Soviet Semiotics

AN ANTHOLOGY Edited, Translated, and with an Introduction by DANIEL P. LUCID

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Chapter
1

The Role of Semiotics in the Cybernetic Study of Man and Collective

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1. Semiotics, the theory of sign systems, arose at the junction of various sciences that investigate the sign systems used in human society: the natural languages studied by linguistics, the artificial formalized languages analyzed in mathematical logic, and others.[1]

Any sign requires the presence of a signifying, material aspect by which the sign can be perceived by human sense organs or the appropriate instruments and a signified aspect or meaning that correlates the sign with certain objects situated outside the sign system. For example, for the signs of street signals, the colored signals (yellow, green, red) are the signifying aspect, and the messages ("go," "stop") are the signified aspect. For the words of natural language, a sequence of acoustic signals (spoken language) or optical signals (written language) is the signifying aspect, and a word's meaning, defined by translation into another language or correlation with extralinguistic objects, is the signified aspect.

In various processes of recoding or translation, only the sign's signifying aspect changes, while the signified aspect or meaning remains unchanged (for example, when a word of written language is presented in a cipher code); Shannon defined meaning accordingly as the invariant in mutually synonymous operations of translation and recoding. In work with the handicapped, it may be physically impossible to employ the usual linguistic signs, but one has recourse to variants that retain the same set of meanings, although the signs have a different material aspect, as in the tactile language of the blind-deaf-and-dumb.

For this reason, it proves possible to insert the diverse signs used in human society into a computer and to employ the machine for various operations on signs and sign systems such as machine translation, machine review, and machine demonstration of theorems. Of course, as Oettinger formulated most distinctly, in this instance numbers are only

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a means of codifying other signs, such as the words of language or the signs of the formalized languages of mathematical logic utilized in computers; therefore, it is advisable to speak not only of computing machines, but also of semiotic machines.

2. From the viewpoint of contemporary cybernetics and semiotics, man can be described as a mechanism that performs operations on signs and sign sequences. Similarities and differences between the working of brain and computer pose the question, "people or machines?" Similarities and differences between human and animal behavior and intellectual activity pose the closely related question, "people or animals?" These questions amount for the most part to investigation of the relation between the sign systems used in human society and the sign systems employed in modern machines and animal signalization.

Recently discovered data on signalization in animals such as bees, dolphins, and chimpanzees make it possible to ascertain a number of important distinctions between these systems of signalization and the sign systems, including natural language, used in human society. Animal signalization is characterized by the absence of different levels within each sign system. For animals, each signal is indivisible, in contrast to human language, which distinguishes the level of phonemes or letters of the alphabet, the level of words, the level of syntagms, and so on. Moreover, usually only one system of signalization is used within an animal collective, in contrast to human collectives, which have diverse sign systems serving the same collective. Chimpanzees constitute one of the rare exceptions: they display a potential for parallel utilization of acoustic and optical systems of signalization. Chimpanzees also reveal a closer analogy to human semiotic systems in other respects, and can be supposed to possess an analogue to the cultural-historical mode of transmitting information in time as well as possessing the genetic mode of transmitting information that seems to prevail without exception in all other animals except the anthropoid apes.

One of the most important distinctions between animal signalization and human natural language is that for animals each signal is correlated with one strictly defined class of situation, comparable to the air raid signal in the human collective. In this respect, animal signalization is more similar to those formalized languages used in modern machines and pertaining to a limited sphere of objects than to natural languages, in which each sign can have any meaning with the sole stipulation being that it must not be confused with other signs that belong to the same local vocabulary; thus it is prohibited to confuse words such as "salt," "pepper," and "mustard," but the word "salt" can acquire other meanings in a specific context: for instance, in the expression "salt of the earth" in poetic language.

