

Semiotics of the 20th century

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Abstract. Semiotic and linguistic studies of the 20th century have been important mostly in two senses — (1) they have opened a road for comparative research on the origin and development of language and other systems of signs adding a new dimension to the history of culture; (2) they have shown a possibility of uniting different fields of humanities around semiotics suggesting a way to trespass separation and atomisation of different trends in investigating culture. In the 21st century one may hope for closer integration of semiotics and exact and natural sciences. The points of intersection with the mathematical logic, computer science and information theory that already exist might lead to restructuring theoretical semiotics making it a coherent and methodologically rigid discipline. At the same time, the continuation of neurosemiotic studies promises a breakthrough in understanding those parts of the work of the brain that are most intimately connected to culture. From this point of view semiotics may play an outstanding role in the synthesis of biological science and humanities. In my mind that makes it a particularly important field of future research.¹

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My presentation consists of the three parts: in the first I discuss the results of the study of cultural prehistory and history of mankind viewed through the sign systems that were used at different periods; in the second I am giving a survey of the development of the science of signs in the 20th century; in the last part I am offering some suggestions about the possible nearest future of the science.

1. The origin and development of semiotic systems

The history of the achievements of human thought and culture is intimately connected to the rise and elaboration of signs and texts through which they have been expressed. Understanding of our language and other sign-systems constitutes a part of self-recognition necessary for our consciousness. Modern science is asking questions concerning the beginnings and evolution of the Universe, of our planet and of the self-conscious life on it; an interest in the origin and development of human sign systems is consistent with this general tendency to search for the roots. The main trends of semiotic research of this century have enriched our view of cultural history by enlarging the perspective on the development of signs. A brief summary of the most important results of these evolutionary investigations and of the problems still to be solved follows.

1.1. Biological communication systems

To understand the initial stage and the main direction of the development of human sign systems, it is necessary to study their evolutionary origins as seen in the pre-sign forms of the behavior of animals². A particularly interesting case is presented by the social insects. It is understandable that a large society needs some cybernetic network of control and information. The behavior of social insects that offers extremely interesting parallels to human societies is governed mostly by chemical signals. Signalization system of social insects rests on transmission of a restricted set of chemical substances (pheromones), which may be compared typologically to primitive forms of chemical regulation (perfumes, alcohol, drugs) in human societies.

But in the same societies that are controlled by the pheromones much more refined special systems of transmitting information evolved. Brilliant experiments by Frisch have shown the way dances

² Although designation *Zoosemiotics* as well as its alternative *Biosemiotics* became widely spread, it lacks sufficient scientific ground. It is still not proven whether really one can speak about signs (signifier, signified etc.) in respect to the systems of signals used by animals, see below on apes that might constitute an important exception (as probably also some marine mammals).

are used by bees to encode the information about a source of food (Frisch 1976).³ This language is specialized. It can transmit only information about a source of food, a direction of the flight towards it and a distance between it and the bee-hive; the message is never directed to a concrete individual, it is always addressed to everybody in the bee-hive⁴. There are two main types of dance. The general message about a rich source of food being available not far away from a bee-hive is given by a round dance: a bee is turning around, first to the right, then to the left and is repeating circles now and again for some time. To inform about a distant source of food a “tail-wagging” dance is used: a bee is running a short distance straight ahead wagging the abdomen rapidly from side to side, then makes a 360-degree turn to the right, again running in a straight line for some time and then turns to the left repeating the same pattern again. The distance to a bee-hive is rendered by a number of turns the bee makes.

The dance may be called a total performance addressing to several senses. It transmits an audio-visual message as the movements of a dancing bee produce sounds.⁵ But the odour of the food a specimen of

³ Such a writer of the beginning of the 20th century as Maeterlinck who was interested in the bees (and other social insects to each group of which he dedicated a special book) wrote also about ‘the intellect of flowers’ (*intelligence des fleurs*) in connection to the bee-flower interaction. From this point of view the signaling role of the colors and smells of plants (much later used in the human culture as a part of human sign systems) might be studied. But a systematic research on the pre-sign aspect of the world of plants might belong to the goals of sociobiological and semiotic experiments of the future century.

⁴ Principal differences from human natural language were examined in an article by Benveniste (1952) as well as in Hockett’s works (Hockett 1960).

⁵ An attempt to come to an equation connecting different values of the bees’ dances led to a formula in which the speed of sound appears. At one of the American cybernetic conferences of the time of the *Sturm und Drang* of cybernetics a remark was made that to a hypothetical bee-scientist this speed might have had an importance comparable to the speed of light in human physical theories. The interesting side of the joke refers to a probable link between the size of an organism and the speed limitations. In any case the bee is considered to be an example of a smallest (and particularly successful) flying creature already in the Hattic-Hittite myth of the God Telepinu (2nd mil. BC) in which it is opposed to the eagle as a large one. A particular role is ascribed to bees and honey not only in Greek mythology (where the influence of Ancient Oriental images seems possible), but in the other parts of the world as well. Here (as in many other cases) modern scientific interests were anticipated by the myths.

which is brought by a bee is transmitted directly during the tactile contact between the bees and the followers. It is like some types of advertising in modern society. Of all the different senses used during a dance, the optical one is the most important. The direction of flight is indicated with respect to the position of the Sun.⁶ During the running part of the tail-wagging dance the bee takes such a position that it sees the Sun at the same angle as during its previous flight to the feeding place. If a bee dances on a perpendicular honeycomb inside a hive, it is usually quite dark there. The bees cannot see the Sun, but rely instead on the direction of gravity. They orient the straight portion of the dance at the same angle to the direction of the gravitational force as the angle they have flown with the respect to the Sun in their previous flight to the source of food. In this sense one may speak about rudimentary applied astronomy and geometry among the bees. But this knowledge as well as the communicational possibilities are used only in connection with the specific goal of this system of transmitting information.

Among the animals that are considered to be on a higher level of evolution and have a much more complicated nervous system there are many who live mostly in large groups (like wolves or elephants). Communication between the members of such groups is important for the survival. In most known cases the systems of such signals (calls) are predominantly vocal (birds, marine mammals and primates are particularly important for a comparison with human sign systems).

1.2. Origin and development of human primary sign systems

By primary sign systems those that are directly realized by the signals perceived through senses (vision, hearing etc.) are understood as different from secondary sign systems encoded by the signs of another system⁷ (see on different types of secondary systems below, 1.3). As

⁶ The ability to use the Sun (and also an artificial source of light, e.g. a lamp in a dark room) as a sort of compass was discovered also for the ants by Felix Santschi (as early as in 1911), but only the bees inserted this kind of knowledge into their communication system.

⁷ The difference was introduced in the Moscow–Tartu semiotic school that used this terminology. The borders between the two types are not absolute, as, for

some types of signalization similar to human primary semiotic systems are known among the animals, particularly primates, it is possible to study their origin on a comparative base.

1.2.1. Gestures

Predominant use of gestures in connection to intellectual tasks characterizes large apes (chimpanzees, gorillas and orangutans). For all these high primates a particular importance of the visual mode is characteristic.⁸

To reconstruct the probable earliest types of gestural signalization of a common ancestor of humans and all the large apes (including orangutans whose split from the rest is dated more than 11 mill. years BP) recent observations on the communicational possibilities and learning of orangutans are particularly important. The experiments with a young orangutan Chantek made in 1979–1986 have been described in detail.⁹ Being immersed into a human cultural environment he acquired 127 gestural signs combining them later sometimes in groups of two signs following each other (chimpanzees in similar experiments could combine several signs although they were learning them more slowly than Chantek did). Situations in which Chantek signed were connected to food and drinking (a favorite topic of the ape-human symbolic interaction in all the experiments of the last decades), playing and some details of the everyday life. Each sign referred to a very large complex of objects linked through associations. Thus a sign referring to a bug could designate different insects, but also a picture of a graph shaped like a butterfly, tiny brown pieces of cat food, and small bits of feces. A sign denoting a dog referred also to pictures of a dog and of a cheetah and to some other animals

instance, some gestures may be receded in words (see below on numerals) and thus different sign systems are interrelated historically.

⁸ Gibbons (*Hylobates*) that are the closest relatives of the great apes use vocal signalization to much larger extent. It may be supposed that at some point in the evolution of the higher branch of primates there occurred a shift to gesture signalization and visual mode, traces of which can be seen in human traditions as well. Chimpanzees use vocal signals (calls), but their function is different from that of gestures.

⁹ An informative documentary film is also available.

(including orangutans on television and a tiger at the circus), to barking noises at the radio and to a noisy (“barking”) helicopter (Miles 1994: 528). Chantek preferred to use proper names and not pronouns while addressing people. That can be compared to a similar behavior of a small child experiencing difficulties in the use of personal pronouns and other shifters. In comparison to a human child an orangutan educated by his caretakers could reach the level of Piaget’s sensorimotor period moving towards the preoperational one.

Methodology and theoretical conclusions of many similar recent studies on the use of gestures and other visual (such as modern artificial computerized) systems of communication among common chimpanzees, pigmy chimpanzees (bonobos) and gorillas rest disputable. Still it seems that the number n of basic signs learned by apes in the human-ape interaction does not exceed two hundred:¹⁰

$$n \leq 2 \times 10^2. \quad (1)$$

A quantitative difference from the size of an average everyday vocabulary of any human language is very large: the latter includes no less than 2×10^3 words, the whole amount of the lexical items reaching up to 2×10^4 . But numerically and semantically analogous system was used by very small children (up to 3 years old) talking to adult members of an American Indian Comanche tribe. In this specialized language there are approximately $40 = 2^2 \times 10$ words that usually refer to a very broad range of objects: [’uma’] may be translated as “good; beautiful; let me do your hair; let me put a dress on you” (words of a mother addressed to her child), also “look, what a good dress! what a beautiful toy!”; the same word can designate any beautiful, colored or bright thing attractive for a child; it renders the colors “red”, “yellow”, “blue” (Casagrande 1965: 245–246).¹¹ A necessity to refer with one

¹⁰ According to some preliminary data the largest number of signs has been found in gorilla-human communication (Patterson, Linden 1981), but one should distinguish between the basic set of signs and one-time compounds (cf. Terrace 1984).

¹¹ A sign [’] refers to a glottal stop as in a dialectal American English [wo’e] instead of ‘water’. It seems that a small vocabulary may be a characteristic feature of such “pidgins” created to facilitate the interaction between creatures with different communicational capacities. From the same point of view the sets of words (mostly interjections, very often of onomatopoeic character, but also equivalents of proper names) used in addressing different domestic animals in

sign to many different objects may be a result of these quantitative limitations. Such objects are linked to each other by associations that are far from being logical; a comparison to “complex thinking” of a child as described by Vygotskij suggests itself.

In some cases the associations used by chimpanzees are of the same kind as those of orangutans: a sign denoting a dog is also used for barking. Chimpanzees are able to create new combinations of signs. Thus instead of the standard combination {“cold” + “box”} suggested by Gardners to Washoe to denote refrigerator she invented herself another one: {“open” + “food”+ “drink”} (Gardner, Gardner 1972: 38). In comparable data on the communication with a gorilla (Koko in F. Patterson’s experiments) particularly interesting are the cases where she tries to deceive a teacher transmitting a lie or probably joking, but at the same showing some elements of logical thinking when she acknowledges her lie. Particularly interesting are the unexpected linguistic successes of a pigmy chimpanzee (bonobo) Kanzi. In his early childhood he had learned meaning of several oral sentences of English and could fulfill the tasks given to him orally using at the same time a whole set of possible combinations of signs of an artificial visual system of communication that he had understood himself by observation without special teaching directed at him (Savage-Rumbaux, Lewin 1994).¹²

Such studies have shown the ability of apes to imitate, partly develop and distort communication systems taught to them by humans in artificial conditions. Much more rewarding should be the data on gestural communication of large apes in natural environment. Some of the common gestures of gorillas are comparable to those of humans, as for instance, iconic signs representing the degree of social closeness between individuals by the spatial relations (signs similar to handshake and embrace). But some of such signs that might have been inherited (genetically or culturally) have different functions; thus, a sign of putting out one’s tongue means extreme surprise among gorillas and in some human cultures of the Far East, but has another

different languages (first of all in specialized dialects of cattle-breeders) might become particularly interesting.

¹² On a possible explanation of Kanzi’s abilities connected to his exposure to English at an early age cf. Deacon 1997: 126–127. Kanzi’s passive understanding of human vocal commands that he could not reproduce reminds similar possibilities of some dogs.

(offensive) meaning in Europe. Such comparisons are still isolated as there is no systematic description of natural sign systems of different cultural groups of large apes.

Studies in primate communication made it possible to suppose that gestures were more important for the intellectual operations of early hominids although they coexisted with a relatively small number of sound signals (calls, similar to those used by some other high mammals) that had not yet developed into a phonemic language. The common origin of the latter and the gestural communication may be reflected in the relation between the modern systems of gestures and the left (dominant) hemisphere (Poizner, Klima, Bellugi 1987). The emerging difference between gestural communication and human acoustic codes (language, songs and music) has been crucial for the emergence of human brain.

Languages of gestures belong to those systems of signs that are widely used as substitute of natural language. For the mankind not only linguistic diversity but coexistence of different semiotic systems seems to be very important starting with the earliest periods of history. In modern societies gestures substitute natural phonemic language only in some pathological cases (such as the communication of deaf-mute people¹³) as well as in some exceptional social situations.¹⁴ But the extraordinary importance of this type of semiotic systems not only for communication (particularly between tribes speaking different phonemic languages), but also for the archaic intellectual processes still might have been observed among American Indians in the previous century. The great American anthropologist Cushing (1857–1900) who had been introduced into the mysteries of the Zuñi tribe performed an experiment that Lévy-Brühl called possible for a genius only: he achieved the formation of manual concepts connected to gestures¹⁵; it was only in our century that the experiment was

¹³ For semiotic studies particularly important were the works of A. I. Sokolianskij and his followers on blind-deaf-mutes, see Ivanov 1998: 490–494. Through this example, it proved possible to study relations between different (hieroglyphic and alphabetical) sign systems and the ways to acquire one of them after another.

