

THE MECHANICS OF SEMIOTICS AND OF THE "HUMAN MIND"

Part I: Report of the latest development of Peirce's semiotic in the Stuttgart semiotic conception

1. Prolog

This paper is based on the work done for my PhD thesis in 1978. The first two chapters are loose translations of Max Bense's¹ works on semiotics which are added here for the benefit of those readers that are not familiar with the latest developments in semiotics.

The threevalent information bound inherent in computer programming like index, pointer, and address or base, displacement, and symbolic address, and so on, have a direct bearing to the triadic, trichotomic sign relations in semiotics.

The probability that the functions involved in thought processes are the same as those in information processing is quite large, and the operations involved are similar. This consideration makes an investigation of the facts involved seemingly worthwhile.

The general prevailing notion that the functions of the mind could not be described with reductive methods - in opposition to the deductive methods - as from a computer, and hence also for models of the mind, does not hold true any more.

Since the 'Trial-And-Error-Method' was introduced by computers the reduction method has become an integral part of information theory, and can be utilized in models of the mind and mind processes.

2. Semiotics

Any serious scientific research into the structures of the mind and mind processes is impossible without the knowledge of "signs", "symbols", "objects", and so on. The science of signs is semiotics, hence a study of the mind must involve semiotics. To understand the "mechanics of semiotics", a concise review of its basics is a prerequisite for understanding the "working", i.e. the 'mechanics' of the human mind.

For the next two chapters a short review of the most important aspects of semiotics will be presented. This is necessary because the mechanics of thought and thought processes do require the vehicle of signs.

Originally called 'semeiotic' by Ch. S. Peirce, who formulated the ground rules, it developed into a science which differentiated and classified all signs according to methodology and utilisation. The naive sign concept, semiotics before Peirce, and the scientific concept of semiotics as it is known to-day must be kept separated.

The naive sign concept developed in colloquial speech by situation bound usage and as undefined and not terminologised sign it is more a technical than a theoretical concept. The theoretical sign concept on the other hand is a product of man's inquiring, speculative intelligence, of the human consciousness in general, and especially in conjunction with sciences such as metaphysics, mathematics, logics, and so on, and the requirements for "indirectness", "demostrability", and "consolidability" of descriptions, expressions, statements, declarations, propositions and so on, involved in these sciences. Since Aristotle and Euclid, through Leibniz, Arnauld and Lambert up to Bolzano and Peirce the theoretical concept of the sign was much more studied than the naive, in colloquial use, sign concept. Sometimes a comparison is made between "natural" and "artificial" signs; of course natural signs do not occur, only natural phenomena do. A sign is always declared as such by the user of a 'natural' sign. Semiotics deals with the sign itself, and so it is always a thetical creation (see M. Bense, E. Walther, and others).

The introduction of a sign means name-giving, and each name-giving is a sign setting which originates within the intentional, thinking mind. Yet it should not be seen as an elementary, simple, and homogeneous act. The thetical process involved is synthetic, and multiphased. Sign introduction is selective, thetical, and designative. These three phases are the reason why the 'medium', that must be selected out of an available, relevant repertoire is first, second the sign must relate to an intentional object i.e. it must designate, and third, the object must relate to a context that is chosen from the same repertoire.

Therefore, the thetical introduction of a sign is triadic in nature. Peirce² who was the first to note that fact called it 'triadic sign relation'. To represent, - a sign must use a representing medium, an object to be represented, and a context related interpretant. In this relationship the 'medium', 'object', and 'interpretant' are in an orderly sequence that is inherent to the nature of the sign, which is never an item but a relationship within which an item could be declared as a sign.

Triadic sign relations (SR) contain a 'medium' S(M), an 'object' S(O) (the designated subject, object, affair, item, and so on), and an 'interpretant'

S(I) - as the meaning within a predefined context. The definition of a sign relation within the frame of a representation scheme is therefore:

$$SR = R [S(M), S(O), S(I)]$$

Peirce realised as well that if the sign relationship S(M), S(O), and S(I), can completely differentiate and graduate the correlates of these three signs, the subsigns of these do again have a triadic relationship which he called trichotomy. Introduction of the trichotomy for ('M') has its origin in perception and was given the characteristics of quality, hence 'quali-sign', the selection of an unique pattern with singular propriety, 'sin-sign', was second, third and last the conventional legalised medium of representation, 'legi-sign', as in a word or a form, and so on. The trichotomical differences in an object relationship ('O') are those of 'icon' (usually a picture, pattern or part of it) related to the object, a pointer or 'index' to a causal, phenomenal or formal relationship to the object (as the geographic 'nord' and the magnetic compass needle pointing 'nord'), the object related 'symbol' as the third item in 'O' is introduced fully independent of the designating object and so functions as pure name.