The earliest stages in the development of the language of an individual or of a whole collective are typified by a complexity of meanings in which a sign or word functions as the family name for an entire complex of heterogeneous objects. This phenomenon occurs both in baby talk and in the languages of certain Australian tribes that retain extremely archaic features. In the Aranda language, the same word is used to mean "roots of the water lily covered by water," "human bones," "who?," "sleeping people," and "night," which are united by the common trait, "relation to the invisible and unapparent." A similar complexity of meanings is found not only in normal development but in the pathology of dissociation and in the language of schizophrenics. In the subsequent development of language and of human intellectual activity, complex meanings remain characteristic of everyday conversational language, poetic language, and the language of the human sciences, but there are also meanings that are formed in correlation with strictly defined fields of subject matter.

Scientific development comes about by means of the continual interaction of scientific languages, which are formalized or are being formalized, with nonformalized natural language; the latter, because it lacks a whole number of fixed semantic restrictions, can describe the entire diversity of human experience, including phenomena that still cannot be described scientifically or can no longer be described scientifically as a result of human errors. Natural language remains the fundamental interpretation for all the formalized languages constructed upon it. Indeed, possession of natural language and the sign systems constructed upon it is the specific particularity of man. Therefore, machines could only be included definitively in human society if the problem of teaching natural language to machines were solved, a prospect that lends the greatest theoretical interest to research in the fields of machine translation and the vocal control of automata.

The strictly human features that distinguish man from animal can be defined wholly in terms of specifically human sign systems that allow man to take part in a collective. This distinction is demonstrated by pathological cases in which man does not learn language and can be observed by comparing the blind-deaf-and-dumb who have not received linguistic instruction with those who have been instructed.

It follows that the human sciences, which study man, must begin by examining semiotic problems.

3. As the outstanding Soviet psychologist L. S. Vygotskij observed in the 1930s, signs are a means of controlling human behavior.[2] Man cannot govern his own behavior directly and creates signs in order to control it indirectly. The history of culture can be described to a great extent as the transmission in time of sign systems serving to control

behavior. Semiotic systems for the programmed control of human behavior are elaborated due to the internalization of external signs, a process that can be partly compared to the automation of programming. This process can be traced most distinctly in the emergence of internal speech. Investigation of children's speech makes it possible to ascertain that speech arises initially only as a means of communication and a way for adults to control the infant's behavior.

The collective monologue of children is an intermediate form of speech found between speech as a means of communication and "mute" internal speech; in the collective monologue, each infant delivers a monologue but maintains the fiction of communication and of the presence of potential interlocutors. This "egocentric children's speech" has parallels in the surviving archaic features of linguistic behavior in certain tribes. The next stage, immediately preceding internal speech, is the speech that the infant utters aloud before falling asleep and that requires the absence of an audience; this form of speech has been explored only in recent years by means of tape recordings.

Internal speech, which plays a determining role in controlling the behavior of adults, can thus be considered a result of the internalization of external sign sequences. Internal speech and learning one's native language are examples of programs that are introduced into man and then automatically, unconsciously, determine his behavior for the duration of his life. This process can also be observed in other internal sign systems, including the unconscious symbolism studied by Freud. These unconscious sign systems are formed in man at an early age and are analogous to the amply documented biological phenomenon of "imprinting" first impressions, which then determine an animal's behavior to the extent that it is not genetically predetermined.

A fundamental fact to consider in comparing brain and machine is that a man's behavior is determined by programs introduced into him by the collective; of course this collective programming follows the predetermining transmission of genetic codes. A machine that has not been programmed can be compared to an infant's brain in the early stages of development. It would be vitally important to compare successively the potential for instruction in machines and man; in this comparison, man should be considered to be an automaton that undergoes prolonged instruction simultaneously with the autoconstruction of biological development or growth. Therefore research on training autoconstructing automata, such as those studied by J. von Neumann and A. N. Kolmogorov, would have particular significance for a comparison between man and machine.

4. It follows that analysis of sign systems is one of the chief means of studying man; semiotics erects a bridge between the human sciences,

experimental psychology, physiology, and other natural sciences engaged in the study of man.

Formal description of human linguistic intuition is a basic task of current mathematical linguistics and presents in manifest form those unconscious behavioral programs that permit man to construct and understand meaningful linguistic texts. The tasks being addressed in mathematical linguistics are similar to those encountered in the last decade by the conscious investigation of scientific language in logical research and in studies on the metatheories of the individual sciences, and also to the tasks of recognizing unconscious behavioral programs.