¹⁴ For instance, a prohibition to speak is observed by members of some monastic orders. A similar substitution of the oral language by a gestural one is observed in connection with funerary rites and some other rituals among the Aranta tribe in Australia.

¹⁵ In a recently published letter of 1880, Cushing wrote that among the Zunis “a most elaborate gesticulation accompanies excited or emphatic oral demonstrations

appreciated and repeated by the great Russian cinema-maker and a forerunner of semiotics Sergei Eisenstein who was fascinated with Cushing's discovery.

To the areas in which for a long time gestural signs had coexisted with their synonyms in natural language (originally their own linguistic names) belonged the system of finger counting (Cushing 1892).¹⁶ The link between counting and gestures of fingers goes back to the period when the left temporal zone of the brain of *Homo sapiens sapiens* was shaped. A damage to this zone may result both in finger agnosia (incapacity to recognize one's own fingers) and aculculia (incapacity to count).¹⁷ As Vygotskij remarked in his studies on the fossilized traces of ancient signs in the behavior of modern men, early finger counting is an elementary form of cultural arithmetic. It appears both among small children in modern cities and in the ancient societies such as the Egyptian one where it was necessary to show one's ability for finger counting to reach the privileged position in the Netherworld.¹⁸ Most native peoples of Australia and

— yet many of the signs thus used being too artificial to have had origin in simple natural conceptions, and from this not only but also from their close affinity to those of other tribes, we must infer that they have been remotely acquired or at least that they are survivals of an ancient intertribal gesture speech" (Cushing 1990: 98–99).

¹⁶ In a recently published manuscript *On Zuni language* Cushing remarked that "the Zunis, although they have the words for the expression of numbers [...] always use the fingers in counting" (Cushing 1990: 106). From the linguistic designations of numbers and fingers he reconstructed "the time when the Zunis or their ancestors could not express the number without the use of the fingers" (Cushing 1990: 107; cf. also Cushing 1892: 292–296).

¹⁷ Combination of these deficiencies with the loss of the binary spatial opposition left-right and also with agraphia (damage done to writing) was called "Gerstmann syndrome" after the German neurologist who discovered it in 1930. Later studies have shown that each of these incapacities may appear isolated also. Nevertheless, for cooperation of cultural and neurosemiotic studies it seems important that all these different abilities are shown to be represented in the same area of the brain. As to writing, its possible original link to counting is supposed by the recent discoveries discussed below. Particularly interesting is the possibility to connect these features of the parietal zone of the dominant hemisphere of the human brain to the partly similar spatial incapacities (unilateral neglect) found in case of a damage to corresponding parietal zones of the brain of monkeys. Here it is possible to suggest a way from the earlier spatial capacities to those connected to such special human semiotic gifts as counting and writing.

the Pacific area have continued to use similar archaic systems of body parts counting until 20th century and it may be supposed that in this particular area a shift from gestural code to oral language occurred relatively late.¹⁹

1.2.2. Acoustic signals. Natural language

To discover the order in which different sign systems might have developed in the course of human history and prehistory one may try to combine data of biological sciences including molecular biology and those of linguistics and other semiotic disciplines. Some numerical characteristics of systems of the vertebrate communication make it possible to reconstruct the earliest stage of the prehistory. In all these systems the number n of different signals can be expressed by the inequality (2)²⁰:

$$10 \leq n \leq 50 \quad (2)$$

¹⁸ In an ancient Egyptian conjuration studied by Sethe a dead king asks a ferryman (a double of the Greek Kharon) to take him to the Eastern part of the channel in the Otherworld. The ferryman retorts: "Have not you brought a man who can not count his fingers?" In reply to this the king recites a poem in which each line corresponds to a finger and the order of lines is determined by the pattern of the ancient Egyptian finger counting. In modern Coptic tradition continuing the ancient Egyptian one, gestures are still used in the system of organizing musical performance partly similar to modern conducting. In Egypt starting from the Dynasty period and later, pictographic and hieroglyphic (logographic) signs were used which represented archaic gestures corresponding to musical scores and designated to conduct musicians (as it is continued also in the modern Coptic tradition, cf. Coptic "PTΩPE", that means "to clap hands, to sing accompanying song with gestures". In ancient Egyptian "*ir tr*"= "dance", "...*rr*" = "hand"). The expression "to sing with a hand" is attested already in ancient Egyptian hymn to the river Nile. Gestural signs connected to music find parallels in Egyptian gestures linked to counting and in "manual concepts" of many archaic cultures.

¹⁹ In such modern languages as English the old gestural counting system can still be discovered through the etymology of terms for 5 and 10.

²⁰ Those systems that have been taught by humans to apes in the experiments discussed above are much larger. But it has still to be investigated whether anything comparable might be found in the natural environment (such suggestions were made, for instance, about bonobos, but they have not been confirmed by actual observation).

As the average number of the signals in different primate vocal communication systems is around 40 it can be supposed that the main difference in the process of hominisation consisted of the change of the level of organization. The number m of the elementary sound units or phonemes in different languages of the world can be expressed by the inequality (3)²¹:

$$10 \leq m \leq 85 \quad (3)$$

The number of the elementary sound signals has remained the same as in the other vocal primate communication systems. But in the latter each of these units has a certain semantic function. Each of them refers to some situations that are important for the whole group of animals (for instance, a signal of danger). Phonemes of human natural languages do not have a direct semantic function. They are combined into sequences rendering certain meanings. In modern languages a relatively small number of phonemes m is used to produce many thousand words.²²

²¹ The smallest number of phonemes ($10 \leq m \leq 15$) is known in the languages of Pacific area from the Ainu language on the Hokkaido island in the north to Polynesian languages of the Austronesian family in the south (the amazingly small number of consonants in these languages was discussed from this geographical point of view by Haudricourt) and also in some parts of the Amazonian zone in Southern America (originally maybe connected to the Pacific area) as well as those Australian languages that have only one series of stops. The largest known number of phonemes is represented by Modern North-Western Caucasian languages as Abkhazian and its dialects with $m \approx 80$ (or exactly 82) phonemes. For the protolanguage of the whole North Caucasian family a very rich system with a comparable number of consonantal phonemes has been reconstructed. Thus it seems that the rich consonant systems have been characteristic of the Caucasian area for last several thousand years.

²² Roman Jakobson and Claude Lévi-Strauss supposed that such creation of multi-level systems on the base of much simpler ones inherited from the previous stages of development is characteristic not only of the development of language but as well of the other aspects of human cultural evolution (such as tools to produce tools and the incest prohibition with its social consequences) specific for man only.

A long discussion on the anatomical possibility of an oral phonemic language for Neanderthals has not lead to a definite conclusion.²³ It is supposed that some development of an inferior frontal lobule in the Broca area as well as of the inferior parietal lobule corresponding to Wernicke area is observed already on the endocasts from the skulls of *Homo habilis* that may point to a progress in linguistic capacities connected to these speech zones. But they might have been connected initially not only to vocal calls, but to other signs (for instance, gestural). A definite conclusion on the functional asymmetry of the brain and a probable dominance of the oral language connected to the left hemisphere may be made on the base of the skulls of the humans of the Upper Paleolithic time. Connecting data of physical anthropology, archaeology, paleoneurology and molecular genetics several scholars have started the investigation of a probable ancient distribution of the varieties of language of *Homo sapiens sapiens*. Data of other sciences can be linked to those of comparative linguistics.

Classical Indo-European comparative grammar created and developed in the 19th century was successful in reconstructing a common ancestor of a whole family of languages. In the late 19th and 20th centuries these methods were applied to most of the languages of the world that gave a picture of their history in the last millenia. In the 1950s and 1960s an important achievement was made by the American linguist Moris Swadesh (1909–1967) and his followers who introduced lexicostatistical methods of establishing glottochronology of cognate languages by finding percent of historically identical words belonging to lists of 200 or 100 most often used basic terms (such as, for instance, ‘to come’, ‘to drink’, ‘long’, ‘black’ etc.).²⁴ The calculated time t between the present (or the moment when the vocabulary is observed) and the split of dialects of an ancestral language giving rise to its descendants is estimated according to the formula (4):

²³ Lieberman (1984, 1991) suggested that the structure of a reconstructed throat excludes possibilities of a human-like speech; but it was supposed that a recently found Neanderthal hyoid bone was compatible with an oral language.

²⁴ The empirical conclusion on a relative stability of the basic vocabulary is corroborated by the necessity to continue contact between generations starting with the age when the native language is learned. In the last decade methods of computational cladistics have also been applied to find formal criteria of the degree of closeness of related languages.

$$t = \log C / 2 \log r \quad (4)$$

where C is the portion of coinciding words in the lists for both languages and r is a coefficient of preserving the basic vocabulary for an interval of historical time (empirically deduced as 0.81 to 0.86 in one thousand years). Glottochronology has shown an approximate age of many known linguistic families and the degree of lexical closeness between their members inside each family. But this technique works safely only if the distance between languages is measured no more than by 5–7 thousand years; otherwise the number of disappearing words grows and the results would become less reliable. For theoretical studies of the approaches to the category of time in the science of the 20th century it seems interesting to notice parallel use of quantitative methods to establish linguistic time in glottochronology and the molecular clock in the genetical studies comparing corresponding parts of genomes of related species.

Most of the existing and known (dead written) languages are grouped into several hundreds of linguistic families. Dispersal of most of them has taken place relatively late. That means that the proto-languages of these families (their hypothetical ancestors) had existed no earlier than some millenia ago (and thus the lexicostatistical method can be successfully applied to them).

The next step permitting an in-depth reconstruction has been inaugurated by Vladislav M. Illich-Svitych (1934–1966). Developing the idea put forward by the great Danish scholar Holger Pedersen (1867–1953), Illich-Svitych (e.g. 1989, 1990) has laid foundation for an exact comparative study of the *Nostratic* macro-family that includes as its separate branches Indo-European, Kartvelian (Southern Caucasian including Georgian and Svanetian)²⁵, Uralic (Finno-Ugrian and Samoyed)²⁶, Altaic (Turkic and Mongolian, Tungus-Manchu,

²⁵ Some amazing coincidences of Kartvelian and Indo-European had been discovered already by the founder of the Indo-European comparative grammar Franz Bopp who dedicated his last book to this question. In the 20th century Gamkrelidze and Machavarini have demonstrated the extraordinary similarity of the whole systems of Indo-European and Proto-Kartvelian nominal derivation and root structure.

²⁶ Yukagir (now spoken by few people in the North of Siberia) seems to be an archaic language distantly related to Uralic. Close connections between Uralic

Korean and Japanese), Dravidian²⁷ and probably Afro-Asiatic (Semitic-Chamitic including Semitic, Ancient Egyptian, Cushitic, Berber, Chadic and Omotic) family²⁸. The new aspect of comparative studies of a macro-family introduced by Illich-Svitych consisted in a rigorous phonetic comparison of the reconstructed protolanguages of separate families included into a larger unit. The technique of comparison and reconstruction is the same as in the traditional historical linguistics, but the objects of study are pushed back at the temporal distance that exceeds that of the previous comparisons more than twice (the estimated time of Proto-Indo-European — 4000–5000 yr, the estimated time of Proto-Nostratic — more than 10,000 yr)²⁹. A similar attempt to reconstruct a large macro-family has also been made

and Indo-European were first discovered by the Swedish scholar Collinder and studied later by the Slovene scholar Chop and the Finnish linguist Koivulehto.

²⁷ According to McAlpin's hypothesis, Dravidian is related to Elamite, one of the ancient Oriental languages attested in a very old series of monuments (in the Western Iran). Although several group of researchers attempting to decipher the Proto-Indian inscriptions of 3–2 mill. BC suggest a Dravidian character of their language, there is no definite reading of the texts as yet.

²⁸ Some scholars following Illich-Svitych suppose that Afro-Asiatic is included into Nostratic while according to another point of view it is a separate macro-family but distantly related to Nostratic. Several scholars include also Eskimo-Aleut and Chukchee-Koryak families into the Nostratic macro-family.

²⁹ As the methods of Illich-Svitych and his strict followers are not different from those used in the traditional historical linguistics, a certain neglect of the achievements of this school seen in many American linguistic publications can hardly be defended. There are still several real methodological problems in connection to the long-distance reconstruction of macro-families. First, as the number of words (or morphs) being substituted by innovations or borrowings grows, only few elements remain on which the comparison should rest. Second, for a very distant time some objects might have become cultural achievements, the names of which might have been interborrowed. Third, as the long-distance reconstruction depends on the comparison of protolanguages the unsafe results of the latter might be detrimental to the more distant studies. Another problem is connected to the possibility to demonstrate main macro-families by multilateral comparison of lexical items as attempted by Greenberg in respect to languages of Africa (where his classification has been accepted by specialists), America (rejected by many specialists; a similar hypothesis was hinted at by Sapir and developed 25 years ago by E. Matheson using traditional technique of reconstruction) and the Indo-Pacific area (where most languages, as Papua groups on the New Guinea) are still not sufficiently known; the last suggestion partly coincides with the one made later by Wurm.

concerning the family that includes Northern-Caucasian³⁰, Yenisseyan³¹, Sino-Tibetan and probably Na-Dene³². It can be supposed that all the known languages of the world are descendants of no more than 10 macro-families such as (besides those enumerated above) Khoi-San³³, Niger-Kordofanian (including Benue-Congo to which belong all the widely spread Bantoid and Bantu languages), Nilo-Saharan³⁴,

³⁰ The comparative grammar of North Caucasian has been built by the great Russian *émigré* scholar Prince Nikolai Trubetzkoy and developed recently by Nikolaev and Starostin (Nikolaev, Starostin 1994). As shown by Diakonoff (1983) and Starostin, Human (attested in the 3rd–2nd mill. BC in Northern Syria, Northern Mesopotamia and Asia Minor) and Urartian (documents in the area of the Lake Van and Armenia, 1st mill. BC) belonged to the same family; a similar hypothesis seems to be proven in connection to Hattic (a sacred language of the Hittite Empire, dead by the beginning of the 2nd mill. BC). Northern Caucasian origin of Etruscan (brought to Italy from Asia Minor) is not yet definitely shown, as the texts have not been interpreted. A hypothesis on a relationship of North-Caucasian and Basque is been discussed, but the definite proof has not been given.