The trichotomy of the contextual 'interpretant' was described by Peirce as 'rhematic', 'dicentic', and 'argumental'. Max Bense defined them as 'open', 'closed', and 'complete' subsigns which can be logically characterized as 'neither true or false', 'true or false', and 'true only'. This results in the complete sign relation:

$$CSR = R [M(qua, sin, leg), O(ic, in, sy), I(rhe, dic, arg)].$$

Out of this complete sign, according to Peirce, ten sign classes can be produced if, and only if, the triadic subsigns are in ordered sequences of generative or degenerative semiosis. Each one of these ten sign classes completely defines a realized, and functioning sign as a representational scheme. In its totality these ten sign classes consist of six rhematical, three dicentic, and one argumental class. Of these the main sign classes are: 1. Rhematic iconic quali-sign, 2. Dicent indexical sin-sign, and 3. Argumentic symbolical legi-sign. These involve the reality thematics of the 'medium', the object's 'designation', and the meaningful 'interpretant'. The remaining seven classes are then developed as intermediate ones.

Peirce developed a categorial system in connection with his triadic-trichotomic sign representation, where the categories are divided into 'firstness', 'secondness', and 'thirdness'³ to be utilized for foundational, representa-

tional, and graduating aspects of his sign relationships. Triadic relationship in signs are fundamental, triadic relationships in categories are graduated i.e. scaled. Coordinating the two relationships S(M), S(O), S(I) and 'firstness', 'secondness', 'thirdness' produces 'firstness' as .1., 'secondness' as .2., and 'thirdness' as .3., notation that are introduced by M. Bense also to the trichotomies of the subsigns, so for 'M' the notation is .1.1., 'firstness of firstness', .1.2., 'firstness of secondness', and so on.

The complete main sign classes are:

- A. Rhematic class = 3.1 2.1 1.1
- B. Dicentric class = 3.2 2.2 1.2
- C. Argument class = 3.3 2.3 1.3

The semiotic operation through which sign classes can be transformed into the-
matics of reality is called 'dualisation' by M. Bense.

Dualisation is the process in which the for-and-back-elements of subsigns are exchanged in connection with the reversal of the sequential order. This transformation of a sign class (sign thematics) results into a reality class (reality thematics).

The categorial numerical notation allow two semiotic representations, namely: the semiotic sign thematics, and its involved thematical reality describing the pure, complete sign relations of 'firstness' (M), 'secondness' (O), and 'thirdness' (I) within the theory of semiotic inclusion grading in conjunction with the differenciating concepts of semiotic object and interpretant.

The 'sign' i.e., sign relationship is not only a representational scheme, but functions also as a communicational one. In semiotic representations triadic relations function as substitutes, i.e., as substitutions in representational semiotic schemes; in the communication scheme however the triadic relations take the functions of transmission. In representation the main aspect is the object relationship, in communication it is the medium 'repertoire' relationship which counts.

3. The thematics of reality

The logic representation of semantical truth of theoretical facts in linguistic expressions (in their simplest form) are two variables, namely 'true' (T) and 'false' (F). The relationship of these variables to the relevant expression is based on the operation of 'negation' which allows us to swich from one to the second variable.

Thus the comprehension of the logical truth thematization is independent of any ontological thematization of the reality notion involved even if the formulated relevant expression is scrutinized with the aid of the 'truth criteria' postulated by Alfred Tarski⁴ who defined semantic truth as contained in the following formula:

$$T(x) \longleftrightarrow p;$$

i.e.

"p" is true if, and only if, p

in which "p" is a variable representing the name, or unique description, of that sentence. The easiest way to obtain such a unique description is to put the sentence in quotation marks. Thus we get such instances of (T) as "Snow is white" is true if, and only if, snow is white.

