to consider. [4]

2.2 Quantum Physics (within microphysics)

In the standard model of particles the phenomenon of quantum intertwining that lies behind the violation of Bells' theorem is just an element of Quantum Mechanics that had not been able to be represented by any classical image of physics and mathematical logic. It is a phenomenon that had been labelled as very rare, that was manifested like something in between two objects that are separated and united at the same time. Some other non-classical physical descriptions that are the manifestation of the same root principle are the collapse of the Wave Function, of which we will only say that in a world of uncertainty, the breaking of or bifurcations produce a change or a new history that begins without any tendency or previous memory, although with some continuity in the System. This is what French mathematician Thom modelled as the theory of catastrophe. [5].

At the beginning of the mathematical construction of quantum physics, Max Born realized that everything pointed at a very particular characteristic contained by the mathematics of matrixes: the product of matrixes was non-commutative. Let us remind that logically, the multiplication has logical meaning "y" (\wedge). Working from the property of observable pairs that did not commute, Heisenberg proved that the imprecision of the value "pair set of observables" predictable by the theory depended on this property. It is in this way the Principle of Uncertainty is originated. The properties of a particle that can be measured are co-related with that of another part due to quantum intertwining. Both of them are a whole, allowing that their state is only well defined when an additional measure is taken on the other complementary part as well. Let us go deeper on this matter.

At the beginning of quantum physics the physical language of anti-particles was added. Anti-matter? Are these particles only of opposite charge? Is the positron a positive electron? Is it just that? What is it? Where do these particles come from? The mathematical equation had predicted it in the beginning; it had two solutions, a negative one –which was the real electron, detectable in experiments- and another one, the *identical*, seemingly symmetrical but with positive charge. Mathematics established that Nature had to respect this counter-factual quasi-symmetry. Then, for a proton there had to be an anti-proton and this should work in the same way for all the physics of matter.

When a particle is found in a special manner with its anti-particle, they both fuse in one unit and give origin to a superior physical form that is Energy –visible matter and the matter once again called Dark matter (without being so). If it is conceptualized as complementary particles, as parts of an indivisible unit in which uncertainty relations are actually complex relations between two parts that are canonically conjugated (in mathematical terms) we can understand their physical reality.

Is then the wave - particle paradox licit? It is not such thing as a paradox; it is actually a counter-reflective dual manifestation of the same physical Unit. They are complementary manifestations of the visible-invisible unity.

Because of all the fore-mentioned, the so called anti-matter has a conceptual denomination that is mathematically incorrect: instead of talking about anti-particles or dark matter, it would be better to say 'complementary or canonically conjugated', using mathematical language. It is not something negatively adversative or contradictory, antithetical or dialectic, but rather particles that are complemented in their properties constituting an absolute, in such way that they are two parts (just as space and time) that are born and dead always in couples, never isolated. They constitute an absolute Unit.

The sense of these canonically conjugated relations and what it implies from the point of view of probabilistic prediction is what Bell's theorem makes confusing. In Probabilities, the repeated measurements of the characteristics of a System can be considered as samples of random variables. In quantum the predictions are formulated in terms of the probabilities in complex numbers (duals), that an electron is detected in a particular region of space or that it has an up spin or a down spin, all related to their dual anti-particle. The classic idea that an electron is an individual that *has* a defined position and spin prevents that Quantum is able to predict those values in a precise way. The two sides of a coin cannot be seen simultaneously. The electron is part of a dual indivisible unit to the effect of the measurements of its behaviour.

The complex dual statistic nature of the quantum predictions is related to the sense of un-completeness of a mathematizable system as well. There are hidden variables in the sense that the non-dominant dual is unpredictable, and it is inexorably joined to the predictable dominant that, through this union, is transformed in unpredictable by a complex value mathematic.

When talking about a Unity from which the (visible) electron is a part of the dual, then the interpretation of alternative realities (or the interpretation of several worlds) is not only viable but also counter-factually logically possible.

If the dual components can "communicate with one another" faster than light –they are a unity, there is no distance between them, the communication speed is non-existing- Bell's inequality can be easily overtaken. This theorem then reveals that the System consisting in a *pair of intertwined electrons* is rather actually two dual particles. The phenomenon means that when a pair of matter - anti-matter particles is produced, it is actually an individual that always maintains a counter-reflective physical manifestation; they cannot be considered completely independent from one another. A deterministic theory is not possible; by being non-commutative the average of products of variables in distant places depends on the order in which they appear in the pre-mediation integral or, in simpler words, whether the dual is spin \uparrow or \downarrow . This is the property of reality that originated augmented values of Bell's inequalities.

To summarize, the concept of individual existence in microphysics is (+boson, -fermion)

And it not strange that this phenomenon of micro-physics is related with the argument of reduction ad absurdum, as we mentioned in the mirror image in the initial chapter, related to operating as a bit counter-reflective *dynamics*.