³¹ Now the family is represented only by the Ket language spoken by several hundreds people in the Western Siberia. In 1962 I had yet an occasion to work with the old women who were the last speakers of a related Yug language that disappeared several years after that. In the 19th century castren described Kot that belonged to the same family, but was dead soon after he had made his notes. Words and forms of some other languages and dialects of the same group have been written down by travellers in the 18th century. As the brilliant scholar A. P. Dulson has shown, in the old times the rivers of the Northern part of Central Asia had names related to Yenisseian words for river and water. That proves the wider spread of the family before it had been ousted by the newcomers. A distantly related language of the same macro-family Burushaski (in the Himalayan mountains) has some grammatical features reminding of Yenisseian.

³² The idea of Sapir concerning a Sino-Tibetan connection of Na-Dene has been revived in the recent studies. But some specialists (without relevant arguments) generalized fashionable scepticism suggesting some faults in the Na-Dene reconstruction as well.

³³ This group of languages (including so called Bushman and Hottentot) has a chance to be the only relic trace of the speech of original African population and thus may be crucial for the picture of the early development of human language. Unfortunately these languages have not been studied thoroughly enough and may soon disappear. Thus an international endeavour at their description seems to be among the urgent tasks of the linguists of the future century.

³⁴ A hypothesis on a possible larger macro-macro-family — “Congo-Saharan” (previously called “Sudan”) including both Niger-Kordofanian and Nilo-Saharan has not yet been widely accepted. As there are some features common to Afro-

Austro-Thai (to which belong the Austro-Asiatic and Thai languages of the Southern Asia and the Austronesian languages of the Pacific islands), Australian and Amerindian. The recent comparative historical research on large macro-families of Eurasian languages suggests a possible common origin of all of them although the whole problem of long-distance linguistic relationship has remained controversial. If the hypothesis on the common origin of such macro-families as Nostratic, Afro-Asiatic, Sino-Tibetan-Yeniseian-Northern-Caucasian is proven, it might be connected to the idea of the African homeland of *Homo sapiens sapiens*.³⁵ The genetic data on the oldest waves of the dispersal of the early humans migrating from Africa seem to correspond to recent linguistic hypotheses (Cavalli-Sforza, Menozzi, Piazza 1994).³⁶ Differentiation of languages and the dispersal of original macro-families was the result of later movements across Eurasia and the other continents. For a period after the Neolithic revolution a spread and dispersal of macro-families and

Asiatic and Niger-Kordofanian, one may speak about a chain relating all the groups of the languages of Africa with the exception of Khoi-San. It is exactly this isolated position that makes the latter a particularly important object for historical studies.

³⁵ In that sense the myth about the existence of one language in the earliest times such as can be found already in the Sumerian texts and is continued in the story of the tower of Babel, anticipated modern scholarly research. While supposing that the existing linguistic families (with some possible exceptions, cf. above on Khoi-San as a probable trace of those African languages that had remained in Africa) go back to a single language, modern scholars do not exclude the possibility of the disappearance of some of the most ancient languages. The over-all picture is not yet quite clear because many of existing (and rapidly dying out) languages have not yet been described and several old languages were put down in the written form that has not yet been deciphered (for instance the Cretan Linear A and Hieroglyphic writing, an unknown writing system of the Central Asia of 1 mill. BC many monuments of which have been recently found etc.). The place of several culturally important languages (for instance, Sumerian) and of several unclassified ones (as Ainu that has been spoken on the islands Sahalin and Hokkaido) in the whole scheme has not been found.

³⁶ Not only cultural achievements, but also natural catastrophes (such as the cyclic warming of the Central Asian climate or a sudden flooding of the Black Sea around 5500 yr BC) might have caused migrations of the type found in the history of the speakers of Indo-European dialects. A return to the idea of the importance of catastrophes seems a feature of the recent development of several sciences.

families having split from the former is connected to the diffusion of new inventions and explained by economic trends.³⁷

Modern studies of endangered languages suggest that no more than 600 languages out of 6,000 that exist in the world may survive in the next generation (Robins, Uhlenbeck 1991). This possible catastrophe of the nearest future might be even more serious than the one studied by the specialists in ecology. Mankind is rapidly losing the degree of linguistic diversity that it had for last thousands of years.

As it is supposed that a large part of the world's population will live in large cities in the 20th century, the future of linguistic and other semiotic systems will depend of the urban situation. We may identify two main types of the large city in the last 9 millennia of the history of civilization. The first type is characterized mainly by the linguistic diversity of the population. A large city of this type was either at least bilingual in its oral and/or written linguistic network of communication or multilingual like already the large cities of the ancient Western Asia starting with Ebla (Northern Syria, the middle of the 3rd mill. BC), Ugarit (Northern Syria, 14th–15th century BC) etc. In the second type of cities the semiotic diversity is normal, whereas the linguistic one may be minimal or reduced (as Athens of the 5th c. B.C. where most of the semiotic systems of European arts and sciences have been founded). In post-industrial American large cities, such as New York, Boston, Chicago, as well as in the large cities of California, both types are united. The linguistic diversity in its utmost form (approximately 150 different languages in Boston, etc.³⁸) coexists with a very large number of specialized semiotic systems (of religions, sciences, humanities, arts), including the mass media and other sign systems (such as advertising, traffic signals etc.) that are addressed to the average citizen. However, there have been no large

³⁷ Recent series of studies by Colin Renfrew (1996), Peter Bellwood (1997), and other scholars. Renfrew uses the conclusions of Johanna Nichols on the difference between the languages having spread at the early times and those which might have diffused much later in connection to the technological achievements. These results are based mostly on typological data.

³⁸ In Los Angeles no less than 200 languages are spoken, with more than 10 of them having a large number of speakers from several millions (Spanish being second only to English) to several hundreds thousands (Armenian, Persian, Mandarin and Cantonese Chinese, Japanese, Vietnamese, Tagalog, Khmer, Russian).

cities without a complex network of linguistic and/or other signs — a network comprised of no less than two (and usually more) systems of such signs.

1.2.3. Music

There are several problems of animal communication that probably will be solved only in the future century. These include the semantic aspect of the long acoustic messages transmitted (and sometimes repeated) by cetaceans (whales and dolphins).³⁹ Among different species acoustic communication is particularly developed by those animals that are connected to the air as the main element of their environment (birds, partly gibbons that are most vocal among the apes that can be partly explained by the arboreal ecology of their life on the branches) or to water like whales, dolphins and other marine mammals. Some striking analogies found in the respective asymmetries of nervous system may be due to parallel development. In the bird singing and cetaceans' messages possible parallels can be found to personal songs that characterize an individual.⁴⁰ This method might be older than the use of personal names.⁴¹ In these biologically ancient cases musical text has an individual as its signifier. But later on also the social structures may find direct iconic representation in music (Putilov 1980). The investigation into probable origins of a genetically transmitted specialization of certain zones of the right (non-dominant)

³⁹ Besides echolocation, the acoustic messages of cetaceans include for instance long song-like messages of bowhead whales, complex utterances of humpback whales, high-energy clicks of sperm whales and highly developed communication systems of dolphins. Only some elementary signals like those of danger have been decoded so far, in spite of a number of serious studies and a lot of popular writings about dolphins' capacities.

⁴⁰ For instance among Kets, Saami and Siriono (an American Indian tribe in Bolivia) As first noticed by Kandinsky in 1919, the principle is also very close to Wagner's use of leitmotifs to characterize a particular hero. This device was later used in some films by Fellini (*Otto e mezzo*).

⁴¹ As remarked by such logicians as Russell, names do not have a corresponding concept (there is no notion like **peter-ness* associated to *Peter* etc.). Thus a preference for names in the animal and man-domestic animal interaction (see above on apes) may be an indirect argument for a non-sign character of a large part of animal communication.

hemisphere where main musical capacities can be localized, might become a particularly rewarding evolutionary analysis. To understand the evolutionary relationship between different sign systems the problem of gradual separation of language and music is of utmost importance. There should have been some selective pressure (in the Darwinian sense) for musical abilities to become genetically transmitted. Rhythmic structure might have been among the oldest biologically important constituents of musical messages. Beside the probable concrete positive physiological value of the rhythm (see below on this in connection to rites) it represented a symbolic image of *harmonia mundi* in later human culture.⁴²

Artificial capacities of musical instruments were added to natural human vocal resources (arising with the emergence of human throat that made singing possible) at a relatively early stage of cultural evolution, as it has recently been discovered. At the beginning of the semiotic activity of modern man, one can find first traces of special devices such as those made of reindeer toe bones with blowholes in them. They were found in France and date from around $2^2 \times 10,000 = 40,000$ yr BP. It is possible that they were used as signalling whistles if not as instruments in a modern sense. In the Bronze Age stringed instruments of the lyre or harp type became important not only for music and vocal performance it accompanied, but for the poetry and ritual in general. The links between their shapes and names in Greece and ancient Orient indicate the integration of the whole large area where later European cultural tradition was anticipated and prepared for. As musical instrument technology was considered to be among the main aspects of the religious life of the society its international development has been spreading on a scale and with a speed comparable to modern achievements in the most advanced fields of technology.

The 20th century saw an attempt to restore the ancient social function of music.⁴³ The music of the 20th century influenced by the

⁴² See below on a possible (at least partial) explanation why the early fundamental role of music may be connected to the function of singing it accompanies.

⁴³ First studies on the semiotics of music attempted analyses fashioned according to the pattern of structural linguistics. As it was also in the case of film, it is very slowly that those specific features of music have been recognized that make it quite different from natural language. Of these features, particularly the absence of any element equivalent to a word (=sign) has become evident,

ideas of Wagner and Nietzsche has struggled for synthetic global constructions as in Mahler's compositions and stood in direct iconic relation to this epoch like Shostakovich's symphonies or Schönberg's *Eyewitness from Warsaw*. Probably the most courageous attempt was initiated by Scriabin, who died in 1915 without finishing his project *Mysterium*. The necessity of a holistic semiotic approach to it follows from Scriabin's wish to impress all the senses of the audience, not only using sound and colour, but addressing also tactile and olfactory perception and taste. Scriabin was composing a sound-and-color music based on the assumption of a one-to-one correspondence of the colours and elements of the harmonic structure. Approximately at the same time when Scriabin worked on *Mysterium*, but later than *Prometheus* (1911; the work had been composed at 1910), Schönberg introduced a similar line into the scores of *Die glückliche Hand* (op. 18, 1913; the work had started at 1909). As Eisenstein supposed, these ideas of Scriabin could be developed in the modern coloured film (as in the second series of *Ivan the Terrible* and other audio-visual arts of the future).

The performance of the *Mysterium* that Scriabin had planned to take place in India⁴⁴ in 1917 was supposed to put an end to the world history. This problem had been studied by him long before it became fashionable after Fukuyama's work. As Scriabin was thinking about the deepest problems of the religious philosophy of his time using all the most radical devices of modern avant-garde art his *Mysterium* might have become a decisive breakthrough in the cultural history.

The main problem remains. Keeping in mind Berdyaev's idea about modern politics as a kind of continuation of the avant-garde art, one may ask whether the performance planned by Scriabin has been continuously rehearsed after his death by the forces that determine the modern history of the world.

although music and poetical discourse (as distinguished from the everyday speech) may share some characteristics. Recently temporal structure of music has been elucidated from a semiotic perspective. Different periods of the European music history have been studied from the point of view of their semiotic features.

⁴⁴ For Scriabin India was important not only because of the ancient Indian thinkers with whose ideas he became acquainted through theosophy. Scriabin studied Sanskrit and remarked that one had to go through it to come to something that is higher. We can draw a parallel here with the great Russian futurist poet Hlebnikov who studied Sanskrit in his search for a new international language.

1.2.4. Visual art

It may be supposed that no less than 200,000 years ago the red colour (ochre) already entered the symbolic triangle red-black-white, which is universally represented in all the languages and cultures of *Homo sapiens sapiens*. If the earliest human societies could use both gestural signs and phonemic language to express the set of notions of the primitive culture, the next major step was achieved with the beginning of visual art (Leroi-Gourhan 1964, 1965). The earliest visual signs of the Upper Paleolithic art according to radio-carbon dates for symbolic statuettes found in Vogelherd (the Southern Germany) are attested already 30,000–29,000 years BP. New discoveries in Southern France have shown that cave painting begins also at that time — approximately 10,000 years after *Homo sapiens sapiens* had appeared in Europe. Such widely represented cave painting images as hands seem to be connected with gestural communication, thus it may be supposed that there was a direct connection between different forms of visual representation and gestural symbolism. In modern man, the visual art oriented towards holistic images belongs (like musical creativity) mostly to the functions of the non-dominant hemisphere. But the dominant one is responsible for details of the images that are characteristic of the early period of the history of cave art. According to chronology established by André Leroi-Gourhan (1965: 205–256; 1986: 79–144; 1983: 145–151), after an early pre-figurative period (35,000–30,000 years ago) the Aurignician and Gravetician styles I and II appear (30,000–20,000 years ago). At that time mostly very large details of animals are represented; the signs that are symbolic show their connection to images of genitalia. The next (Solutrean) period is characterized by the archaic style in (20,000–15,000 years BP) in which proportions are not natural with the head being shown much smaller than the body of an animal. The signs become more abstract; this tendency develops during the next period. In the Magdalenian period (15,000–11,000 years BP) the classical style III appears and the figures of animals acquire realistic proportions.