The study of human linguistic behavioral programs now makes it possible to solve problems that involve linguistics, experimental psychology, and physiology: assessment of the depth of memory of a finite automaton that generates propositions and of its dependence on the proposition's depth in Ynvge's sense; investigation of the way man discerns speech by accumulating signals on various levels; creating programs for the construction of speech movements; and determination of the dependence of disorders involving the separate levels of language and other semiotic systems on diseases affecting various areas of the cerebrum. Also, linguistic research stimulated by the problems of constructing an intermediary language for machine translation is now beginning to ascertain those common features of all human languages that should all be explained in the end by certain common features of the organization of the human nervous system and by common features of all human collectives.

In order to state the problem of the automatic decipherment of an unknown language with any exactitude, there must be an explicit formulation of those properties that lie at the basis of the human researcher's intuition and are founded on the common properties of all world languages. This problem is directly connected with the construction of languages for cosmic communication, which was carefully studied for the first time in a monograph by the Dutch mathematician Freudenthal. In studying this question, it is particularly important to isolate not only the common features of natural languages but also the common features of both natural and artificial languages, including the logical-informational languages constructed by machines. Linguistics and semiotics are now starting to concern themselves in earnest with methods for constructing new languages—future languages—as distinct from the past languages that were the main object of research in nineteenth-century historical linguistics and from the present languages that were the main object of research in descriptive linguistics of the first half of the twentieth century. Certain recent findings of mathematical linguistics make it possible to isolate common features and distinctions between

natural and logical languages; experiments in constructing intermediate languages lying between natural languages and the languages of mathematical logic have been particularly rewarding in this respect.

Certain peculiarities of the syntax of natural languages can be described as the result of a compromise between the task of expressing a specific logical content common to logical and natural languages, and the necessity of making use of the human nervous system, which imposes definite limitations on ways of expressing this content, specifically, limitations on the proposition's depth and some other syntactic parameters. Like a number of other mathematical-linguistic and physiological studies of recent years, such research has succeeded in investigating the correlation between the mechanism using a specific sign system and the organization of this sign system itself.

It seems that a number of essential features of human behavior can be described by applying a consistent semiotic viewpoint. A great many behavioral phenomena become intelligible according to the hypothesis that man elaborates every sequence of signals received by his sense organs as if it were a meaningful message; man is a decipherer and proceeds from a natural disposition to regard any message as meaningful. Thus, in ordinary linguistic communication, even obviously meaningless messages are perceived as meaningful, while attempts to interpret natural phenomena as signs are especially characteristic of earlier periods of human history. Another example of the semiotic approach to human behavior is offered by the analysis of dreams.

A human individual's potential can be evaluated by describing all the sign systems he can use, including both multilevel sign systems composed of natural and scientific languages and monolevel sign systems such as the various natural languages. In traumatic aphasia and speech disorders, it can be shown how organic changes in the brain lead to violation of the sign systems used by the individual and to a corresponding violation of behavior. Psychiatry furnishes similar clinical material pertaining to violation of the normal relations between various sign systems: for example, the special artificial languages of schizophrenics, or the case of hysterical behavior described by Freud in which a woman patient did not use her native language during her fits, but rather a foreign language she did not ordinarily employ. Each sign system an individual employs is used to transmit information and control behavior in situations linked to the performance of functions in the collective, and the individual as a whole can be described as the system that controls all of these sign systems. Therefore the cases investigated in psychiatry and social psychology of violation of the individual's normal functioning amount to loss of control of specific sign systems in their entirety, although part of these systems may be preserved.

5. A collective can be evaluated by describing all the sign systems of different levels used in it: natural languages, artificial languages, gesticulatory languages, etiquette, street signals, signboards, advertisements, scientific languages, religious ceremonies, monetary signs, clothes. In evaluating a collective, as in evaluating a single individual, it is important to look for possession of a maximum number of systems on different levels, from the simplest to the most complex, and also for the extent of their diffusion in the collective; often the proportion between the number of individuals possessing a specific system and the population of the entire collective depends on the level of the system, as can be seen especially in means of mass communication such as radio, television, cinema, and the press. The presence of different systems of the same level in the collective can serve as one of the ways of assessing its divisions.