Although semantic truth definition is based on two valued (T, and F) logic, semiotics is founded on a three valued relationship of 'sign-relation' or simply 'signs' which function within triadic representations, and whose members are 'partsigns' or simply 'subsigns' that make up various triadic combinations called triplets. A triadic combination of triplets derived from the 'total sign' (the three times three subsigns) within the framework of a triadic representation scheme can, theoretically, be introduced three times:

- 1) As (sign) functional aspect i.e. as relation between medium (M), object (O), and interpretant (I).
- 2) As (sign) operational aspect, via the semiotical thetical introduction (\vdash), the ordering (\longrightarrow), and selection (\triangleright).
- 3) As (sign) categorical respectively fundamental aspect, i.e. through the 'firstness', 'secondness', and 'thirdness' of Peirce or the "prime signs" .1., .2., .3. of Bense.

From the above three aspects, the well known ten sign classes can be derived. Also the dual 'thematic reality' as defined by Bense⁵ within the frame of the ten ordered triadic sign classes can be deduced ('meta-sign') as a thematized triadic sign relation that covers a certain reality in its representation scheme, and belongs to the sign class of reality contrary to the sign thematics of the sign itself. In other words all signs are created from an objectivated reality and hence are empirically reconstructable.

The continued development in Stuttgart of Peirce's type semiotics showed that the trichotomies of the subsigns, on which Peirce assigned the triadical correlates M (Medium), O (Object), and I (Interpretant), are actually reality the-

matics with matching sign classes that function (where homogeneous and inhomogeneous reality thematics are separated) as .1., .2., and .3.

The 'total sign' i.e. the 'total sign-relation' (TSR) is created out of all triadic correlations and its trichotomic subsigns:

TSR (M(Qua,Sin,Leg),0(Ic,In,Sy),I(Rhe,Dic,Arg)); or

TSR 1(1.1,1.2,1.3)2(2.1,2.2,2.3)3(3.1,3.2,3.3).

These contain of course all ten sign classes with their (homogeneous and inhomogeneous) deducible thematized realities. Thus the system of the 'total sign' becomes the finite 'all class', in other words the basic elements for all triadic sign relations and all semiotical representational schemes. These of course include all existing representational schemes within the mind too.

Taking into account the nine subsigns of the 'total sign' (TSR) and their generating semiotic incrementability, then the homogeneous, closed trichotomies create (on semiotic foundations) well ordered, graduated complements within the frame of trichotomies, that means thematized reality representations that are involved in the reality criteria of semiotics. This is analogous to the criteria for logic in the formal languages (Tarski) where 'object language' and semiotic representation on one side, and 'meta language' and the value of reality's representation on the other, are the analogons.

$$\text{Rpw}(\text{Sign Class}) \longleftrightarrow \text{Rth}(\text{Sign Class})$$

The sign class and its reality thematic are related to each other (M. B.) as object language and its meta language because the sign class defines in any case a particular triadic sign relationship of SR(M,0,I) as the representing scheme of a representable entity whose (semiotic) realization is always done by one of the three schemes:

M (.1.,.2.,.3.)

0 (.1.,.2.,.3.)

I (.1.,.2.,.3.)

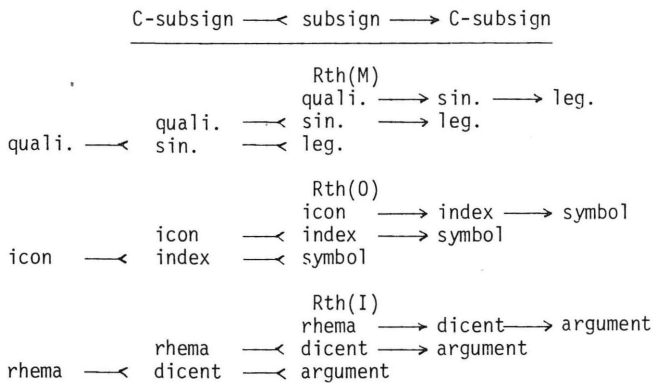
as in the case of the three main classes or in the additional seven of the thematized reality classes. At present we shall refer only to the first three main classes. It is quite obvious that these three selectable, homogeneous, and complete thematized realities involve three "representation values" (M. Bense) with their trichotomical succession of subsigns that established the categorical degree of semiosis. The degree of semiosis is characterized by the semiotical values in relation to each homogeneous and complete reality thematics involved. Generally in colloquial speech these are said to be

- (.1.): open (op)
- (.2.): closed (cl)
- (.3.): complete (cp).