As the joint French-American studies of the Lascaux cave have shown, to produce excellent paintings found on its walls such advanced methods as wooden constructions (of the type used until

recently in order to reach high parts of the wall surfaces) and high temperature needed to prepare red paint had been applied.⁴⁵

The art is not only highly developed technically, but its semiotic structure seems already complicated. Some of the binary oppositions that determine the structure and semantics of cave painting may be expressed by several different images. It is supposed that the figures of horses and bisons denote the same poles of the male and female principles that are also expressed by the sex signs.

In the later history of arts some of the motifs of the Upper Paleolithic art reappear. But it is supposed that such main symbols as the world tree are introduced at a later time and determine the schemes of most religious (Christian and Buddhist) works of the next periods⁴⁶. The 20th century saw a combination of most advanced experiments in the visual art and of their theoretical analysis. An attempt to find a new technique of semiotic art analysis based on the idea of discovering elementary units of artistic perception has been made by the Orthodox Priest Pavel Florenskij in his studies of spatiality in the visual arts.⁴⁷ He supposed that human perception divides any picture into several areas the borders between which are shown by the painter.

⁴⁵ Both the way to raise the temperature and the kind of the bone catalytic mixture added to the iron ore to produce the red paint are similar to those used at the beginning of the Iron Age (more than 10 thousand years later!). One may suggest that theoretically inhabitants of Lascaux could have produced iron (and iron weapons that at this early age might have lead to complete disappearance of the whole species). But they preferred to make excellent pictures. To them religious and aesthetic values connected to these pictures were so important that all the potential of the culture had been exhausted to produce them. In this a possible answer can be found to the question put by Lévi-Strauss in his *Pensée sauvage*: why people of the Stone Age did not invent the atomic weapon although their mind was already capable of doing it?

⁴⁶ V. N. Toporov who has published a serious of works to this question suggests a term “the epoch of the World Tree” for the period that includes also the classical European art of the Middle Ages and the Renaissance.

⁴⁷ Florenskij’s work from the middle of the 1920s, long before he was arrested for the second time and executed, has been published recently: the most complete text was translated into Italian by N. Misler: Florenskij 1995 (a shortened Russian version: Florenskij 1993). For the general semiotic theory of art a three-volume book of Ernst Cassirer was particularly valuable; in it a difference between the symbols (signs) of art and of those of natural language and myth have been studied (Cassirer 1924–1929). A similar approach was developed by Spet and his collaborators at the Russian Academy of Artistic Sciences (Misler 1997).

A semiotic theory of the inverted perspective as opposed to the linear one was exposed by Florenskij in connection with a distinction of the two main views of the space in the history of culture.⁴⁸ Florenskij started to work on an encyclopedic dictionary of signs of different cultures called *Symbolarium*.⁴⁹ But after his death only the first chapter dedicated to the sign of a point was found and published. It seems that after Peirce, Florenskij was the scholar who had the broadest view of different aspects of human semiotic activity.

1.3. Secondary modelling systems

There are several types of secondary sign systems. First, there are ways to recode the elements of another code as written language in its relationship to the oral (natural) one or to express the elements of one code (for instance, literature) by means of another one (the natural language). Second, there is a possibility to use elements of the everyday life (dwelling, dress, food) in a symbolic sense. The process is partly similar to the one studied by Vygotskij in respect to what he called ‘higher psychic functions’: such abilities as memory existed earlier than the time when they were reinterpreted as elements of the new psycho-cultural social structure. Third, there is a possibility of combining different elements into one complex semiotic system, as ritual in an archaic society or movie in a modern one.

⁴⁸ Approximately at the same time working independently of Florenskij, Panofsky published his version of the symbolic concept of perspective. He has studied a series of works by Francastel from the point of view of the historical transformation of perspective in Western European art. Among several parallel studies of perspective as a symbolic (semiotic) device carried out in the first part of the 20th century those begun by Eisenstein seem particularly interesting in comparison to the one accomplished by Florenskij. To both of them the linear perspective seems particularly hostile as it was associated with the official style introduced by the totalitarian regime. In that case a semantic and pragmatic interpretation of an artistic device has been forced upon a scholar by the society. Eisenstein’s views on perspective were connected to his studies of the structure of the depth composition of a shot in cinema.

⁴⁹ Most numerous collections of signs (or “symbols”, although in Peirce’s terms one would prefer to call most of them icons and indexes) that were published as special reference books almost exclusively deal with visual semiotic units with addition of some signs met in mythology and folklore.

1.3.1. Tokens. Hieroglyphic and alphabetic writing

The oldest archaeological traces of a visual system that encoded the earlier finger count are discovered on the Paleolithic monuments. According to an important discovery made almost simultaneously by Marshack (1972, 1976) and Frolov (1974), the oldest tallies have numerical function. Tallies and notches that are found from the earliest period are divided into sets with 5 or 10 members each that makes a comparison with finger counting evident (Frolov 1974: 116). Marshack supposes that the groups of signs represent a lunar calendar. Later the development of pre-writing devices was caused by the new functional needs of a growing food-producing society. Schmandt-Besserat reckons that the tokens considered by her as the first precursors of writing appeared after the Neolithic revolution in connection with the necessities of developing economy of production (Schmandt-Besserat 1992).

Numerical quantifiers exist in several natural languages. They are used with specific nouns denoting objects to be counted. A similar tactile and visual three-dimensional system has been developed after the Neolithic revolution covering the whole area of the Near East⁵⁰. The earliest deciphered writing appeared in ancient Egypt. During recent excavations at Abydos (near Cairo) inscriptions on the ivory labels attached to oil jars have been found. They record in hieroglyphs where the jars come from. Of a similar applied character are the oldest Mesopotamian (“Proto-Sumerian”) inscriptions on the administrative tablets known from the very end of the 4th mill. BC. Chronologically

⁵⁰ For each type of commodity a special three-dimensional token was used. The regular solids (cones, cylinders, spheres, tetrahedrons) and some other geometrical figures represented objects (grain, cattle etc.) to be counted. To make a transaction safer the tokens were put in a special clay envelope. The next step consisted of impressing the tokens on the surface of an envelope. When a three-dimensional symbol had been represented by a two-dimensional one, a possibility of creating writing appeared. Some of the archaic cuneiform signs are supposed to have arisen from respective tokens. One of the most interesting discoveries consisted in finding the special token-based signs on the oldest tablet that had proceeded cuneiform writing. The set of regular solids used as tokens is interesting for two reasons: on the hand, in order to apply some geometrical ideas to the history of writing; and on the other hand, to prove the suggestion according to which a restricted number of visual images constitutes the alphabet seen in primitive art and religion.

close are Proto-Elamite and Proto-Indian inscriptions. The language of the latter rests unknown.⁵¹ As the signs on a Vincea inscription found in the area of the old Balkan culture of the 4th mill. BC are very close to Proto-Sumerian, it is possible that there was a link between these two areas of the early writing. But since the ancient Balkanic writing (used in a number of monumental inscriptions of the 6th–4th mill. BC in different parts of the Balkans and also in Hungary) has not yet been deciphered, it is not known whether really writing appeared in the Southern-Eastern Europe two millennia earlier than in Egypt and Mesopotamia.

An important innovation in the information-preserving system in Ebla (3rd mill. BC, Northern Syria) consists in the existence of a large and well-organized archive — a multilingual library of cuneiform documents. Many general semiotic principles of modern libraries and archives have been known since the middle of the 3rd mill. BC.

The early hieroglyphic sign systems based on pictorial or pictographical representation slowly moved towards *logographic* link to the *phonemic* language. A major step in the development of the semiotic systems was a shift from logographic representation of words to the later alphabetic principle. In the development of a normal child in a modern society, after the child achieves a certain degree of knowledge based on learning holistic (global) images, the acquisition of literacy makes it possible to perform successive operations not only on letters but also on natural numbers and other sequences of discrete symbols. With this opens a possibility of understanding the notions of order and set and of rational and legal reasoning. Diachronic historical research on a similar change from logographically oriented ancient Oriental cultures towards those built on the discrete alphabetic principle (as started in Western Semitic traditions and continued in the Ancient Greece) has revealed the role of the elements⁵².

⁵¹ See above on Dravidian. Absolutely unknown is the origin of the ancient Chinese characters (there exists a theory about a connection to some special types of Western Eurasian astrological symbols, but this hypothesis has not been proven) and of the MesoAmerican (Mayan and Aztec) writing and of the old Peruvian (Inkas') (mostly) mathematical knot writing *quipu*. Although Trans-Pacific cultural influences seem possible in this case (as in many other aspects of Pre-Columbian cultures), definite proofs have not been found.

⁵² Latin *elementa* (rendering Greek *stoikheia*) was derived from the names of the letters *l-m-n* in the middle of the alphabet (cf. *a-b-c* in its initial part). In alphabetic cultures elements usually are called by nouns (e.g. *atoms*, *molecules*,

Historically a particular and very complicated question concerns the development of the written musical notation for songs. Long after written signs had been used to encode the oral speech in its semantic and phonic form, a similar attempt was made in connection to the music and verbal text of a song.⁵³

1.3.2. Space. Architecture. Urban semiotics

The huts and the cultural habits of constructing them have some rudimentary parallels in the ape behavior and are known as early as 200,000 years BP (already at the Paleolithic site of Terra Amata). But a step ahead led to the “domestication of space” to use André Leroi-Gourhan’s expression. One of the important achievements in the semiotic study of early culture of *Homo sapiens sapiens* consisted in establishing the structure of the space of the caves on the walls of which animals have been represented. It appeared that to the main couple $A+B$ (usually a horse and a bison) a third animal C (mostly an ibex or a mammoth, sometimes a stag or a doe) is added. There might also be a fourth or a fifth animal (D , a rhinoceros, a feline beast). Distribution of these images on the walls permits to understand the structure of a cave (Leroi-Gourhan 1986: 98–118⁵⁴).

After the Ice Age such buildings as temples were built partly as reproductions of the old habitation. A proof may be seen, for instance, in stalagmites and stalactites brought to a temple in Çatal Höyük (one of the oldest cities in Asia Minor, 7th–6th mill. BC); it can be presumed that a similar function was transferred to candles much later. There was a steady growth in the semiotic potential (and the linguistic

genes, quanta, particles, strings, phonemes in the European scientific traditions) different from the verbs as the main linguistic means of description in such languages as Iroquois (for instance, Onondaga) and many other American Indian ones (cf. Ivanov 1993a).

⁵³ The first known example is a song in Human with notation for strings of a harp and possible intervals between their pitches found in the international city of Ugarit (Ras Shamra), 13th century BC. Such a system had been first elaborated in Mesopotamia from which corresponding Akkadian terms were borrowed into Human just as Italian musical terminology spread in European languages in the post-Renaissance period.

⁵⁴ On the base of the studies of Leroi-Gourhan, V. N. Toporov gave a semiotic description of the prehistory of space in art.

potential) of a large city beginning with the Neolithic Revolution (City Revolution in terms of Gordon Childe.) Not only cities themselves tended to become larger and larger according to the laws of so-called “social physics” but also their sign systems. The old sign systems (such as those of natural languages and visual signs based on the languages of gestures and other archaic and/or archetypal symbols), some of which had been inherited from the ancient eras in which early settlements were founded (i.e., the Upper Paleolithic caves), were reinterpreted and integrated into the new urban semiotic webs of communication. In the first known cities of Asia Minor (such as Çatal Höyük according to Mellaart’s studies), and in other parts of the ancient Near East, new complicated systems of visual signs, partly based on reinterpreted archaic symbols, were constructed. These new complex systems were mostly employed in the most important communicational city centres of that period (and much later) — the temples (in Çatal Höyük, for example, these buildings had specific symbols incorporated in them such as bucranias and columns, symbols of the right and left hands, etc.). The role of a temple as the main information-preserving centre of the city has remained significant throughout history until modern times. No matter what other urban activities (particularly military and commercial) became important, the temples remained the main places of informational activity. Therefore, one may speak of a temple-oriented stage in the semiotic history of the cities. This stage continued for many millennia and can still be seen in the importance of temples and churches, both as religious centre and as the most important element of the preserved cultural semiotic history of cities.

An important iconic role has been attributed to the spatial scheme of a whole village or a city. Thus in a society with dualistic organization the opposition of the two moieties (opposed exogamic halves of the tribe) and their subsections was reproduced in the arrangement of huts or houses of their members. A city is considered a model of the universe.⁵⁵

⁵⁵ Its structure corresponds to the scheme of the relations between the main gods of the pantheon: for example, the four temples of Ebla are devoted to the four main Semitic gods and are oriented according to corresponding cardinal points (a similar semiotic scheme was preserved in Nenevia and, may be seen in a transformed form in later cities of Ancient and Medieval Western, Central, Southern and South-Eastern Asia).

If for most of the Middle Ages the main communicative and particularly information-preserving or information-transmitting functions were fulfilled by monasteries, during the next stage of the semiotic history the universities fulfilled this role. The differences between entire areas in Europe may be defined as monastery-oriented city versus a university-oriented city.

1.3.3. Dress as symbol

Although dress (at least in countries to the north of tropical areas) may be important for the survival, and also serves as a ternary sexual feature, it acquires the role of a sign (of an ethnic group, social position).⁵⁶ As archaic culture is partly based on the ritual inversion of the structure (or on the anti-structure according to Victor Turner), it is symbolized by the carnival dresses; in the archetypal carnival men dress as women and women dress as men. Accordingly the role of masks becomes prominent⁵⁷.

As dresses and some other objects of the everyday life (for instance, kitchen utensils, means of transportation) become a part of semiotic life of a community, the role of such devices as ornaments grows. Ornament is based on symmetry. Its study is an important link between such natural sciences as physics, redefined as completely based on the notion of symmetry (Yang 1996) and semiotics objects obeying similar laws at another level.