The size of a collective's operative memory and the extent of its passive means of memorization can be assessed with the help of growing new disciplines such as information science, which is developing rapidly in connection with solving the problems of the automatic search for information and of the construction of languages for computers. The sign systems for the collective as a whole and for the individual person serve not only as a means of communication but also as a means of control, and thus define the role of semiotics in the cybernetic analysis of the collective. Given the presence within a collective C of a subcollective C^1, which is a subset of C and plays the role of a controlling system with respect to C, it is essential to ascertain which sign systems are used by C^1 as distinct from C (problems of social cryptography), which sign systems are common to C and C^1 (problems such as the special languages of the higher castes in India), and which sign systems are specific means on the part of C^1 for controlling C (mass communication).

In order to compare a collective in its entirety with automata or a collective of automata, it is essential to analyze the semiotic tasks undertaken by the collective. A. N. Kolmogorov's analyses of poetic language should be mentioned as one of the first attempts of this sort; his research has made it possible to move from general statements about the limited potential of cybernetic machines as compared to human collectives to precise analysis of the quantitative limitations that do not permit machines to create, for example, poetic texts of high artistic quality. In connection with this research, information theory and the theory of automata pose the problem of assessing the ever more complex tasks for which ever more complex automata are required; delays in task solution are assessed accordingly. Chomsky formulates an essentially similar task concerning language in analyzing the conditions necessary so that, as the parameter n defining the automaton's capacity is in-

creased, the mechanism $G_{(i,n)}$ would be able to understand in a definite sense an ever growing number of propositions generated by the grammar G_i. Chomsky describes language as having a more complex structure than previously supposed; his research not only assesses the complexity of the tasks one man accomplishes in speaking and hearing, as Chomsky himself mentions, but is also valuable for investigating the whole collective that is able to use the language which it has elaborated.

Experimental study on the possibilities of teaching languages to automata, for example, in a game situation, is particularly important theoretically in order to compare the role of language and other sign systems in collectives of humans and of automata. It is also essential to continue the experiments already initiated in zoopsychology on elaborating the sign systems of anthropoid apes in collective problem-solving.

6. The most important special problem of modern linguistics and semiotics is that of analyzing the different levels within a single sign system, or the relations between sign systems belonging to different levels; this problem does not lie so much at the junction of these sciences with other sciences as at the basis of all the tasks of linguistics-proper and semiotics-proper.

A more exact definition of the very concept of a sign presupposes studying the relation between different levels within a system and the relations between systems of different levels. The meaning of a sign entails the presence of a signified aspect without which it would be impossible to speak of a sign. This meaning can be defined in two ways: either by indicating equivalent signs on the same level within the same system—synonyms like "melancholy . . . sadness . . . grief . . . sorrow . . . ennui"—or by indicating equivalent signs on the same level in another system, such as another natural language, thus establishing equivalence on the basis of identity with respect to signs of a higher level, for example, signs of an intermediary language with an artificial semantics.

Description of the lowest levels of linguistic organization is directly linked to problems also posed in other sciences: thus, analysis of phonetic language on the level of distinctive elements (labial/nonlabial, nasal/nonnasal) is directly connected with research on the construction of vocal movements in physiology and with corresponding questions of speech perception in psycholinguistics. Modern linguistics has investigated higher organizational levels that are properly linguistic: i.e., the levels of phonemes, morphemes, words, and syntactic combinations of words.[3]

Nonetheless, until recent years the least-studied levels of language have been the highest ones, including the level of meaning, the corresponding level of semantic units of an intermediary language, and so on.

Yet analysis of these highest levels is a fundamental problem, both from a theoretical viewpoint, since any sign system serves above all to express meanings, and from a practical viewpoint, since all the fundamental tasks of the automatic processing of linguistic information amount to transmitting the same meaning while changing the linguistic means for its transmission. Moreover, the recently discovered high semantic redundancy of the majority of texts in natural languages makes the task of automatic review considerably more important than that of translation.

