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SIGN, DATA, AND INFORMATION.

AN INTRODUCTION TO A SEMIOTIC UNDERSTANDING OF INFORMATION.

Synopsis:

Data is not necessarily information, however information is data within a certain frame. Frames conveying information are not "squares" as some people may visualize, they are rather "triangles". These and some other interesting aspects of information are examined through the view of theoretical semiotics.

The growth of scientific research and development has been traditionally based on inferred, deductive systems regardless of the means utilized, i.e. empirical (real) or theoretical (intelligible). Principally, these conclusive systems are performing a verification process eliminating contradictory statements by causal (inductive) respectively axiomatic (deductive) methods.

However, since the turn of the century it became evident that together with the prognostic inference systems another progressive system of research came to being, namely: reductionism. The crisis in mathematics and logic (Hilbert, Frege) on one hand and the crisis in physics and cosmology (Planck, Einstein) on the other one, were the cause for the independent sciences to turn to generating theories following the ideas of Euclidian axiomatics of geometry with the same intensions, of course, as those in the inference systems.

All conclusive inferred systems that are in the domain between hypothetical on one side and contradiction-free reality criteria on the other side are well known, often mentioned and demonstrated (by H. Weyl, D. Hilbert, P. Bernays, E. Kaila, R. Carnap H. Reichenbach and many other) therefore it is unnecessary to go into these details. Nevertheless, it must be said that Hilbert in the explanation of his axiomatic and later elaborations, attached a

great significance to the basic element in mathematics, namely the sign, especially in relation to the foundations of mathematics. From him is also the expression: "In the beginning there was the sign..." of course he never defined the sign operationally or otherwise.

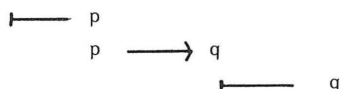
Returning to the "last" indivisible element of a system by means of theoretically founded methods is why progress in scientific research and development is possible at all. Analyzation of signs generates a methodical, operational, definable and applicable system which is called "theoretical semiotics", where ground rules and fundamental expressions were introduced by Charles S. Peirce. During the last 25 years the work of Peirce was researched, studied and widened to the extent that now we can speak of real, applicable theoretical semiotics as part of basic scientific research. Fundamental research and science in general have a obligation which is not only to define frames of operation but it must also lay down ground rules; in the spirit of its intensions, both are of equal importance.

The instrumentation devised by C.S. Peirce for research in information in general and for the sign in particular (he postulated that the vehicle of information is the sign) is founded on an ordered "triadic sign relation". In fact it is exclusive generation of representation by means of basic operations in relationship. This basic relationship operation as a matter of fact is the sign, with other words, the sign is nothing else but a relationship function. This scheme of representation operates in the deepest, fundamental layers of our experience; thinking, verbal and nonverbal expressions, information and communication, everything is covered by these functions. As a strictly defined basis-relationship it goes to the process of founding entities from which all higher representations are generated, i.e., it steps back to the definite, elementary scheme that is not reducible anymore. The three members of this scheme were postulated by Peirce as three fundamental categories allowing maximal abstraction and universal applicability which should cover any ontologic possibility.

Peirce defined the basic categories as "Firstness", "Secondness" and "Thirdness", where firstness dealt with means, secondness

covered the object and thirdness the representing interpretant. The revolutionary idea in this scheme is of course the fact that suddenly a sign is not just a "thing" but a relationship between a material thing, an existing thing, and an intelligible thing. This basic-relationship is not yet an operational⁺ sign, nevertheless it defines the sign as a combination of elements with which a representation of the world realities is possible. This takes place within frames (signs) where each one represents a medium, represents an object and represents an interpretant. Therefore also the formal nomenclature of M, O, I or the primes of .1., .2. and .3. that have been defined by Peirce and (the prime numbers) Bense. The resulting combinations are (representing) sign classes each one referring to one predefined, particular (representing) theme of reality.

The general function of semiotic theory, which is no doubt also an important aspect of every theory, is that it appears as a thinking, intelligible scheme on one hand and as an conceptual consistent hypothesis, based on introduced assertions, on the other hand when its functions of relational fields are examined. Nevertheless, it is consistent over the whole range of languages and metalanguages. This means that every theory which has a real informative content contains also a foundation potential, i.e. a real basic context in which its methodology functions. Within the framework of comprehensive, processable and systematic interdependence of the whole, there are, of course, the hypothetical, relativating, adopted concept of entices on one side and the rational-definite, i.e. controllable, finite, abstracting operations on the other side. This is valid for both, the logical, inference systems as well as for the categorical, universal, foundation systems such as is the triadic sign relationship. In mathematical logic deduction follows the scheme of:



⁺ A sign is operational when "introduced", i.e. when presented and semiosis or retrosemiosis can take place.

