The ultimate invariant equation

Symmetry and invariants of the scientific laws

Graphs in the book are translated by the author.

Antonio Bellacicco

THE ULTIMATE INVARIANT EQUATION

Symmetry and invariants of the scientific laws

(a scale free self-similarity representation of the scientific laws)

$$x \text{ or not } x \equiv x \rightarrow x \equiv \text{not } x \rightarrow \text{not } x \equiv \text{not } (x \rightarrow \text{not } x) \equiv \exists!\, x,$$

$$(x \rightarrow y) \text{ or } (\text{not } x \rightarrow \text{not } y) \equiv (\text{not } y \rightarrow \text{not } x),$$

$$p^n + q_n = q^n + p_n = 1, \quad q = 1 - p, \ n = 0, 1, 2, \ldots, \infty,$$

$$2+2=2 \bullet 2.$$

έστίν έστίν ή οῦκ έστίν.

אֶהְיֶה אֲשֶׁר אֶהְיֶה.

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“To Viviana, Marco, Elisabetta.”

“What You see is how You see.”

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The ultimate invariant equation

Symmetry and invariants of the scientific laws

Preface

The book deals, through simple algebra, with the deepest invariance principle from which many relevant laws in different fields can be deduced. The principle is represented by an equation which is an extension of the algebraic rule, owned exclusively by the number 2, like $2+2 = 2^2$ and more general than an isomorphism, on the equality between the additive group and the multiplicative group, $f(x)+g(y) =$ $h(u)\, k(v)$ and then $f(x)-g(y) = h(u)/k(v)$, which seems to be the source of almost all the laws in different fields. For $f(z) = \mathbf{z'\, w}$, where z and w are two vectors, we have the special case where $\mathbf{w = 1}$. Actually, the equation introduces the dimensionality aspect where the product represents an area. As a consequence, we can easily introduce the temporal dimension. The equation represents both a metric tensor and a competition law which guarantees the equilibrium. It seems to be the mould of all the phenomena. We are aware of the leading concept of group of symmetry and of the well-known covariance principle, where the laws are independent from the choice of any coordinate systems. We actually propose a more general principle which embodies the known linear case, whose invariant is the area of a surface, where a product of two variables is equal to a sum of two other variables, which holds in the physical world, in economics, in probability, in logic and in biology. In particular, we equate an inner product to a scalar product and in general, an additive group to a multiplicative one. As far as the dimensional aspect is considered for the purpose of the book, the proposed principle represents a general symmetry, which identifies invariance as far as it, regards an algebraic structure, independent from any metric choice, and from a specific coordinates system. The transition from a law to another one is determined by a transformation, which corresponds to a numeric rule, whose ultimate instance is the unique case of the number 2, which appears in both sides. We will check some fundamental laws in physics, in biology, in economics, in probability and in logic, showing their isomorphism, apart some suitable transformations. The temporal variable becomes either or one variable of the product. The generalization plays like a coupling principle, generator of new entities, which enjoy new properties. The iterative property given by the sums and by the products of the number 2 suggests the concept of growth and consequently, the concept of infinitum and of 0. In other terms, all the laws lay on a principle of growth based on the same self-reproducing scheme and a principle of equilibrium, as far as two opposite forces are faced. In spite of its simple aspect, where a sum equates a product, as it holds for the number 2 and for the prime numbers, we are able to deduce many basic laws in different fields. The concept of chance finds its logical foundation in the invariance equation, which plays like the number 2 rule. As a consequence, we conjecture a common pattern of many looking like different phenomena, which represents two competing forces. We follow a general geometric approach in terms of graphs, simplexes, clusters, and plane shapes. The Galilean assert on the laws of the Nature, written in terms of squares, triangles, circles, yet holds in an extensive way. We do not deal deeply with each particular area, like the games theory, the elementary particles or the DNA and their symmetries or something else. Consequently, as far as we deal with different facets of the same invariance principle, like waves, energy or probability, we confine ourselves to the pure formal aspects, given by the introduced transformations and by their rules. More generally, the deepest foundation of the ultimate invariance equation is given by a general property of the prime numbers. The real world looks like a puzzle where recombining the same patches, like surfaces or functions, we discover new forms which represent the laws of new phenomena.

As a consequence, we have a family of isomorphisms between the couples like $\Psi = \{G(+)\text{-}G(\cdot) = G'(+)\text{-}G'(\cdot)\}$. The family Ψ actually is an algebraic category. The interpretation of Ψ suggests that the aggregations of entities at the various scales reproduce the same format rule Ψ which looks like the deepest law of every phenomenon. The format Ψ regards the elementary particles in each atom, the galaxies, the cellules of a body and the economic exchanges between aggregations of people. Moreover, the distinction stochastic-deterministic becomes a matter of a transformation, only.

The fundamental forces actually regard rules of exchange between entities of the same level of aggregation. In general terms, clusters of clusters become new entities as: aggregations of elementary particles become atoms, aggregations of atoms becomes molecules, aggregation of molecules becomes cells or other materials, aggregation of cells becomes bodies and aggregation of bodies becomes an economic entity ruled by the survival principle. The survival principle is equivalent to the sharing of costs and benefits as well as the emergence of specializations.

The novelty of our approach is the general category Ψ of isomorphisms between laws. The category is identified by the format of a unique equation. Again, the probability distributions own a deterministic counterpart, which shows the same format of the other laws. The sum of two forces corresponds to the sum of the probability of two complementary events. The unifying principle resides no more on the equation in a given field but on the type of equation, which owns different meanings. The chance