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THE PHILOSOPHY OF SEMIOTICS

The basis for the philosophy of science is the theory of science, which includes the traditional epistemology as well as cybernetics and system theory which also provide the foundations for the theory of numbers, and perhaps even for the theory of mathematics. As a matter of fact, all sciences are bound together by the theory of science in which mathematical logic, linguistics, model theory, physics, and of course semiotics - to mention only a few - play an important part and therefore should be considered as integral parts of it.

Since Ch. S. Peirce¹ defined semiotical epistemology, it has become clear that no single data can exist that constitutes the basic element of cognition. Knowledge can be neither the mosaic, nor the hierarchical structure made of elementary data, because no single datum has any cognitive sense, i. e. there is not a separate self-subsistent content. Each and every meaning coexists with other meanings in a structure of interrelated networks and only due to this fact can an emotional or intellectual content be existent. A single, isolated cognition would be meaningless and hence impossible: consequently, each meaning can be comprehended exclusively through other meanings, never directly.

Semiotics, as the theory of signs is called, overcomes the traditional dualism of subject and object in epistemology. Cognition is no longer interpreted as the dyadic relation, it becomes *triadic representation*, which implies that the direct approach to an object is impossible. Cognitive reference to an object has to be mediated by some means, which will say that a particular object is meant in a particular way and never just simply felt, hence it is neither ever free of interpretation nor fully present. That is where traditional epistemology cannot serve as the scientific tool, and the wider scope of the *philosophy of science* has to be invoked and applied.

As stated above, cognition and perception are not dyadic but triadic functions (as defined in information transmission and semiotics) between subject and object and have to "pass" (be 'mediated') through a medium, in this case (cognition and perception as memory-interpretant) the mind is in the position of an interpretant rather than of the creator of cognition. However, as a

system of signs, cognition exists outside consciousness and is selfsubsistent to it.

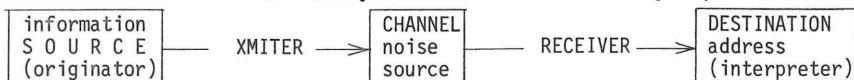
The general theory of signs differentiates between presented and represented aspects of things, between the given and the designated, the factual existing material "world" and the intelligible hypothetic function of the mind; that means semiotically, between objects and object relationships. The reality of "objects" are (at least partially) detectable, whereupon object relations can be thematized, as will be shown in the Chapter of Thematics of Realities.

In general, the theory of signs does not provide any clues regarding the quality or value of information - of knowledge per se (it does tell a lot about the nature of information). In a universe of signs there is no place for self-justification. No sign can be self-evident because *ex definitione*, it depends on other signs. All information processing is based on Semiotics and so can be seen as the foundation of all information processing theories.

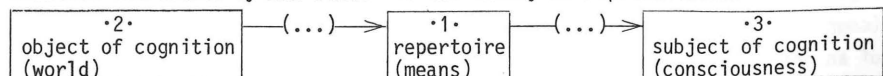
Information theory, as defined, is concerned with the discovery of mathematical laws governing systems designed to communicate or manipulate information. While the central parts of this theory are chiefly of interest to communication engineers, some of the concepts have been adopted and found useful applications in fields such as psychology, linguistics and semiotics. It is important to keep in mind that this theory is quite different from classical communication engineering theory which deals with the devices employed but not with that which is communicated and with how it functions.

A basic ideal in information theory is that information can be treated very much like a physical quantity, such as mass or energy. Encoding and decoding of information as well as measurement of information can be very exacting functions and useful for understanding the operations involved; however, this is not the place to go into these details.

The scheme of information theory is based on the following sequence:



Or when applying the prime-signs of the fundamental-categorical prim-sign relation introduced by Max Bense² in the theory of representation



sign processes, i. e. semiosis³ and retrosemiosis, are analogous to the scheme of the general communication system as shown above. The human mind uses signs (and subsigns) as vehicles for information (a thought is a sign, according to Peirce) that are interpreted, as everything else in information in its broader sense, to include messages occurring in any of the standard communication mediums and to include the signals appearing in the nerve networks of animals and man. Furthermore, the signals or messages need not be meaningful in any ordinary sense. The measurement of information, which indeed belongs to information theory, is from the point of linguistics or semiotics of little interest although when meaning, describing or relating to real or conceivable events it is important to the communication engineer.

The probability that the functions involved in thought processes are the same as those in information processing is quite large, and the operations involved could be similar. This consideration makes an investigation of the facts involved to seem 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 anymore since the 'Trial-And-Error-Method' was introduced by computers and the reduction method has become an integral part of information theory; it can be utilized in models of the mind and mind processes.