Out of the first postulate p a second, q is deduced. In the semiotic foundational system the logical follow up sequence is replaced by the sequence of the primes designating the sign classes respectively their thematics of reality.

$$pSc (3 \rightarrow 2 \rightarrow 1) . pRth (1 \rightarrow 2 \rightarrow 3);$$

Sequencing always reaches the next foundational expression, i.e. the next "lower level" of the reality thematic from the "fundamental" entities.

The reduction of a scientific proof system to a logical, i.e. axiomatic, deductive inference system does lead to presumptions for plausible axioms but in no way to entities of basic, reality thematic for foundational systems. Only the categorical, universal, relational-ordered, representation system based on Peirce's triadic sign classes and their dual thematics of reality (as well as the operationally stepped semiosis) lead to the last entity of the operational (reality-thematic) founding system.

Basic research that results from the development of scientific proof results always in either "reality thematics", or in its dual form of "sign thematic" as introduced in the triadic sign relations within the sign classes. Both the sign class and its dual, the reality thematics, together, are the semiotic founding system for all metasemiotic entities which could be discussed, such as language, formulas, phenomenon etc.

A theory has always been the scientific instrument for control and setting limitations, defining the fields of operation, the theory of semiotic happens to be the most fundamental tool for scientific research and hence is indeed of prime interest.

A signal is defined as an interruption in a field of constant energy transfer. With other words signals are defined as intentional changes in a particular environment, they obey the laws of thermodynamics etc., however can not be defined as data. From signals a message can be generated which is data, which will be effective as a message, if and only if, the signals are successfully

transmitted. Signs are defined as concrete denoters containing meaning of an intrinsic nature. Animals respond to signals (dogs & apes) respond to simple signs. Complex signs embody symbols (devices for abstraction) and icons (Group of interactive symbols) as do gestures in kinesics. Expressions are also signs which can be divided into two basic groups, namely: events and design. Information however is transmitted only if the received message was "news" to the recipient independently of the nature of the sign, i.e. event or design.

The vehicle of *information* transmission (Shannon, Wiener) is by way of encoded data which is to say it is a "package" or a unique frame of data, i.e. it is nothing more or less than data bound in a frame of references. The theory of transmission of signs, i.e., of information frames, (not messages), is the subject of theoretical semiotics, especially the chapter dealing with the semiotic communicative aspects of the sign.

The sign being a triadic (triangular) scheme can be seen as a frame, which contains ordered, categoric,thetic data which may or may not point to another frame, i.e. to another sign. Within the frame there are three basic elements for O (for object), M (for medium) and I (for interpretant). These elements never appear as O, M, or I, but are disguised as one of its three subsigns, i.e. its trichotomic form. In the case of the object (O) element the three trichotomies are either icon, index or symbol. For the firstness of the scheme, i.e. M, the medium appears as one of the three: quality subsign, as a singular subsign or as a legalized subsign, in semiotic terminology called qualisign, sinsign and legisign respectively⁺.

- 1.1 Quali; like the quality of red color for instance,
- 1.2 Sin; uniqueness of a thing, a face, fingerprint, etc.,
- 1.3 Legi; the conventionality of a letter, word etc..

On inspection of the above one can immediately deduce that behind

⁺ The nomenclature in theoretical semiotics has only historic significance, it was introduced by C.S. Peirce at the turn of the century.

each of the above elements a vast repertoire of items must be buried if a match with an item is the object of the game. However a sign per-se can involve (point) only one element of the above, suggesting that a repertoire will be selected. Depending on the other trichotomic elements involved, a new sign can be generated, "in camera" so to say independent of the presented sign. This generation is done by a process called semiosis respectively retro-semiosis and involves the whole instrumentarium of theoretical semiotics. So, these other signs will allow a "search" within the individual, selected repertoires.

The secondness within the sign designates the object also with the aid of its three trichotomic subsigns, namely:

- 2.1 Icon; as in a passport photography,
- 2.2 Index; as the compass needle pointing north,
- 2.3 Symbol; as the "scarlet letter" in prose.