Wheeler emphasises: "Bohr's modest words direct us to the supreme goal: Deduce the quantum from an understanding of existence"

3. Dynamics

Let us take the following bit general generative equation:

$$+x^{+1} \pm (-x^{-1}) = \alpha$$

we will denominate α as original generative constant. From this equation there are two 'extreme' bit cases related to real systems, whether it is in biological systems and/or physical systems that have been interesting to mathematics and other sciences.

3.1 Non-harmonic dynamics

In the extreme bit case 'negative' in which the sign is '-' and the generative $\alpha=0$ we have precisely the original equation of complex numbers:

$$\alpha=0 \rightarrow +x^{+1} - (-x^{-1}) = 0 \rightarrow +x^{+1} = (-x^{-1}) \rightarrow +x^{+1} = -1/x \rightarrow x \times x = -1 \rightarrow i^2 = -1$$

This equation can have more than one reading regarding the context where we apply it but that we can summarize by stating that this is an equation of evolutionary instability by counter-action: the engine of the dynamics of change in any system. This defines the non-stable but generative relation of distinction between neighbour kinship, from a neighbour itself with its own counter-reciprocal. There is a distinction or unbalance that is alternately generated, which by being counter-reflective produces an infinite self-referent process. The *whole*, present by its negation, the *nothing*, is in a configuration process of becoming something. Bringing to mind words from G. Spencer Brown [6]: 'the perpetual error of occidental philosophers has been to assume, without any justification, that nothingness cannot have consequences. On the contrary, not only can, but also must have them'.

This is the definition of complex numbers $i^2=-1$ o $i=\sqrt{-1}$ that is the mathematics that within other technological applications, for example electricity, allows to model the flow of alternate current that by this condition, produces movement. These two previous expressions refer to the value of x that finds its mirror image $-1/x$, in an alternate manner, from a local x morphology and to a global $-1/x$ and vice versa, from global to local, as the principle of causality and change. F. Varela stated in this context [7] that what

happened in a neuronal web was precisely this concept of causality, reciprocal effect of \leftrightarrow ó \updownarrow "local (x) - global (-1/x)" in the manner of an auto-poietic circuit. What is more, he considered that this dynamic view was one of the most important issues of the 20th century Science, because it resolves an enormous number of problems. According to his words, it is a kind of scientific revolution [7]. The passing of these small actors or locals to allow the emergence of a global web and, at the same time the effects of this global web at a local level, are mutually affected. There is causality from bottom to top \uparrow and from top to bottom \downarrow . This intrinsic counter-reflective dual harmony builds up and then is taken apart in the moment by moment: emerges – undoes – emerges- undoes- emerges-undoes... This goes against the usual reductionism of the global as the result of the unidirectional consequence of its local effects. Causality is an effect from bottom to top as well as from top to bottom. It is \leftrightarrow or \updownarrow . With this vision, the highest levels in the hierarchy of complexity can have autonomous causal potentials, build up to that level, regardless of being functionally dependent on the processes of inferior level and in a similar way to the opposite way. It is a recurrent process top-down-top-down or symbolically

$$+x^{+1} \parallel -x^{-1} \parallel +x^{+1} \parallel -x^{-1} \dots$$

Real dynamic causality takes place in this way. Even the action of the mind as a superior corporal level, as F.Varela also explained, can have its effects or even modify the local corporal components of inferior level.

3.2 Harmonic dynamics

Let us approach now the concept of beauty, by using our generative equation:

$$+x^{+1} \pm (-x^{-1}) = \alpha$$

For the second bit extreme 'positive' case in which the sign is + and the generatrix $\alpha=1$ is originated the quadratic equation of the golden ratio

$\alpha=1 \rightarrow +x^{+1} + (-x^{-1}) = 1 \rightarrow \dots \rightarrow x^2 - x - 1 = 0$ or of harmonic proportion or of natural stable harmonic change: in an asymmetric manner that generates the sensation of liking or beauty and is identified by some biologists as a harmonic relation of neighbour kinship (mystically denominated aurea or divine proportion by the ancient).

Here, the central point is the following. Let us set the equation and centre the idea:

$$+x^{+1} + (-x^{-1}) = 1$$

In a System or a world closed to the whole, mathematically represented by the unity (=1), it is configurated from two parts in a non-balanced equilibrium, but harmonically bi-participative between the dominant individual (x) and its dual counter-reciprocal self-referred image, expressed in a global manner (1/x). Beauty lies in that two parts contribute

under their shape to a dual image shared in a sense of total unity, as in a *chiaroscuro* from Da Vinci.

In this regard, how is beauty perceived by the brain? Let us understand it through music. The relation between music and mathematics was explained by D. Hofstadter [8] in the structures of its canons and the fugues of classical music. So that **canons** and **fugues** (**~canons**) form together a musical piece that is pleasant to hear, they must follow the laws of counterpoint or counter-reflective duality. Counterpoint means 'key opposed to key' and its rules seek the independence of different vocal lines to assemble harmonically when being interpreted in unison (in a dual manner). Those melodies that form canons or fugues and that follow the harmony proportional to the *golden ratio* will certainly produce music that is beautiful and emotional. Musical beauty is also expressed in the transverse and multicultural concept of bit in Revolution [9].