1.3.4. Food and drink as symbols

As sacrifices to the gods were considered mostly as serving food and drink (sometimes also smell of burned food) for them, this aspect has become one of particularly significant elements of religion.⁵⁸ Some

⁵⁶ Hjelmslev (1943) emphasized particularly the innovative character of P. Bogatyrev's study of the dress as sign, created in the atmosphere of the Prague Linguistic Circle of the interwar period.

⁵⁷ It is worth noticing that the notion of a person in European languages goes back to Etruscan (originally Greek) term designating a theatrical mask.

⁵⁸ In a motif repeated in the mythologies of several ancient Oriental peoples and also in the archaic folklore of some European countries (for instance, in Latvian

tribes (for instance, Xihkaryana in Brazil) consider difference in diet and observing food taboos the main difference between humans and animals. Some restrictions (as prohibition of cannibalism and eating some animals) reveal most striking ethnic and cultural differences. In this respect Spaniards accepted at Montezuma's court suffered their first terrible shock. Comparable differences between Indian castes are connected with fundamentals of the Hindu religion.

1.3.5. Sexual urge and love

Sex being understood from a purely physiological point of view is different from those infrastructures of social (see above on kinship in Lévi-Strauss' view), religious and aesthetic character that are superposed on it at the level called "sublimation" in psychoanalysis. Already in the signs of the cave art interpreted as symbols of genitalia one may suspect a broader meaning. They might have been connected, for instance, to the social and religious binary opposition of a dualistic society. As a later example studied in comparative poetics one may cite the notions of the "mad love" and "fair lady" as developed in medieval Judeo-Arabic and some other Oriental⁵⁹, Spanish and Provençal traditions. As it intersected with Gnostic ideas, it influenced Dante and his followers in modern European literature. An interesting side of the 20th century culture might be seen in a systematic attempt to return from such infrastructure to its supposed physiological roots using procedures prescribed by psychoanalysis.⁶⁰

folk songs) gods decided not to kill mankind since they will lose their source of food in that case. This god-human relation appears to be mutual. In the 2nd mill. BC an expression "to drink a god", "to eat a god" is attested in ritual texts of Asia Minor, and it is there that the origin of an image developed much later into the concept of communion can be found.

⁵⁹ The introductory stanzas of *Vepxis tqaosani* ("A Knight in the Leopard's Skin") by Rustaveli has been studied by a great specialist in Caucasian philology N. Marr who developed ideas from Veselovskij's treatise on the same motif in the medieval European poetry.

⁶⁰ In modern literature, for instance, in Joyce's *Ulysses* and in many works influenced by this novel, there was also an attempt to ignore all other cultural taboos connected to physiological functions of human organism. This systematic anti-semiotic attitude might be understood as carnivalistic Anti-Structure;

1.3.6. Myths and Rituals

Some of elements seen in these early synthetic rituals may be older than *Homo sapiens sapiens*.⁶¹ Those signs that appear in modern pantomimic arts and ballet are probably historically linked to the old syncretic art that combined music and gestures. According to the theory proposed by the great Russian specialist in historical poetics Alexander Veselovskij, the original syncretic performance of the early times joined together elements of what we now might have designated as music, song, dance, drama, ballet. For all these most ancient forms of art integrated into a syncretic ritual performance, the rhythm seems to be the decisive constructive principle. Modern neurophysiological research has shown the connection of different forms of rhythmical activity (such as rhythmic music, dance or jogging) to the positive action of endogeneous opioid peptide neurotransmitters like the five amino-acid enkephalins, endorphines and dynorphin. The latter are mimicked by the drugs spreading in the modern society. It can be suggested that one of the main reasons for this may be connected to the loss of the main function of the art (particularly of music) that rendered *harmonia mundi*. Historically this function might have been the most important one. It could have antedated the social mnemotechnical role of singing that grew more and more valuable as the amount of knowledge to be memorized and transmitted became larger with the development of culture.

1.3.7. Songs. Folklore

According to a probable hypothesis music and singing became necessary for the cultural survival of the illiterate societies.⁶² It seems that

according to Bakhtin, the use of the images of “the bottom of the body” is characteristic of folk carnival.

⁶¹ Thus rain dances and rain charms documented in very old texts and attested in different societies especially as relictal childhood forms find interesting analogies in recently studied pre-cultural patterns of behaviour in many groups of chimpanzees.

⁶² This function might have remained in those early Neolithic societies in which prewriting in the form of tokens and later writing served only to encode bureaucratic lists of objects and were not yet applied to put down mythopoeical and legal texts. If one compares the spread of computers to the introduction of

for several thousand years the memory of culture was mostly connected to songs accompanied by music. Important discoveries made by Lord studying the Southern Slavic folklore have shown the formulaic character of the original poetry yet inseparable from singing and music. By comparing experimental facts on Slavic and Central Asiatic Turk (Uzbek, Kirgiz a.o.) rhapsodies one comes to the conclusion that each of them could reproduce (with possible variations) texts containing as much as 107 bits of information.⁶³ The role of singers in such societies as the modern Southern Slavic, comparable to the Homeric audience, suggests that they were initially responsible for the transmission of all the mythological historical heritage of the tribe.⁶⁴ If artificial methods of information transmission were absent or underdeveloped they might be substituted by memorizing and repeating such combinations of words of the natural language that had been transformed into parts of poetical compositions which were performed with the musical accompaniment.

1.3.8. Literature

Literature has originally been connected to folklore. As Propp remarked, the first literary texts (as *Gilgamesh*) were simply folklore compositions put in the written form. The possibility to write down such compositions did not come easily.

Caesar formulates the opposition of the religious use of the traditional memorization of the oral texts and a possible use of Greek

writing one might suppose that the predominant use of sophisticated sign-transformational computing machinery for business and administrative work (as different from creative activity) repeats a similar delay as that experienced by the early Neolithic societies.

⁶³ For such exceptional singers as the Kirgiz Pulkanshair who could dictate up to 25×10^4 lines, the estimated quantity of the transmitted information may be even more and approaches the upper limit of the memory as suggested in experimental psychology. For a general view on the importance of aesthetical rhythms in connection to social memory cf. also Leroi-Gourhan 1965.

⁶⁴ That makes plausible the idea of the great Russian poet Nikolaj Gumilev (executed by the Bolsheviks in 1921): according to his recently published studies in comparative poetics interrupted by his death, he supposed that an archaism had been preserved in the role of druids and poets ("bards") in the Old Irish society (cf. modern views tracing these institutions back to the Proto-Indo-European.

letters to render simple everyday sentences in Gaulish (as documented later in the Gaulish inscriptions). This seems important for understanding analogous facts in other areas. It can help to explain why writing in many societies (as Mycenaean Greece and early Mesopotamian cities of the pre-Sumerian or Uruk period) was not used for rendering sacred or mythopoetic texts still transmitted only orally. A tension between conversational folklore elements of literature and those aspects that are connected to the written speech are characteristic of later periods of its development. Social linguistic differences caused by urban life are reflected in the works of authors who started to introduce features of this new urban language in such genres as short stories (in China first developed by Pu Sung Ling-Liao Chai). But the use of hieroglyphic writing made this particular aspect of the literature quite different from the one based on the principles of alphabetic cultures. Thus, for instance, although in the Chinese tradition the genre of the detective story (a genre strongly based on the criminality and communicational features of a large city) developed in the Tang period; however, Pu Sung Ling's detective stories, characterized by archaic semiotic methods of divination by dreams, were antithetical to the alphabetic detective principles of the first detective stores about Paris (written by Poe) more than two centuries later.

Language not only became the main topic of philosophical disputes in the 20th century: a discussion of its role for literature became crucial both for poets (T. S. Eliot, Mandelstam, Brodsky) as well as for critics and literary scholars (New Criticism, Russian formalists).

1.3.9. Theatre

Modern anthropological studies (particularly those of Victor Turner — Turner 1982, 1992⁶⁵) have shown the close relationship of the ancient ritual and theatre. Olga Freidenberg (1977) remarks in her

⁶⁵ After this great ethnologist-semiotician had moved to America, his main semiotic interests were concentrated on the anthropology of performance. Not only did he study the ritual as a protoform of a theatrical performance. He himself participated in theatrical activities serving as an aesthetical experiment. A parallel to Eisenstein's attempt at a "revival of a myth" in his Wagner's *Die Walküre* performance of 1940 (and a series of theoretical works on the same topic) is striking.

writings on the subject that theatrical space and a bidding of a theatre has long preserved the character of a model of the whole universe.⁶⁶ A particular social and semiotic role of the theatre became most evident in classical Greece. Theatre had an important unifying function in an extraordinarily diversified system of different sign systems and texts, many of which had been established in the Pericles' age (tragedies, comedies, geometry, architecture, sculpture, rhetoric, to name just a few).⁶⁷ Theatrical performances contained verbal parts, action, dances, singing and music, representing a later transformation of the original syntactic or total performance as reconstructed by Veselovskij. The conversational features of a local city dialect representing a social dialect are pronounced in genres such as an Aristophanic comedy. One may compare this phenomenon to partly similar linguistic features of the plays of great Old Indian authors, like Kalidasa, in which personages speak different Indo-Aryan languages (Sanskrit and a variety of Prakrits) according to their social position and gender. Different from Greece, India did not know the genre of tragedy.⁶⁸

In modern Europe starting from Diderot and up to Vygotskij, the philosophers, aestheticians and psychologists have been analyzing the semiotic features of an actor. A capacity of playing another person becoming a signified in theatrical semiosis constitutes one of the amazing features of modern culture that has its continuation in cinema.

⁶⁶ It was reflected in such terms as French '*paradis*' (originally a word for '*Paradise*' — "the top gallery", "The Gods" in British English), Russian *rayok* (originally diminutive from *ray* "paradise") in the same meaning.

⁶⁷ Approximately 1000 free citizens of the city might have attended a given theatrical performance according to the calculations of the mathematician, A. N. Kolmogorov. There as also at the sporting games the whole adult active population was present and these were places where it was possible for all the members to exchange information. Such meetings are different from the small symposia, described by Plato, in which relatively restricted groups, for instance, of Socrates' pupils engaged in dialogues were present.

⁶⁸ V. N. Toporov, one of the main founders of the Moscow–Tartu semiotic school, has studied the semiotic aspects of classical Sanskrit drama in a recently published book. In early Roman literary theatrical masterpieces one may find traces of the original multilingual situation of the ancient cities, for instance, in the Punic, i.e. dialectal Phoenician-Semitic parts of Plautus' play *Poenulus*. Its Latin title uses the Etruscan designation for a Carthaginian person speaking Punic. This fragment helps to reconstruct Western Semitic (Punic) genre of comedies that influenced also Etruscan theatre (the latter can be reconstructed on the bases of those features of Roman comedy that can be traced back to the Etruscan influence).

1.3.10. Audio-visual media and cinema

The general tendency towards a synthesis characteristic of the first half of the 20th century has manifested itself in the creation of audio-visual media. This aspect of modern communication acquired extraordinary importance for entertainment, advertising and other commercial and political goals. From the aesthetic point of view cinema has remained the most interesting achievement. Here a completely new semiotic system has evolved which made the combination of theoretical analysis with an aesthetic experiment possible. In modern semiotics and in the neighboring area of humanities, particular attention has been given to film language, the study of which was begun already by Sergei Eisenstein. In the *semiotic studies of cinema* the first stage consisted of the comparison of a movie's structure and a verbal text. Specialists were interested in finding units corresponding to words and sentences in a cinematographic discourse.⁶⁹ With the development of sound movies, it appeared possible to reduce the importance of short-cut montage, building a whole film on the plan-sequence (as, for instance, Renoire did); Bazin became the main theoretician of this new wave.

The next stage in the development of semiotic theory of cinematographic discourse was connected with Roman Jakobson. He introduced a difference between metaphorical movies (to which early silent films using montage imagery belonged) and metonymic films in which close-up and other methods based on spatial contiguity became prominent (Jakobson 1990).⁷⁰ Enormous possibilities opened up by

⁶⁹ As Eisenstein and other great film-makers of his generation were particularly interested in *montage* as the main device they were approaching the film as a text comparable to texts in linguistics. Most of all they were interested in the possibility of finding discrete units or cadres-shots equivalent to words and montage phrases built from sequences of these elements. Eisenstein's montage theory included a comparison to hieroglyphic writing. Eisenstein planned movies in which the avant-garde montage technique would be used to create intellectual cinema.

⁷⁰ As shown by Jakobson, the opposition between metaphoric movies and metonymic ones is similar to those found in other fields of semiotic activities, for instance, rites (similarity-based magical rituals as opposed to those where an object is substituted by its part according to the *pars pro toto* principle). The general problem of the parts and wholes in different semiotic texts has been investigated in the light of Husserl's phenomenology. Recent developments of

computerized montage may be seen as a new vista for experimental film semiotics. At the same time it becomes possible to start analysis of semiotic foundations of new audio-visual systems that are technically ripe for being used, but have not yet become true art.⁷¹ Even the position of the TV as an independent semiotic system is not yet clear. The future century might bring quite a new breakthrough in this field.

1.3.11. Sciences

From the point of view of semiotics, different sciences are considered as a separate secondary modeling semiotic network. The independence of each of them is connected to elaboration of a specific sign system. The oldest specific notation in the area of humanities intersecting with modern semiotics has been invented by ancient Indian linguists (no later than in the middle of the 1st mill. BC if not much earlier). The construction of the artificial — and to a large extent formalized — metalanguage of Panini's Sanskrit grammar had been made possible by the character of Sanskrit as an “elaborated” language (*sams-kṛta* “following the rules of grammar”). It had remained an example of formal description for Bloomfield (1887–1949) who initiated a formal trend in the American descriptive linguistics of the 20th century.⁷² As it was discovered by Egyptologists of the 20th century, some special forms and constructions different from texts of the other genres can be found in ancient Egyptian scientific (mathematical and medical) texts. But a new language for mathematics has been elaborated in the European tradition starting with the ancient Greece. The mathematical

semiotic film analysis included an application of metalinguistic methods of analyzing the utterance, particularly deictic relations as well as pragmatic dimension.