These characteristics are valid for the triadic correlates (M,0,I) as well as for the trichotomic subsigns (Ic, In, Sy) who are operationally related, as for instance, an Object (.2.) relation is always 'closed' but its first sub-sign the icon (2.1) is open. To be exact we can say that an 'icon' is a 'finite open' representation which doesn't exclude the possibility that because of the subsign of representation in certain homogeneous frames the 'icon' is complete open, i.e., not closeable representation.

The complements of the complete representations of the semiotically thematized reality, and their three ordered subsigns function as complete, homogeneous parts. That shows the existence of matrixes crossing over the higher semiotic matrixes from thematized reality's values of the reality thematics to the next higher (or lower because degenerative semiosis is also possible) semiotic matrixes.

If " \longrightarrow " should denote the generative semiosis, and " \longleftarrow " the degenerative one, then the following semiotic reality matrixes show the complementary representation (C) of



generated homogeneous reality thematics:

These are the three main, complete, thematics of reality, the remaining seven inhomogeneous mixed thematics of reality are not considered, but could, easily in principle, be formulated according to:

$$SC1Rth (3.1 \longrightarrow 2.2 \longrightarrow 1.3),$$

that means for the maximally mixed and evenly distributed identical sign rela-

tion, where the following is valid:

$$\text{Rpw}(\text{SCae}) \longleftrightarrow \text{RTh}(\text{SCae})$$

i.e.

$$\text{Rpw}(3.1 \longrightarrow 2.2 \longrightarrow 1.3) \longleftrightarrow \text{RTh}(3.1 \longrightarrow 2.2 \longrightarrow 1.3)$$

It should be noted that in such inhomogeneous thematics of reality in addition to the selective also the coordinating aspects of the generative resp. degenerative functions will be involved. In the above quoted example, reality thematics of an 'aesthetic state' (M. Bense), only coordinating functions were involved in the constitution of the triadic relationship. The thematics of reality for SC1 (RTh(ae)) are accordingly:

$$\begin{array}{ccccccc} & & & \text{RTh(ae)} & & & \\ 1.1 & \longrightarrow & 1.2 & \longrightarrow & 1.3 & & \\ & & 2.1 & \longrightarrow & 2.2 & \longrightarrow & 2.3 \\ & & & & 3.1 & \longrightarrow & 3.2 \longrightarrow 3.3 \end{array}$$

Categorical firstness in semiotic terminus (.1.) means 'source', and categorical thirdness (.3.) means 'sink'. When looking at the above example it becomes evident that the maximally mixed and evenly distributed subsigns of the 'aesthetical state' have two sources and two sinks as do all (homogeneous and inhomogeneous) thematics of reality. The character of reality, i.e. the concept of reality is based on the criteria of scaled positioning (ordinal categories), and not on weights (cardinal categories). Hence, in semiotics the concept of reality is based on the sequence of primes .1., .2., and .3. scheme.

The notion of reality is an ordaining concept. Identification (semiotical representation) depends on the specific position within a given triadic relationship (of a sign class), the difference between 'being' (Sein) correlates and the trichotomic intentional correlates of the reality involved.

The primes are the criteria for 'existence' of ordinary triadic realities and so,

$$\text{M} \longleftrightarrow .1., \text{O} \longleftrightarrow .2., \text{I} \longleftrightarrow .3.$$

With other words, any 'something' is a 'medium' in a process involved in representation, and takes the first place herein.

The various intensional criteria of these 'existence' correlates are:

$$\begin{array}{llll} \text{in M: qua.} & \longleftrightarrow 1.1, & \text{sin.} & \longleftrightarrow 1.2, \text{ leg.} & \longleftrightarrow 1.3 \\ \text{in O: icon} & \longleftrightarrow 2.1, & \text{index} & \longleftrightarrow 2.2, & \text{symbol} & \longleftrightarrow 2.3 \\ \text{in I: rhem.} & \longleftrightarrow 3.1, & \text{dicent} & \longleftrightarrow 3.2, & \text{arg.} & \longleftrightarrow 3.3 \end{array}$$

(The sign \longleftrightarrow is to be read as "only then when", and the basic, prime categories are to be understood to differentiate only in their positional sequence.)

4. Semiotic Matrixes

The following table (Fig. 1) shows the ten unique sign classes that are universal, as originally developed and described by Peirce⁶.