4. Principle -U2+: the bit present in every web, field, body, material or immaterial system that can be considered as complete in Nature. The existence of this principle is guaranteed by a self-reference or dual self-organization that is complementary or counter-reciprocal in the interaction of its two individual components. The dynamic of this system is achieved by the counter-reflective contribution of its two macro-complementary units, converging in an endless loop. The continuity of a condition of quasi-symmetry is a necessary and sufficient factor for the existence of the System. The lessening, unbalance, disproportionate asymmetry or the prevailing of one over the other and the lack of alternation between the two parts will derive in the loss of autonomy or the disappearance of the global system. Physically, it is a conjugation of two stages. The strict meaning of the symbol **-U2+** entails a duality that cannot be separated. It cannot be seen as only **-U2+** or **U2+**. It is rather a canonically conjugated and counter-reflective symbiosis in which the alternate interchanges of one part build or forms part of the other and vice versa.

As a final reflection, let us make reference to ourselves:

... Strange loops... I am convinced that the explanation of emerging phenomena of our brain – ideas, hopes, images, analogies and even our conscience and free of will- are based in a certain type of Strange Loop, an interaction between different levels where the higher level is extended towards the lower level and it has an effect on it. At the same time, these two levels are determined by the other. In other words, there is a resonance of a reciprocal reinforcement between the different levels. The 'I' is constituted as such at the moment in which it acquires the faculty of reflecting itself [8]

5. Logic-mathematics in time zero; the imaginary is real.

Leibniz and Gauss left the question latent of what physical action produces the square roots of negative numbers and recognized that algebra could not teach anything in this, but that general a physical principle underlay to all the algebraic equations.

Bit *principle* -U2+ states that the Universe no longer is a big mirror that, rather than interchanging left and right, traded every force particle for a matter particle, and vice versa. This effect counter-reciprocal mirror occurs in our complex numbers, quaternion's, octonions... in all the Mathematical one and all the concepts of the reality.

Why existence?

But will the search for the final truth always be a mirage? The truth seems to be in some sense also imagined or in the belief on something such as faith that cannot be seen or for which, for someone outside religion, can be conceptualized only as Hope, but that comes from the *Heart*, which is something concrete for the human being. Instead of being taken only from one side of the mirror, it seems that wisdom comes from accepting the vision of both sides.

In bits-Socrates: **know** || **~know**

In bits -U2+: **...Know (know || ~know) || Know (know || ~know)...**

Kurt Gödel, logical-mathematician, explains very well how a solution is not exclusive according to what side of the mirror we are, but rather is found in an integrative combination of both complementary images, an one vision:

"One must say that the fecundity of materialism is partly based only in the immoderation and the wrong direction of the right sided philosophy that followed it. As soon as we occupy as well on the 'precision and imprecision' or, respectively, 'truth and falseness' of these two directions, the correct attitude will show us that truth lies in the medium or that it consists in a combination of the two conceptions" [10]

and thus we arrived ..."only the principle of organization which is (no organization) at all would seem to offer itself"

References:

0 Information,physics,quantum: The search for links. John Wheeler issue

1 The Game of Logic. Price Three Shillings. London, Macmillan and Co. and New York. Richard Clay and sons, London and Bunqay.1887 .Lewis Carroll

2 Expansion and M-Supergravity in Eleven Dimensions, F. Izaurieta. Tesis U. de Concepción.Chile.2006.

3 Space And Time, a translation of an address delivered at the 80th Assembly of German Natural Scientists and Physicians, at Cologne, 21 Sep 1908. In H.A. Lorentz, H. Weyl, H. Minkowski, et al., The Principle of Relativity: A Collection of Original Memoirs on the Special and General Theory of Relativity. New York: Dover, pp. 75-91 (1952).

4 Causality and Complementarity in The Philosophical Writings of Niels Bohr, Volume IV, Jan Faye and Henry J. Folse (eds.) (Ox Bow Press,1998).

5 Stabilité Structurale et Morphogénèse, Essai d'une Théorie Générale des Modèles. Benjamin, New York, 1971.

6 Laws of Form, George Spencer Brown. 1973. Bantam Books, paperback.

7 Interview to Francisco Varela for Eric Golea(video available in R.E.U.N.A.)

8 Gödel, Escher, Bach: an Etemal Golden Braid, Tusquets Editores S.A., 2007 D.Hofstadter

9 Revolution, Jean Michel Jarré Performance at the Destination Docklands Concert 1988, London.

10 Kurt Gödel, Collected Works, Volume III (1961) publ. Oxford University Press,1981. The modern development of the foundations of mathematics in the light of philosophy.