Algorithms involved in information processing systems are invariant to the representational transformation and are always completely divisible into activities and decisions. Cybernetics defines the (human) brain as an information processing system; nevertheless, drawing parallels between a computer and the human brain has been quite often defined as an unscientific, heuristic speculation. Some scientists went as far as to declare such speculation unmoral and unethical. Joseph Weizenbaum⁴ who warns computer specialists not to get arrogant, and compares brain functions with that of computers, is one of many. But does he really know enough about brains in order to make such a statement? On the other hand, brain researchers do compare brains with large computers although they probably do not know much about computers, i. e., about hardware and software. A computer processes rigorously precise data, man accepts fuzzy data and carries out operations that are not strictly rigorous. Therefore, in computer a memory and its treatment are distinct, in man they are mixed. Computers use rigid "addressing" of data, but human memory works by using association of data presented as an argument, i. e. retrieval is done according to the content of the information and not according to the external address,

artificially added to the data. The difference is qualitative as well as quantitative. Nevertheless, in human memory retrieval of stored data is first done by some sort of associative network and then location is selected by an item with specific characteristics.⁵

Whatever the case, the differences or similarities are of no importance for the discussion; here the subject is semiotics rather than computers or brains although both are information processing systems. A. Newell and H. A. Simon point out⁶ the indispensability in creative human thinking as in computer simulations of what they call 'heuristic' operations in which a number of possibilities may have to be examined, but the search is organized heuristically in such a way that directions most likely do lead to success are explored first. Means of ensuring that a solution will occur within a reasonable time, certainly much faster than by random hunting, include adoption of successive subgoals and working backward from the final goal.

Nevertheless, some known facts should be quoted, in order to get a notion of the magnitudes involved as mentioned by J. Eccles⁷ and to abstract oneself from computers.

There are 200 million discrete connections between the two halves of the brain, millions of micro-structured column areas of the cerebral cortex defined as modules or basic units, which function as the modules or processors in distributed computers. There is as yet no quantitative data on these module operations; however, the number of neurons in a module amounts up to 10000, of which there would be some hundreds of pyramidal cells (like the modules of integrated circuits) and many hundreds of each of the other species of neurons. As Eccles writes: "We can only dimly imagine what is happening in the human cortex or indeed in the cortices of the higher mammals, but it is at level of complexity, of dynamic complexity, immeasurably greater than anything else that has ever been discovered in the universe or created in computer technology" (pp. 236-240).

Today, a giant computer may have a dozen or so processors, perhaps interconnected with other computers over telecommunication links, but not millions.

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.

Information is the stuff on which intelligence grows, the "atoms" of information are signs and the science of signs as mentioned already is semiotics, therefore, information and the systems and theories dealing with it must be considered as related to these principles.

A system is defined as consisting of elements that are recognizable but indivisible entities. There are two groups of systems, namely static and dynamic ones. Attributes for a dynamic system are:

- a) a repertoire of transactions,
- b) a network for these transactions.

A chosen repertoire must be able to reflect each occurrence within the system. The networks are the basic blueprints of the system's architecture in which all paths between the various elements are described. Again we recognize two types of dynamic systems, those made of material i. e. physical systems, also called hardware systems, and semiotic or software systems such as language, mathematics and so on. Such software systems that reflect, i. e. that are based on a hardware system, are models. Hardware systems are further divided into natural (physical, biological, social) and artificial, say technical ones.

The philosophy of systemology embraces all systems and models (which can be realized). Although hardware systems dealing with information processing belong to cybernetics and software ones to semiotics, the fact that information theory and the theory of automata are the undivisible whole of cybernetics, forces the involvement of semiotics in cybernetics in general.⁸

The notion of memory is of importance when automata theory, system engineering, or mind and machine are subjects of discussion (see N. Wiener, 1948). Memory and semiotics are closely related in the sense that without memory there is no mind (as machine or as attribute). As in information theory, the channel i. e. the medium in semiotics are indispensable elements, and both are memories in which signs are imbedded. Regarding the "memory" aspect of information processing systems, it can be generalized that such systems (with memories) are considered equal (in the sense) if their functions are equal. That statement points to the cybernetics postulate that human reaction to action from the "world" is information-originated in the human brain.

Memory stores signs and their representational functions are schematic operations $F(M)$, in which the functional relationship (M) is always triadic, namely:

$$F(M) = [M(M), M(0), M(1)].$$

Each representation is always a thematization and communication, hence representation is only possible by way of signs and their classes. The sum of all sign classes results in:

$$\Sigma : \text{Semiotics} > \text{Mathematics} > \text{Logic} > \text{Linguistics}.$$

Classes composed of selected and ordained entities are inhomogenous, as for example is the aesthetic state (Bense) where singularity and thematics are of the same sign class.

One of the major controversial problems in the theory of memory (originated from the human memory) is the difference of opinion between the defenders of the classical electrophysiological (or synaptic) theory of memory storage, and the defenders of a chemical theory, writes Popper⁷, as if that question can give any clues to the real nature of memory. In "Encyclopedia Britannica" the following is written about this subject: "There is some evidence that the presence of Nissl bodies in neurons indicate that RNA (ribonucleic acid) plays a major role in the functioning of the nerve cells and is probably responsible for the storage of information (memory)" (Vol. 18, p. 446).