⁷¹ The situation can be compared to the one that Hocart (1936) found similar in the development of ritual and social institutions and biological organs: a special technical device exists long before its function appears.

⁷² The purely formal character of Panini's grammar made it also possible to manipulate with its symbols in search for internal reconstruction of the past of the system (as it was done in the 19th century by Saussure and in the 20th century by Benveniste in his *Origines*). As the great Danish linguist Otto Jespersen declared in his speech at the 4th International Congress of Linguists, “the chain between Panini and Trubetzkoy is unbroken”. The formal analysis started by Panini was continued both by comparative studies and in structural description.

sign system for analysis, as developed by Newton and Leibniz, is the best example of a completely new semiotic system.⁷³

2. Semiotic science

2.1. Logical semiotics

Peirce (1839–1914), a great universal mind exploring almost all the kinds of semiotic systems, has laid down the foundations of this science in its modern shape. In the beginning of the 20th century returning to his previous studies Peirce was emphasised the importance of “General science of the nature of Signs” for modern knowledge (Peirce 1966 [1908]: 378).⁷⁴ In his later works Peirce anticipated an important field of modern semiotic studies devoted to *comparative*

⁷³ Hilbert, who founded modern metamathematics, declared: “hierin liegt die feste philosophische Einstellung, die ich zur Begründung der reinen Mathematik — wie überhaupt zu allem wissenschaftlichen Denken, Verstehen und Mitteilen — für erforderlich halte: *am Anfang* — so heisst es hier — *ist das Zeichen*” (Hilbert 1928: 1). As he has remarked in another work of the 1920s, a main point of reference is, “die konkreten Zeichen selbst” (Hilbert 1926: 89). From this point of view, semiotic study of the signs of mathematics might clarify its theoretical foundations (Bogarin 1991).

From the point of view of the founder of the quantum mechanics Niels Bohr, mathematics is a special language created on the bases of natural language. Language has remained a main object of reflections for physicists and philosophers.

⁷⁴ In 1895–1902 in a treatise on *Speculative Grammar* Peirce has elaborated his exhaustive classification of signs from the point of view of their function that has remained the most detailed one so far attempted. While discussing the relation of a sign to an object he was developing ideas of Classical Greek, Roman and medieval philosophers and logicians whose works he discussed at length. But he went far beyond the usual logical sphere of interests. He also touched upon different ways of the logical categories related to corresponding forms in natural languages giving as examples, for instance, the ancient Egyptian use of pronouns in a function of a copula different from its expression by verbs or a particular role of nouns in Basque (Peirce 1960: §§ 4, 6). He was insisting on the necessity to get rid of the influence of some chance grammatical particularities of Indo-European languages. Peirce suggested that a linguist should participate in work on the general theory of signs. Being (among other things) a professional specialist in chemistry, Peirce was the first to notice the similarity of the structure of some new chemical compound names of substances and of incorporated forms in American Indian languages.

grammar of natural and scientific (particularly, logical) languages (Reichenbach 1947).⁷⁵ This kind of research has become particularly important much later in connection to artificial intelligence. Thus while writing a set of rules for an automatic translation from Russian into a predicate calculus it has appeared necessary to introduce a special equivalent to a category of adjectives that is absent in most logical languages.⁷⁶ In modern generative semantics and related fields of mathematical linguistics, the comparison of the functional elements of mathematical logic and corresponding forms and words in natural languages (such as a universal quantifier \forall and English *all*) has become the favorite object of studies.⁷⁷

One of the main theoretical results of these studies has been the introduction of a notion of a *metalanguage* coined to discuss an *object language*. In the case of the conversational natural languages that do not strictly obey grammatical rules only some fragments of a system may be discussed in terms of such universal metalinguistic elements as Jakobsonian differential phonological features.⁷⁸

⁷⁵ Among later semiotic studies in this area one may mention a series of outstanding works of J. Chmielewski who has shown an exact correspondence of the syntax of Archaic Chinese and the structures of mathematical logic.

⁷⁶ A comparison to such natural languages as Yukagir (in Northern Siberia) where a verb is used where in English corresponds an adjective, helps to see that one may speak of different degrees of similarity between natural and artificial means of communication.

⁷⁷ Among those logical schools whose contribution to modern semiotics is prominent, the Warsaw–Krakow one succeeded in discovering main features of semantics of formalized languages as well as in finding elegant solutions to the description of syntactic relations. Logical semiotics has become the most advanced formalized area of research on sign systems. The “linguistic turn” in the history of thought of the 20th century was so influential mainly due to the work of such scientists, who, like Russell and Wittgenstein, had started with the investigation of the logical languages and then applied similar concepts in an attempt to understand the everyday speech. In Hjelmslev’s words, “modern logistics has revealed the fact that scientific sign-systems, e.g. those employed in mathematics, must be languages, and that the structure of such languages is by no means fundamentally different from linguistic structure as a whole. That is why modern logicians consider the languages studied by linguists as a particular case within a larger class” (Hjelmslev 1973: 121). According to Carnap, the task of philosophy is semiotic analysis, including the study of the abstract part of everyday language and of the language of sciences (Carnap 1942).

⁷⁸ In case of metamathematics, *metasemiosis* (Curry 1977: 61, 89) can be applied only to a language of a formalized structure.

2.2. Linguistics as a branch of semiotics

A difference between logical trend in semiotics founded by Peirce and the concept of semiology based on linguistics as developed by Saussure (1857–1913) is not necessarily as large as may be inferred from many recent publications.⁷⁹ Among important new ideas contained in Saussure's Course (the first posthumous edition: Saussure 1916) was that of the oppositions constituting the semiotic system. Being influenced by Durkheim's general sociological outlook, Saussure was the first to develop a new theory of natural language as a social institution. Stressing the role of value for a semiotic system of natural languages, Saussure pointed out resemblances between the sign systems and economic systems also based on an axiological principle.⁸⁰ Although this idea opens a new vista not only in semiotic studies, only

The modern theory of formal grammars oriented towards mathematically concise definitions can be valid only in so far as the requirement for metasemiosis is fulfilled. Two most important examples of grammars in the history of linguistics are built for the languages following exact rules: Panini's Sanskrit grammar in ancient India and the *Palais Royal* grammar of French constructed for a formalized system of the language. In Europe for de Saussure the latter represented a paradigmatical example of a synchronous linguistic description. Trying to apply the notion of metalanguage to non-formalized linguistic systems, Hjelmslev suggested a completely new approach. According to his innovative idea, the term *metasemiology* may be used in the sense of a scientific metasystem studying the semiotic objects (called *semiologies*) that are not in themselves sciences. Metasemiology is describing the *substance* of the signs: the objects designated by the signified and the sounds (or graphic and other visual elements) of the signifiers.

⁷⁹ Peirce joined the trend of logical thinking about signs that started in antiquity and continued through the Middle Ages. Saussure's sign theory developed certain ideas from the rational grammars of the post-Renaissance period which were another offshoot of essentially the same line of thought. Saussure's connection to early Greek concept of sign has been explored recently.

⁸⁰ The intrinsic value of the elements of a system was made clear by Saussure already in his work postdicting the "sonantic coefficients" (later known as laryngeals) at an early stage of Indo-European. Comparative linguistics still remains the main example of an exact humanitarian semiotic science as its postdictions (conjectures about the history) can be falsified (in Popper's sense): thus in 1927, Kurylowicz found in Hittite (after its decipherment by Hrozny) traces of these phonemes that were reconstructed by Saussure long before. The best account of the algebraic character of that work of Saussure in relation to his Course was made by Hjelmslev (Hjelmslev 1959: 29).

a few special studies deal with this topic in the economic and social theory.

In the early 1940s Louis Hjelmslev sought to rethink Saussure's *semiology* by combining results of modern structural linguistics and of the first applications of similar methods to anthropology, as well as the ideas of the Vienna and Warsaw-Krakow logical schools. Hjelmslev began the appropriate section of his as yet underestimated *Prolegomena* by suggesting a necessity of an *immanent* (internal logical) approach to sign systems that would make it possible to study from the same general point of view such different fields as literature, art, music, history and also logic and mathematics. Still, he supposed that natural language is in a privileged position among all other semiotic structures since they all may be translated into it. This may be explained by the extraordinary freedom in the shaping of new linguistic signs combined into longer texts consisting of an unlimited number of words (even if false, contradictory, inexact, or unaesthetic). Natural language differs in this respect from other goal-oriented semiotic structures (Hjelmslev 1943).⁸¹ Hjelmslev was particularly interested in the analogy between language and games; later on a synthesis was suggested in an image of linguistic games developed in the later writings of Wittgenstein. Hjelmslev chose some quite *simple semiotic systems* to be analyzed such as traffic signals, dial telephone, striking turret clock, Morse code, systems the prisoners use while knocking at the wall in jail. This kind of research was developed by Zalizniak in his excellent study of street signals. In this work Zalizniak pointed out some concrete relations to which equivalents (like, for instance, synonyms) may be found in natural language. He has also paid attention to the possibility to compare some of the problems discussed in connection to these simple systems to main problems of the semiotic study of *law*.⁸² At approximately the time

⁸¹ Similar ideas on the role of natural language have led to the distinction made in the works of the Moscow–Tartu Semiotic School between linguistic primary systems and the secondary modelling ones using language as their plane of expression.

⁸² Particularly detailed are semiotic studies in the field of primitive law or pre-law. At an early stage of the development the pre-law systems are still very closely connected to the other types of signs, particularly those of magic. Thus it becomes possible to clarify the strictly semiotic character of some of these systems and to apply to their reconstruction methods close to those of comparative linguistics.

when Hjelmslev had worked on his main book, the semiotic ideas of Saussure were developed by Buysens (1943, 1956) who gave a first sketch of different sign systems and suggested principles of their functional classification. Later general surveys of systems of signs had Buysens's work as their base that they have tried to expand.

2.3. Syntax, semantics, pragmatics

In the twenties and thirties it appeared to most scientists that a purely syntactical analysis without the consideration of meaning might be sufficient for a description of a sign system. The notion of meaning as well as pragmatic context of the signs use had escaped the attention of scholars as well as of the avant-garde artists and art historians to whom the internal structure of an object seemed the only relevant object of study.⁸³ In all the fields of semiotic activities, beginning with Malevich's supramatic geometrical figures to Carnap's logical syntax and similar research of his colleagues of the Viennese circle, the internal (purely syntactical) relations among the elements seemed much more important than their semantic interpretation or pragmatic use. The Russian formalist (or "morphological") school of literary studies declared (beginning with Viktor Shklovskij) that the color of a banner positioned on the top of a fortress was not relevant. In a way, modern avant-garde art performed a peculiar semiotic experiment divorcing the plane of expression from that of content. However, it becomes increasingly questionable whether or not the isolation of the syntactic, pragmatic, and semantic branches of semiotics is indeed possible and viable.⁸⁴ Games (such as chess in Saussure's famous

⁸³ Hilbert's program of axiomatic approach to formal mathematical systems (Hilbert 1926, 1928) still remained attractive (for instance, Hilbert's views were cited as exemplary in Kuryłowicz's well known work on theoretical linguistics). Although Gödel's theorem had been proved by that time, its results had not yet been generalized (see a discussion in Penrose 1990).

⁸⁴ With the development of Propp's model, semiotics became associated to the technique of narratology. When analyzing Propp's perception in the West, one is amazed at the long period that divided the continuation of his formal syntactical analysis of the morphology of the fairy-tale (1928) and the apprehension of the importance of his following work on the semantic and pragmatic interpretation of the same scheme (cf. on this difference: Ginzburg 1989: xii). The speech acts

example, also used independently in metamathematics) as well as logical calculi and some aesthetic structures (in music) were seen by Hjelmslev as systems showing only the pure scheme of the structure as such. These semiotic structures cannot be interpreted in a logical or mathematical sense. This gives them a specific semiotic status. The same semiotic problem in connection to modern visual art and music was discussed by Lévi-Strauss (Lévi-Strauss 1964). The absence of one of the planes means a deformation of the aesthetic sign⁸⁵.

2.4. Semiotics of texts

Mikhail Bakhtin (1895–1975) was the first to discover a difference between an abstract linguistic system of signs and a concrete utterance in which each sign gets another “metalinguistic” function due to its role in the whole of discourse.⁸⁶ Twenty years later, this distinction was rediscovered by the great French linguist Émile Benveniste (1902–1976).⁸⁷ This field of research studying discourse as a field

theory helped to find adequate ways of description of such pragmatically important units of natural language as performative sentences.

⁸⁵ Hjelmslev has shown that one-plane semiotic systems that cannot be interpreted have semiotic features different from natural language (Hjelmslev’s so called commutation test as generalization of phonological methods was introduced to study relations between the expression plane and the plane of content in natural language).

⁸⁶ Following the research of Hermann Cohen and Martin Buber in philosophical anthropology, Mikhail Bakhtin discussed the problem of the relation of *I* and *Thou* (*Other*) also from a linguistic and general semiotic point of view. Starting with his early aesthetic writings, Bakhtin became interested in the way the speech of a person interacting with the author had been represented in artistic writings. The results of Vossler’s school, particularly Spitzer’s stylistic studies (1961, 1988) have been incorporated in metalinguistic research of this kind. The different forms of direct speech, quasi-direct speech, reported speech, transposed discourse and pseudo-objective motivation as studied by Vossler, Lerch, Lorck and Spitzer were subsumed into a larger metalinguistic scheme. These new perspectives of philological analysis trespassing the restrictions of a traditional linguistic one appeared to be close to the philosophical study of the Other. The aesthetic problem of the relation between author and hero had been a continuation of the study of indirect speech and other types of discourse.