The situation is similar in the metatheories of sciences that have been analyzed as formal systems. The semantic aspect of the corresponding signs, which is particularly important for tasks of the automatic search for information, has been studied less than the syntactic aspect. The same has been true in analysis of the sign systems of poetic art, where purely formal levels, such as rhythm in poetry, have been examined with much greater precision and detail than the special poetic ways of modeling the world that constitute the highest level of the sign systems of verbal art. However, in recent years mathematical prosody has isolated rather distinctly the hierarchy of different levels that should be analyzed in poetics.

Research on relationships between the sign systems of different sciences, such as physics, chemistry, and biology, and between various levels within the sign system of a single science, poses a central question for human knowledge. Formal analysis of these relationships, and of relationships between scientific languages and the natural language in which an experiment is described, would render possible automation of the basic processes of human knowledge. It should be mentioned that modern science has inherited a hierarchical organization of knowledge from ancient Greek science, which rather clearly recognized the analogy between the hierarchy of levels describing nature and the hierarchy of linguistic levels. The regularities between various levels correspond to the real processes of encoding and decoding signs in using them. Thus the transformational rules that link the various levels of natural language in Chomsky's transformational grammar correspond to real features of discourse analysis and synthesis as carried out by people and automata. The psychological and physiological reality of linguistic levels is evidenced in cases where speech disorders destroy one level while retaining another: for example, the grammatical level may be destroyed while the lexical level is conserved, or vice versa; or the phonemic level may be destroyed while the semantic level is conserved, or vice versa. The following cases provide further evidence: the social stipulation that one level be removed while another is preserved, as in taboos; errors in normal linguistic behavior, such as not distinguishing between homonyms

that coincide on one level and differ on another; possibilities for constructing grammatically correct, marked sequences of words that are meaningless; and other instances of disjunction between the various levels in the actual use of sign systems. In poetry, disjunction between the various levels is common to all poets except the greatest ones, and it manifests itself in use of the sign's signifying aspect as an end in itself, a difference between the levels of meter and rhythm, and the phenomenon of "metrical homonymy."

In both descriptive and historical linguistics, the object of linguistic reconstruction is never language as a whole, but always a language divided into levels.

7. The basic function of every semiotic system is the modeling of the world. According to N. A. Bernštejn's cybernetic physiology of activity, every semiotic world model can also be regarded as a program for individual and collective behavior. The primacy of the behavioral program in a semiotic system as compared to all its other functions emerges with particular clarity in such extreme cases as the teaching of language to the deaf-dumb-and-blind. I. A. Sokoljanskij has shown that engaging the deaf-dumb-and-blind child in active behavior affecting the environment is a necessary prerequisite for such teaching; only gestures actively used in behavior affecting the environment can be used as signs.

Various semiotic systems possess diverse model-building roles. Moreover, the higher the system's model-building function and the larger the number of objects situated outside the system's borders that the system can nonetheless potentially include within its model, the harder it is to formalize it; compare, for example, the languages of mathematical logic with natural languages, or compare the games analyzed in game theory with more complex sign systems where game-like behavior is a function of the sign.

A sign system can only be formally analyzed by describing it in terms of a sign system, as in the use of metalanguage for the formal description of language; the descriptive sign system may be either the same as the described sign system or different and may be especially constructed for this purpose. In turn, the sign system used as a metalanguage can itself be examined only with the help of some metalanguage. Theoretically, this should lead to the construction of an infinite succession of metalanguages in order to describe the signified aspects of signs, but this theoretical possibility is not realized in man's actual use of sign systems due to properties that allow natural languages to be used as the basic human sign system and metalanguage for diverse other languages.

The world model constructed by a specific sign system is usually held in common by an entire collective and is introduced to each individual

who becomes a member of the collective. Moreover, those world models introduced to man at a sufficiently early age through instruction often function, both as world model and behavioral program, automatically and independently of how much they correspond to the conscious world models constructed by the individual at a later time. Therefore, recognition of these unconsciously functioning semiotic models and programs is a necessary prerequisite for the conscious control of individual and collective behavior.