(I) Rhematic Iconic QUALISIGN	(V) Rhematic ICONIC LEGISIGN	(VIII) RHEMATIC SYMBOL Legisign	(X) ARGUMENT Symbolic Legisign
(II) Rhematic ICONIC SINSIGN	(VI) RHEMATIC INDEXICAL LEGISIGN	(IX) DICENT SYMBOL Legisign	
(III) RHEMATIC INDEXICAL SINSIGN	(VII) DICENT INDEXICAL LEGISIGN		
	(IV) DICENT Indexical SINSIGN		

Fig. 1

The modification of this table and the continued development of the triadic trichotomic sign relations made possible the application of semiotics in research of architecture, structure, and modeling of the mind based on triadic trichotomic semiotic, and cybernetic systemology. The defined ten sign classes of representational schemes within the framework of sign thematics, and those of reality thematics in which the introduced representation functions as fixation for reality operates as in the following phases:

a) Monadic reality of a medium, b) dyadic object related reality, c) triadic reality of an interpretant, and d) intersecting, inhomogeneous reality from all three correlates of semiotic relation.

So we deal with the sign of the medium (M) .1., the sign of the object (O) 2.2., and the one of interpretant (I) .3.

The semiotic matrix has a rectagonal form, and consists of 'symbols' of ordinary triadic categories, as shown above, represented by ordinary prime numbers. A vector of these matrixes represent a semiotic function. Semiotic matrixes

are stochastic* in nature because their vectors are exposed to probability distribution. Multiplication and addition of semiotic matrixes result in larger matrixes. When multiplied with a 'symbol' (a pair of numbers) the product shows the multiplier as subsign on all the elements of the multiplicand. Multiplication of semiotic matrixes is not commutative.

Exchanging rows with columns i.e. producing rotational 'mirroring' results in semiotical dualisation where transformation takes place from sign class to the thematics of the reality involved.

The following matrix (Fig. 2) shows the formally legal 'parallel mirroring' where a given sign class is transformed to the accordingly ordered thematics of reality.

	<u>Main class</u>			(x)	<u>Main ThR.</u>		
	<u>M</u>	<u>O</u>	<u>I</u>		<u>M</u>	<u>O</u>	<u>I</u>
M	3.1	2.1	1.1		M	1.1	1.2 1.3 ⁻
O	3.2	2.2	1.2		O	2.1	2.2 2.3
I	3.3	2.3	1.3		I	3.1	3.2 3.3

Fig. 2

The addition or multiplication of two small two dimensional matrixes sums up or results in one three dimensional large matrix. This procedure can be used for 'n' dimensional matrixes as shown in Fig. 3.

1.1	1.1 1.2 1.3 2.1 2.2 2.3 3.1 3.2 3.3	1.2	1.1 1.2 1.3 2.1 2.2 2.3 3.1 3.2 3.3	1.3	1.1 1.2 1.3 2.1 2.2 2.3 3.1 3.2 3.3
2.1	1.1 1.2 1.3 2.1 2.2 2.3 3.1 3.2 3.3	2.2	1.1 1.2 1.3 2.1 2.2 2.3 3.1 3.2 3.3	2.3	1.1 1.2 1.3 2.1 2.2 2.3 3.1 3.2 3.3
3.1	1.1 1.2 1.3 2.1 2.2 2.3 3.1 3.2 3.3	3.2	1.1 1.2 1.3 2.1 2.2 2.3 3.1 3.2 3.3	3.3	1.1 1.2 1.3 2.1 2.2 2.3 3.1 3.2 3.3

Fig. 3

* Stochastic matrixes are those that apply to the description of a system that at any instance occupies one of 'n' existing situation positions, and from a situation 'i' will change to another situation 'j' with the probability 'a_{ij}'. Time independent (constant) matrixes reflect stationary systems.

In the philosophy of semiotic matrixes a certain similarity with the learning matrixes (Steinbuch et al.) could be found. However, all 'learning' matrixes are inherently two dimensional ones, and although many levels of 'nesting' are possible, the fact remains that such matrixes are twovalent units in comparison with the threevalent, semiotic matrix.

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SEMIOSIS 15

Internationale Zeitschrift
für Semiotik und Ästhetik
4. Jahrgang, Heft 3, 1979

INHALT

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