⁸⁷ This gap between system and text constituted the main point of his semiotic theory. He suggested that the semiotic approach would be possible only insofar as linguistic signs or separate words are concerned, whereas the structure of texts

much broader than a sentence (which has remained the upper limit of strictly linguistic study) became quite popular among the scholars applying pragmatic methods. In the writings of the Tartu–Moscow School an attempt was made to overcome the line separating system and text (that was evident at least for semioticians following Bakhtin and Benveniste). In the works of the scholars belonging to this school, literary, folkloric⁸⁸ and mythological texts as well as works of different arts became the main objects of study.

2.5. Information theory

Although the works by Carnap, Bar Hillel and other scholars aimed at measuring semantic information⁸⁹ were very close to the goal of semiotic research, there still remains a problem of the relationship between the latter and the mathematical theory of information. This branch of mathematics as founded by Shannon, Kolmogorov and other scientists studies information of every kind and its transmittance through channels. The case of discrete transfer of information is relevant for linguistic studies as well as for all other (secondary) modeling semiotic systems using discrete code of natural language as their plane of expression. As shown by Roman Jakobson, the informational

should be studied by semantics. At the time when this idea became popular among French semioticians, Barthes introduced the term “*translinguistics*” (Barthes 1969) corresponding to what Benveniste (1969) had suggested to call *semantics* and Bakhtin had designated as *metalinguistics*.

⁸⁸ The special attention given to folklore genres starting with the pioneering works of Bogatyrev and Jakobson of the late 1920s can be explained by a transparent character of the rules of generating a text belonging to this category (as shown, for instance, in the above-mentioned classical book by Propp). Mythological studies helped to link a narratological point of view and the discovery of a ritual scheme explaining the origin of a folklore one (cf. Watkins 1995). Thus Propp suggested that the morphology of fairy tales and the sequence of stages in archaic initiation rites are in an isomorphic relationship. In this way formal analysis has led to universal insights into general laws governing human societies (as in the book on kingship by Hocart published almost simultaneously with Propp’s study: Hocart 1927). A similar approach was used in lectures by Olga Freidenberg to support a semiotical critical study of traces of the irrational archaic features preserved in such modern institutions as court, state and army (cf. Freidenberg 1997).

⁸⁹ Hauffe 1981 with references.

dichotomy of code and message clarifies some important points referring to the relation between a language system and a text.

In the electroacoustical works of Fant and other scholars, based on Jakobsonian universal system of phonemic differential features, the latter are studied from the point of view of the information theory. Continuous messages that are particularly important for mass media are still much less investigated by semioticians, with the only important exception being film semiotics.

Particularly important seem general semiotic problems related to information and its role in modern scientific outlook⁹⁰ and their exploration in connection to language and poetry. Kolmogorov who worked on mathematical foundations of the theory of information suggested main principles of the probabilistic poetics. It appears possible to combine it with the statistical study of verse founded by Andrej Belyj (1980–1934), particularly in his articles of 1910 (Belyj 1985). In these early studies Belyj suggested a whole program of turning aesthetics into an exact science using experimental methods.

⁹⁰ Pavel Florenskij (1882–1937; executed in the time of Stalin's purges after being kept in a Northern Russian camp for political prisoners) was among the first to suggest the opposition of *Logos* or "*ectropy*" (represented by culture and cult) to the second principle of thermodynamics determining the growth of *entropy* (cf. Ivanov 1995). Approximately at the same time Szilárd (1898–1964) published his study on the entropy being diminished by an interference of a thinking person measuring a physical process and serving as a paradoxical Maxwell's demon (Szilárd 1929). According to later cybernetic works by Wiener and Brillouin a probable explanation of the difference in the minus/plus sign between the "*negentropy*" (negative entropy = Florenskij's ectropy) or *information* (in the sense of Shannon's mathematical information theory) and entropy may be understood in a similar vein. Suggesting a special *pneumatosphere* (from Greek πνεύμα "soul, spirit" to Florenskij) — *semiosphere* (sphere of signs in the sense of Lotman 1990) based on the principles of exact science. In that case we may say that the works of Teilhard and Vernadskij suggest a general tendency of the growth of the amount of information. The arrow of time in the human biological evolution as well as in the history of noosphere/ pneumatosphere/ semiosphere is defined by this tendency just as the time direction in the physical world is measured according to the second law of thermodynamics.

2.6. The theory of decipherment

Semiotic studies of the typology of writing were connected to the successes of the decipherment and cryptography theory. The latter was developed in the light of Shannon's mathematical theory of information. In his article on this subject Shannon suggested a general probabilistic approach showing that a relatively short text (not exceeding 20 signs) is sufficient for the decipherment if a language is known. Several magnificent successes in decipherment have been connected to a sophisticated system relating the type of writing to a certain linguistic set of characteristics.⁹¹ Outstanding successes in deciphering a number of unknown systems of writing are significant not only from an internal semiotic point of view. They show the generally high level of research connected to fundamentals of human knowledge. In a way an important part of natural sciences can be interpreted as similar to cryptographic work.⁹²

⁹¹ One of the most remarkable achievements in this area was made by a Russian linguist Nevskij (1892–1937; executed at the time of Stalin's terror). To discover the shape of Tangut (Hsi-Hsia) words he studied their Tibetan transcriptions as well as correspondences to the other Sino-Tibetan languages. His first publication in the field has remained the best introduction to the Tangut language even for those who did not agree with some of his results; although delayed, 40 years later a publication of his other works that contained a large comparative dictionary of the dead Tangut language caused a revival of Tangut studies in Russia, Japan, China and Europe. Gelb's (1963) theoretical study of writing that has remained the main semiotic work in the field was a continuation of his important contribution to the decipherment of Luwian hieroglyphics. The marvellous achievement of Ventris and Chadwick was based on the interpretation of Ventris' grid and Kroeber's triads. Approximately at the same time, Yuri Knorozov achieved important results in deciphering Maya glyphs (cf. Kelley 1976) basing himself on a formal quantitative theory of the layers of language in its relation to writing. Shevoroshkin's study of typology of sound chains in different languages helped him in the general description of Carian writing. Although some details of the phonetic interpretation of letters of Carian alphabet have been corrected in the light of recently studied Carian-Egyptian bilinguals, the general conclusion about the closeness of the language to Luwian has been confirmed.

⁹² This approach was shown to be not only a metaphor when Gamov first suggested a linguistic model in genetic studies. Although his original attempt at decipherment was not successful, later achievements were partly due to this general attitude.

2.7. Neurosemiotics and the functional asymmetry of the brain. Biology and culture

If the achievements of human knowledge were made possible by the coevolution of brain and language,⁹³ the main part of it should be connected to the dominant (in a major part of population, left) hemisphere that is responsible for speech, logical thinking, counting and other operations with discrete signs and objects. According to Eccles, self-consciousness is connected to particular zones of the left hemisphere (Popper, Eccles 1977; Eccles 1994; 1995). Since the linguistic abilities are directly connected to shaping the structure of the speech zones of the dominant hemisphere, it seems that the coevolution of brain and language is a cross-point of the biological and sociocultural development of the noosphere. The first glimpses of understanding the respective role of the two large hemispheres of the brain were known by the middle of the previous century. But it was the great English neurologist Hughlings Jackson (1835–1911) who came to the general conclusion on “the duality of the brain”⁹⁴ (Jackson 1958). Due to the research on aphasia, split-brain studies and other new experimental methods, the neuropsychological and neurolinguistic studies have become one of the most promising fields of research.

⁹³ The idea was widely discussed in several evolutionary and paleoneurological studies of the last decades, see references in Ivanov 1998; Monod 1970; Eccles 1995; the last comprehensive study (almost completely neglecting an important aspect of the hemispheric specialization maybe as a sort of counterbalancing a somewhat exaggerated interest in it in the previous literature): Deacon 1997.

⁹⁴ Roman Jakobson who considered Jackson to be one of the founders of the modern linguistics (Jakobson 1990: 116, 125–126, 485, 511) paid particular attention to his discussion of the distinction between automatic verbal utterances like *Thank God* and the normal speech (Jackson 1958: 135). As Roman Jakobson has commented on Jackson’s conclusions summing up some results of the recent Russian experimental work: “It is characteristic that these zero parts of the speech get easily misinterpreted or simply lost by subjects with a fully active left but simultaneously inactivated right hemisphere. The same situation frequently befalls violent swearing or cursing words and, on the other hand, endearments and other ritualized formulas of courtly etiquette” (Jakobson 1990: 505). These conclusions of the neurolinguistic studies seem important for the understanding of the different functions of linguistic communication.

2.8. Symbolism of psychoanalysis and archetypes

In Freud's book on the interpretation of dreams published just in the very beginning of the 20th century, a whole system of the symbolism of the unconsciousness and some methods of their interpretation have been discussed. During the following century the concepts of psychoanalysis have been studied and criticized from different points of view including the semiotic one. As shown by Benveniste in a special article, many comparisons of this system to those of natural languages suggested by Freud are not valid. But the symbols themselves are extraordinarily interesting as many parallels to them are found in archaic mythologies as pointed out by Freud. Among those later developments that originally were connected to psychoanalysis, Jung's teaching of archetypes has been particularly well explored from this historical point of view. Many visual archetypes found by Jung in primitive art and religion as well as in the imagery of children and mentally ill people are important also for the semiotic study of human creative psychology.

2.9. Possible non-human sign systems

In connection to the search for other extraterrestrial civilizations several specific semiotic problems have been studied. N. Kardashev has attempted to give a measure of the global amount of information that is contained in all the libraries of the world and to compare it to the energetic possibilities to transmit it to the other possible civilizations. Studying the probable energetic capacities of the civilizations that spread all over their native planetary system specialists in semiotics suggested that another type of sign systems might be used by them. As a message bearing an enormously large amount of information may last a very short period of time, it has been suggested that in such a text there might be no discrete signs at all. The civilization based on a hieroglyphic global text principle may not have equivalent to our system of numbers and that may make the use of our mathematics for the purposes of interstarry communication more difficult than it was supposed, for instance, by Freudenthal in his *Lincos* project.

2.10. History of semiotic studies

Early prehistory of semiotics has been enriched by recent studies on the Greek origins of its name. As Gregory Nagy remarks in the introduction to his important study of the topic, “the word *semiotic*-[...] may be perceived in a new light if we look again at its Greek origins” (Nagy 1990: 200). As stressed by a great Russian semiotician G. Spet (1879–1937; executed at the time of Stalin’s terror) in his important manuscript of 1918 (published recently) and by later historians of science (Coseriu 1975: 122–129), the foundations for a general study of sign were laid down already by St. Augustine in whose writings many future ideas of Peirce had been anticipated. Medieval sign theory recently has been revived due to the work of such authors as Eco. He not only studied it with his associates (Eco 1984; Eco, Marmo 1989), but also based on it a part of his famous first novel (cf. Coletti 1988). It has also been discovered recently that such postmedieval authors as John Thomas (John Poincot, 1589–1644) who synthesized the results of the scholastic theory of signs may be considered as predecessors of Peirce particularly in their classification of signs (Deely 1985; Herculano de Carvalho 1961). Development of semiotics in post-Renaissance times has become an object of a series of fundamental studies.

3. Some questions for the future studies

A. Place of semiotics among exact disciplines. Semiotics and natural sciences. Information and message in physics.

Although the connections to mathematical logic and the theory of information point to a possible position of semiotics among exact sciences, still most of these possibilities have not yet been fully explored. The exact borders between disciplines are not easily delineated.⁹⁵

⁹⁵ Widely spread popular articles and books on sign systems are far away from a strictly defined research. Semiotics is being misused by a number of writers mixing this term with postmodernist literature or superficial trivialities connected to an old-fashioned behaviouristic approach. In many recent books propositions have been repeatedly made concerning a possible future separation of several semiotic disciplines. It remains to be decided whether semiotics should be one

A possible future development of humanities may be connected to establishing a bridge between them and modern natural sciences. Just as tremendous achievements of the molecular biology have been based on the use of the methods and results of chemistry and physics, the time has come to build a new synthetic picture of human culture and its history uniting the facts discovered in the traditional fields of research and the new approach inherent to such disciplines as neuropsychology.

Modern physics has been interested in the problems of the transmission of signals and in the relation of the observer, the device used by the latter and the information received, thus several topics unite semiotics and other sciences.

B. Historical tendency.

The general views of noosphere in Vernadskij's theory (as well as the semiosphere of Lotman) were based on the rational notion of the movement towards the highest type of reasoning while Teilhard (and partly also Florenskij) interpreted a similar idea in a Christian way. Teilhard combined the final aim of the movement (his *Omega*) with the image of Jesus.⁹⁶ The movement towards *Noosphere* (the realm of the Thought and Reason) was suggested as the main trend of the human evolution by Teilhard de Chardin and Vernadskij. According to the *anthropic principle* developed in modern physics the beginning of the movement starts with the formation of the Universe. Particular role of different sign systems and symbols of language, art, mythology and religion in this movement may be discussed. Different kinds of linguistic and semiotic diversity are compared in an attempt to see the possibilities of their preservation in a global capitalist world.

field of research or several. The differences between fields where semiotic methods are applied seem to speak in favour of a split between them. At the same time it is apparent that if there is a certain common core of ideas about signs it might be valid in relation to all the possible kinds of them. Thus if semiotics becomes a science, it is supposed not to be split in two.

⁹⁶ It seems that just a religious aspect of Teilhard's ideas looked hostile to such scientists as Monod (see a remark on Teilhard's Jesuit theology in Monod 1970: 45; 1971: 33, which appears strange having in mind the resolute opposition of the Jesuit order to Teilhard's concepts and works). At the same time some of Monod's statements look pretty close to Teilhard's notions of the direction of time in connection to the development of the brain and the Noosphere.