8. The development of human sign systems in the individual (ontogenesis) or in mankind (phylogenesis) is brought about by increases in the number of different levels within the same system and in the number of levels of different systems. Hypothetically, human sign systems originate from an undifferentiated sign system, not yet divided into different levels, which may have been used several hundred thousand years ago by the ancestors of modern man as their sole semiotic modeling system. This primordial system was gradually articulated into an ever more complex network of diverse sign systems on different levels, each in turn forming its own hierarchy of levels. Different systems of the same level and systems of different levels are complementary with respect to each other and provide for the construction of a world model by means of an entire complex of semiotic systems.

The significance of the presence of several systems for the individual person's development can be observed in the extreme example, already mentioned above, of the development of sign systems in the blind-deaf-and-dumb. Here the accelerating growth of new sign systems constructed upon already assimilated systems can only begin after two systems of different levels, the hieroglyphic and alphabetical, have been formed and equivalence has been established between these systems. The normal development of the individual and the collective, particularly in the most recent collectives, manifests a similar process of the ever accelerating growth of new sign systems after the assimilation of several other systems whose signs have been ascertained to be equivalent.

The avalanching growth of sign systems during the past decade has presented increasing obstacles to the organization of the whole system in its entirety and has necessitated automation of translation between different sign sequences to adjust the effective functioning of the whole collective. Translation between natural languages is only one such task, while the most important task is translation between scientific languages and the construction of new artificial languages to accomplish this. Various sciences have prepared for these future syntheses of human and mechanical methods of constructing world models, and among them the first place rightfully belongs to semiotics.

NOTES

1. It is significant that the linguist Ferdinand de Saussure, father of modern structural linguistics, and the logician Charles Sanders Peirce, one of the founders of mathematical logic, concluded independently of one another that it was necessary to create a special science, semiotics.

2. L. S. Vygotskij's book, *Razvitie vysšix psixičeskix funkcij* [The development of the higher mental functions], which expounded this idea, was published posthumously only in 1960. See L. S. Vygotskij, *Psixologija iskusstva* [Psychology of art] (Moscow: Iskusstvo, 1965), pp. 352-55.

(Vygotskij's book on art has been translated into English as *The Psychology of Art* [Cambridge, Mass.: M.I.T. Press, 1971]—*Trans.*)

3. Level *E* in the terminology introduced by N. A. Bernštejn in his book *O postroenii dviženij* [The construction of movement] (Moscow, 1947).

Chapter
2

Foundations of General Semiotics

JU. K. LEKOMCEV

The rapid development of linguistics and descriptive semiotics in our time compels us to return to the foundations of general semiotics in order to specify and broaden their scope. The goal of the present essay is to delimit the particular aspects and problems involved.

1. *The Concept of Semiotics.* Semiotics is the science of sign systems transmitting information inside some social group; it is the science of communicative sign systems. The concepts of the individual and the social group, regarded as sets of communication channels to an individual or a social group, are important for semiotics, although they possibly lie outside its borders. Although semiotics is the science of communicative sign systems, many important phenomena relating to sign systems do not enter into it. These phenomena can be called quasi-semiotic. The scientific discipline that studies both semiotic and quasi-semiotic phenomena can be called episemiotics.

2. *Sources of General Semiotics.* Historically, semiotics was created by representatives from a narrow circle of scientific disciplines: philosophy, logic, and linguistics. However, profoundly semiotic ideas and results with important implications for semiotics arise from within many sciences. Let us cite, for example, some such ideas and experimentally obtained results: E. Durkheim's sociological concept of the internalization of societal norms, K. Goedel's theorems and Bardzini's subsequent results on the foundations of mathematics, Bohr's concept of the light signal's diffusion in the space-time continuum in the general theory of relativity and the Principle of Complementarity, findings on the encoding of impulses in neurophysiology, research on the formation of the reticula, research on animal behavior, particularly signaling systems, and much more.

In addition, many disciplines have come into being that are logically related to semiotics, but are narrowly specialized and have a mathematically oriented apparatus: information theory, code theory, game theory,

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