Philosophically, there are several approaches to a general theory of memory, but none too promising. For instance, the Continuity-Producing Memory of Popper is very much related to what Henry Bergson (1896), (1911) calls 'pure memory' (as opposed to "habits" as with Peirce's notion) - a record of all our experiences in their proper temporal order. This record, however, is not-according the Bergson-recorded in the brain per se, or in any matter: it exists as a purely spiritual entity (inbedded in the *sequences* of the recordings), ergo software. Bergson substituted the famous dictum of Descartes, "Je suis une chose qui pense (I am a thing which thinks)", to 'Je suis une chose qui dure' (I am a thing which continues); and whereas Spinoza had presented reality "sub specie aeternitatis" (in its eternal aspect), Bergson presented it 'sub specie durationis' (in its durational aspect). This means that as long as movement in software exists, i. e. information processing takes place, there will be the feeling of time i. e. there will be duration. Bergson's "Time and Free Will" (1910), constitutes an attempt, primarily, to establish his notion of "durée" (duration) as opposed to what he considered to be the spatialized conception of time employed for scientific and public purposes; and then to proceed toward an original solution of the problem of free will. In "Matter and Memory" (1911)

a detailed consideration of the problem of aphasia leads to a profound study of the means, namely the memory, by which existence is made continuous, i. e. notion of life-time within the mind.

Today, it is a well established fact that the notion of time is due to the memory function, and time transformations in autorhythmic brain structures⁸ are indeed responsible for the notion of past, present and future within the human mind. This is because memory functions do involve sequencing which requires duration (when an interval is longer i. e. lasts more than a few seconds, it no longer is directly perceivable as a whole, but its length can be estimated on the basis of memory functions), so our memory allows us to see reality to extend backwards and forwards in time.

In the eternal mystery of past and future, the latter is formulated⁹ and explained so: "If the future already exists, does it imply a completely deterministic world, devoid of free will? This is a delicate matter which touches on deep philosophical issues concerning the nature of reality and our consciousness of it, but in one sense at least the future is still indeterminate. In the subatomic domain, the quantum theory of matter implies that there are no rigid, mechanistic laws that connect the state of a system (e. g., an atom) at one moment to its state at a subsequent moment. Instead, many possible future states arise, each with a certain probability of being the future. Nature is thus a game of chance, and the world can choose from a myriad of branches. In one (somewhat unconventional) interpretation of quantum theory, not one, but every future branch is separately realized in a sort of multi-foliate reality of coexisting parallel worlds, so on this view time is continually bifurcating and the universe splits and resplits into a condition of cosmic schizophrenia. Thus, all futures are actual rather than potential".

Finally, memory being the channel (semiotically as well as physiologically) of information, it must be said that people forget some facts and "refabricate" the gaps between the ones they do remember accurately, they tend to adjust memory to suit their picture of the world. - "We fill in gaps in our memory using chains of events that are logically acceptable. Our biases, expectations and past knowledge are all used in the filling-in process, leading to distortions in what we remember." So all memories, even those dredged up by psychoanalysis or hypnosis, are apt to be skewed. Or, as Santayana might put it, those two remember the past are condemned to revise it.¹⁰

NOTES

- 1 Peirce, who spend most of his time developing semiotics, says about it himself in a letter to Lady Welby. "Know that from the day when at the age of twelve or thirteen I took up in my elder brother's room a copy of Whately's 'Logic' and asked him what logic was, and getting some simple answer, flung myself on the floor and buried myself in it, it has never been in my power to study anything - mathematics, gravitation, ... thermodynamics, optics, chemistry, astronomy, whist, men and women, wine, metrology - except as a study of semeiotic; ..."
- 2 Max Bense: "Vermittlung der Realitäten" (1976) and "Axiomatik und Semiotik" (1981), as well as Paper 9, 1976, of the Institut für Philosophie und Wissenschaftstheorie of the University of Stuttgart.
- 3 Semiosis; the function in which a sign is generated out of (triadic) sub-signs.
- 4 Joseph Weizenbaum: "Die Macht der Computer und die Ohnmacht der Vernunft". Suhrkamp Verlag, Frankfurt/M. 1977.
- 5 G. A. Kimble & N. Garmezy: "Principles of General Psychology", 3rd ed. University Textbooks, 1968.
- 6 A Newell & H. A. Simon: "Computer Simulation of Human Thinking", *Science*, 134: 2011-2017, 1961.
- 7 K. Popper & J. Eccles: "The Self and Its Brain". Springer International Verlag, 1977.
- 8 J. Zabar: "The Brain Clock", *Cybernetique Vol. 3, Journal of the Association Internationale de Cybernetique*, A.G.B.L., B-5000 Namur/Belgique.
- 9 P. C. W. Davies, "What is Time", *The Sciences*, 1979. *Journal of the U.S.A. Academy of Sciences*.
- 10 "Memory: The Unreliable Witness", by Elisabeth Loftus, psychologist at the University of Washington in Seattle. University Press, 1979.

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