These elements are, as all other trichotomies, ordered, sequential in their significance of depth, categoric entities.

Thirdness, according to Peirce, is the I, or interpretant within a sign. It too can appear as one of the threefold, trichotomic choices: rhematic subsign, dicentric subsign or argument subsign. In semiotic terminology they are defined as:

- 3.1 Rhema; meaning open or logical "neither true nor false",
- 3.2 Dicent; meaning "true or false", - "don't care",
- 3.3 Argument; meaning closed, logical "necessarily true".

The above subsigns imply that any sign utilized in information transfer, in order to fulfill its intentionality, i.e. "news" transfer, must be conclusive. Only then intentionality of information, i.e. transfer of information contained in a message, is fulfilled. This again implies that a sign in information transfer, or signs within a chain for information transfer must have an argument subsign as its interpretant, as conclusive sign.

According to Max Bense⁺ an existing "thought subject" differs from the existing "thinking subject" so much that it can not be defined as 'I' or 'me', but must be called 'Thou'; 'I', is always the thinking subject, the object remains always 'it'. This statement is of importance when the communicative aspects of a sign are analyzed within the framework of epistemology. Especially so, when consciousness is even remotely associated with the interpretant within a sign.

A group consists of a class or collection of elements which may be as specific as numbers or figures or atoms or as vague as an undefined "object of thought." Or the elements may be a class of operations performed on something. Semiotic classes belong to a group which is functioning in semiotic and metasemiotic levels of the world and are *part of* group theory as far as theoretical semiotics are involved. That is so because group theory being an highly abstract and general tool enables science to make sense of the hidden world of the atomic microcosm. Also because of its peculiar power to generate information about structure of events, even if the events themselves cannot be known, it performs an abstracting foundational operation in the realm of elementary communicative logic. In mathematics and physics it unifies disparate things by revealing their common, underlying form. Appearances are stripped away, specifics are ignored, so that only the essentials, the abstract, invariant relations, the sameness in the midst of change, make themselves known.

Can a painting, an art object be expressed in a formula? As far as theoretical semiotics are involved, the answer is a definitive, - yes. The painting "A street scene from Giverny" - 1893, by the French impressionist Claude Monet (which regrettably is not possible to reproduce here) was analyzed and expressed⁺ in a semiotic matrix:

⁺ In an article published in 'Semiosis Nr. 31' vol. 3, 1983. under the title: "Sign, Behavior and Consciousness".

⁺ "Semiotisches System-Modell und Bewußtseins-Prozesse", Robert E. Taranto, Universitaet Stuttgart 1979.

$$Z_{\omega} = \begin{vmatrix} 0.0 & 0.0 & 1.2 & 1.2 & 1.3 & 1.3 \\ 2.1 & 2.1 & 2.2 & 2.2 & 0.0 & 0.0 \\ 3.1 & 3.1 & 3.2 & 3.2 & 0.0 & 0.0 \end{vmatrix} \times \begin{vmatrix} 3.1 & 3.1 & 2.1 & 2.1 & 0.0 & 0.0 \\ 0.0 & 0.0 & 2.2 & 2.2 & 1.2 & 1.2 \\ 0.0 & 0.0 & 2.3 & 2.3 & 1.3 & 1.3 \end{vmatrix}$$

The left matrix defines the complex sign of the painting, the right one shows the reality thematics for the same painting. This complex sign is the result of four small vectors involving picture content, frame, signature and aesthetic (semiotic) involvement of classes.

Norbert Wiener defined information so: "Information is a *name for the content* of what is exchanged with the outer world as we adjust to it and make our adjustment felt upon it". The accent is on the name of the content. It seems when the notion of information is discussed Carnap's "Studies in Semantic" (1961 Harvard Press) comes to mind, nevertheless in order to have 'exchange' we need, in addition to encoder, message, channels etc. also vehicles for information which are *imbedded* in the messages, i.e. we need signs. The unity of knowledge has always been the aim of epistemology or better said of the philosophy of science. Mathematicians and physicist, biologists and linguists, each function in their own separate worlds, speaking separate languages, and having the notion that they are the true holder of the light to illuminate the secrets of nature. However without a sound theory of information the world of science will remain a Babilon.

In conclusion it must be said that theoretical semiotics seems the prerequisite if the exchange of meaning between individuals through a common system of symbols can be analyzed and understood.

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