C. Future of semiotic systems.

What could be the result of the substitution of the methods of cultural transmission (libraries, archives) that have existed for the last 5000 years? Is it possible that the new ways of cultural transmission (mainly through computerized systems linked to the other electronic devices, systems of the virtual reality reconstructing the past etc.) will change some of the human high psychological systems such as memory? Can radical transformation of the present-day systems of elementary and high education be suggested on the base of the modern knowledge concerning the possibilities and early critical ages of acquiring different specific systems of signs (mathematical, artistic)? Combining research in artificial intelligence with *neurosciences* promises to yield in the foreseeable future *automatic devices* of a new type to solve problems (for example, the perception of visual signs) that pose great difficulties for computers today. Computer methods form the basis of bio-information technology and bio-technology, which promise radical advances in applied molecular biology and medicine. Natural languages may and should be compared not only to the software of computers, but also to the different artificial languages of mathematical logic to which the programming languages are connected historically. Semantics of the natural languages can be approached (as Zadeh suggested) by the fuzzy structures. Is it possible to build artificial systems oriented towards less rigid logical classification and closer to human imagery of art? If computers are models of the logical operations of the left hemisphere, can we try to imitate the non-exact (or fuzzy) way of reasoning of the right hemisphere? How can the system of the genetic transmission of information through messages that is studied in molecular biology be compared to the transmission of culture through linguistic and other symbolic (sign) systems? What are the analogies to genetic mutations in the cultural transmission of information? Is it less stable and reliable than the genetic one?

Pavel Florenskij in his posthumous works suggested the importance of *organoprojection* (the continuation of our body through some technological devices). The same idea was discussed by Niels Bohr in some of his philosophical essays: to him a scientist and his device are united, they constitute one observer. Can a border between a scholar and his library be drawn (compare the episode of the destruction of Don Quijote's library in Cervantes' novel)? The problem of the

borders of our body and our self (mind, consciousness) is not solved in the European science and philosophy. In some Oriental schools of thought (Buddhism) the reality of Self (Cartesian ego) is denied and it is thought that the existence is continued through other bodies. Can a computer program continue some features of its creator? What is the present-day relationship between interiorized signs (in the sense of Piaget and Vygotskij) and the exteriorized computational devices? What are the limits and restrictions of some of the most advanced modern computers in so far as the rigorous thinking is concerned (since most computers compute with approximations with quite inexact results)? How are our concepts of space-time (Bakhtinian *chronotope*) influenced by the modern linguistic and semiotic research? What world-views are compatible with the results of the modern neurosemiotics? Is the role of causality changed in the studies of man?

Conclusion

Semiotic and linguistic studies of the 20th century have been important mostly in two senses: on one hand they have opened a road for comparative research on the origin and development of language and other systems of signs adding a new dimension to the history of culture (this aspect is studied in detail in the first part of my paper). On the other hand, they have shown a possibility of uniting different fields of humanities around semiotics suggesting a way to trespass separation and atomisation of different trends in investigating culture (that side of the development is described in the second part of the paper). In the 21st century one may hope for closer integration of semiotics and exact and natural sciences. The points of intersection with the mathematical logic, computer science and information theory that already exist might lead to restructuring theoretical semiotics making it a coherent and methodologically rigid discipline. At the same time, the continuation of neurosemiotic studies promises a breakthrough in understanding those parts of the work of the brain that are most intimately connected to culture. From this point of view semiotics may play an outstanding role in the synthesis of biological science and humanities. In my mind that makes it a particularly important field of future research. To practical applications of these

studies a work on possible engineering models of the brain may belong that will be oriented to solution of problems, which have remained beyond the possibilities of modern computers. Understanding the sign-and-texts transmission and transformation in the brain may give an impetus to new technological achievements. I am personally very much interested in a possibility to apply a rich set of audio-visual technological means that are now at our disposal to create truly new methods of sign transmission and texts construction not only in the arts and media but also to revolutionize education. In combination with the advances in computer sciences these new potential technologies may completely change the way the young generation learns about the world and its history.

References⁹⁷

- Agawu, Kofi 1991. *Playing with Signs: A Semiotic Interpretation of Classic Music*. Princeton: Princeton University Press.
- Ajdukiewicz, Kazimierz 1974. *Pragmatic Logic*. (Synthese Library 62.) Dordrecht: Reidel Publishing.
- Ardzinba, Vladislav G. 1982. *Ritually i mify drevnej Anatolii* [Rites and Myths of the Ancient Anatolia]. Moskva: Nauka.
- Arensburg, Baruch; Tillier, Anne-Marie 1991. Speech and the Neanderthals. *Endeavour* 15: 26–28.
- Asher, Marcia; Asher, Robert 1997. *Mathematics of the Incas*. Minela: Dover Publications.
- Austerlitz, Robert 1983. Is music like language and if so, how? *American Journal of Semiotics* 2(3): 1–11.
- Barbujani, Guido; Pilastro, Andrea 1993. Genetic evidence on origin and dispersal of human population speaking languages of the Nostratic macrofamily. *Proceedings of the National Academy of Sciences* 90: 4670–4673.
- Barbujani, Guido; Pilastro, Andrea; Domenico, Silvia de; Renfrew, Colin 1994. Genetic variation in North Africa and Eurasia: Neolithic demic diffusion vs. Paleolithic colonisation. *American Journal of Physical Anthropology* 95: 137–154.
- Barthes, Roland 1969. *Elements of Semiology*. New York: Hill & Wang.
- Bayley, Harold 1996. *The Lost Language of Symbolism: The Origins of Symbolism, Mythologies and Folklore*, 2 vols. London: Bracken Books.

⁹⁷ The list keeps several references that are not directly mentioned in the article. *Editors' note*.

- Bellwood, Peter 1997. Prehistoric cultural explanations for widespread language families. In: McConvell, Patrick; Evans, Nicholas (ed.), *Archaeology and Linguistics. Aboriginal Australia in Global Perspective*. Melbourne: Oxford University Press, 122–134.
- Belyj, Andrej 1985. *Selected Essays*. [Cassedy, S., ed. and trans.] Berkeley: University of California Press.
- Benedict P. 1972. *Sino-Tibetan: A Conspectus*. Cambridge: Cambridge University Press.
- 1975. *Austro-Thai Language and Culture*. New Haven: HRAF Press.
- 1976. Austro-Thai and Austroasiatic. In: Jenner, Philip N.; Thompson, Laurence C.; Starosta, Stanley (eds.). *Austroasiatic Studies*. Honolulu: University Press of Hawaii, vol 1: 1–36.
- Benveniste, Émile 1952. Communication animale et langage humain. *Diogenè* 1: 1–7.
- 1969. Sémiologie de la langue. *Semiotica* 1: 1–12; 2: 127–135. (Reprinted in: Benveniste, É. 1974. *Problèmes de linguistique générale* II. Paris: Gallimard, 43–66.)
- Bogarin, Jorge 1991. Zeichen, Zahl und Sein: Semiotik als ontologische Rahmentheorie der Mathematik. *Zeitschrift für Semiotik* 13(3/4): 237–245.
- Buckland, Warren 1997. The new film semiology. In: Rauch, Irmengard; Carr, Gerald F., *Semiotics Around the World: Synthesis in Diversity*, vol. 1. Berlin: Mouton de Gruyter, 599–602.
- Bunak, V. V. 1951. Proishozhdenie rechi po dannym antropologii [Origin of speech according to the data of physical anthropology]. In: *Proishozhdenie cheloveka i drevnee rasselenie chelovechestva* (Trudy Instituta Etnografii Akademii Nauk SSSR, vol. 16), 205–290.
- Buysens, Eric 1943 *Les langages et le discours. Essai de linguistique fonctionnelle dans le cadre de la sémiologie*. Bruxelles: Office de publicite. Anc. etabliss. J.BebKgue & Co, editeurs, Societe cooperative.
- 1956 Le langage par gestes chez les moines. *Revue de l'Institut de Sociologie* 29: 537–545.
- Carnap, Rudolf 1942. *Introduction to Semantics*. Cambridge: Harvard University Press.
- Casagrande, Joseph B. 1964. Comanche Baby Language. In: Hymes, Dell (ed.), *Language in Culture and Society: A Reader in Linguistics and Anthropology*. New York: Harper & Row, 245–250
- Casetti, Francesco 1986. *Dentro lo sguardo. Ilfilme e il sou spettatore*. Milano: Bompiani.
- Cassirer, Ernst 1924–1929. *Philosophie der Symbolischen Formen*, vols. 1-3. Berlin: Bruno Cassirer.
- Cavalli-Sforza, L. Luca; Menozzi, Paolo; Piazza, Alberto 1994. *The History and Geography of Human Genes*. Princeton: Princeton University Press.
- Cirlot, Juan Eduardo 1971. *A Dictionary of Symbols*. New York: Philosophical Library.
- Closs, Michael P. (ed.) 1996. *Native American Mathematics*. Austin: University of Texas.

- Coletti, Theresa 1988. *Naming the Rose: Eco, Medieval Signs and Modern Theory*. Ithaca and London: Cornell University Press.
- Coseriu, Eugenio 1975. *Die Geschichte der Sprachphilosophie von der Antike bis zur Gegenwart*, vol. 1, *Von der Antike bis Leibniz*. (Tübingen Beiträge zur Linguistik 1.) Tübingen: Gunter Narr Verlag.
- Critchley, MacDonald 1966. *The Parietal Lobes*. New York: Harner Publishing.
- Curry, Haskell B. 1977. *Foundations of Mathematical Logic*. New York: Dover Publications.
- Cushing, Frank Hamilton 1892. Manual concepts: A study of the influence of hand-usage on culture growth. *American Anthropologist* 5(1), 289–317.
- 1990. *Cushing at Zuni: The Correspondence and Journals 1879–1884*. [Green, Jesse (ed.)] Albuquerque: University of New Mexico Press.
- Daub, E. E. 1970. Maxwell's Demons. *Studies in History and Philosophy of Science* 1: 213–222.
- Deacon, Terrence W. 1997. *The Symbolic Species: The Co-evolution of Language and Brain*. New York: W. W. Norton and Co.
- Deely, John 1985. *Tractatus de Signis: The Semiotic of John Poincaré*. Berkeley: The University of California Press.
- Deliege, Célestin 1965. La musicologie devant le structuralisme. *L'arc* 26: 45–54.
- Diakonoff, Igor M. 1983. Some reflections on numerals in Sumerian: Towards a history of mathematical speculation. *Journal of the American Oriental Society* 103(1): 84–92.
- Eccles John C. 1986. Do mental events cause neural events analogously to the probability fields of quantum mechanics? *Proceedings of the Royal Society of London* 227: 411–428.
- 1994. *How the Self Controls its Brain*. Belin: Springer-Verlag.
- 1995. *Evolution of the Brain: Creation of the Self*. London: Routledge.
- Eco, Umberto 1984. *Semiotica e filosofia del linguaggio*. Torino: Giulio Einaudi Editore. [English translation: *Semiotics and the Philosophy of Language*. Bloomington: Indiana University Press, 1984.]
- Eco, Umberto; Marmo, Constantino (eds.) 1989. *On the Medieval Theory of Signs*. (Foundations of Semiotics 21.) Amsterdam, Philadelphia: John Benjamins Publishing Company.
- Edelman, Gerald M. 1992. *Bright Air, Brilliant Fire: On the Matter of the Mind*. New York: Basic Books.
- Florenskij, Pavel A. 1993. *Analiz prostranstva i vremeni v hudozhestvenno-izobrazitel'nyh proizvedenijah* [Analysis of Space and Time in the Works of Representational Art]. Moskva: Progress. [In Russian].
- 1995. *Lo spazio e il tempo nell'arte*. [Misler, N., trans.] Milano: Adelphi edizioni.
- Forrer, Emil 1940. Das Abendmahl im Hatti-Reiches. *Actes du XXe Congrès International des Orientalistes*. Bruxelles, 1938. Louvain.
- Freidenberg, Olga M. 1997. *Image and Concept: Mythopoetic Root of Literature*. [Moss, C. trans.; Ivanov, V., ed.] Sign/ Language/ Culture: Studies in Slavic and Cultural Semiotics, vol. 2. Amsterdam, New York: Harwood Academic

- Publishers. [Posthumous Russian ed.: *Ot mifa k literature*. Moskva: Nauka, 1978.]
- Frisch, Karl von 1976. *Bees: Their Vision, Chemical Senses, and Language*. Ithaca and London: Cornell University Press.
- Frolov, Boris A. 1974. *Chisla v grafike paleolita* [Numbers in the Paleolithic Visual Symbols]. Novosibirsk: Nauka, Sibirskoe otdelenie.
- Galaburda, Albert M.; LeMay, Marjorie; Kemper, Thomas L.; Geshwind, Norman 1978. Right-left asymmetries in the brain. *Science* 19(4331): 852–856.
- Gardner, R. Allen; Gardner, Beatrice T. 1972. Teaching sign language to a chimpanzee. In: Adams, P. (ed.), *Language in Thinking. Selected Readings*. Penguin Modern Psychology Readings. Harmondsworth: Penguin, 17–42.
- Gelb, Ignace J. 1963. *A Study of Writing*. Chicago: Chicago University Press.
- Gerlach, P. 1978. Panofsky: 'Perspektive als symbolische Form' in semiotischer Sicht. *Die Einheit der Semiotischen Dimensionen*. Tübingen: Gunter Narr Verlag, 319–336.
- Ginzburg, Carlo 1989. *Clues, Myths and the Historical Method*. Baltimore: The John Hopkins University Press.
- Goux, Jean-Joseph 1990. *Symbolic Economies*. New York: Cornell University Press.
- Gruhn, Ruth 1997. Language classification and models for peopling of the Americas. In: McConnell, Patrick; Evans, Nicholas (ed.), *Archaeology and Linguistics. Aboriginal Australia in Global Perspective*. Melbourne, Oxford: Oxford University Press, 99–110.
- Hauße, Heinz 1981. *Der Informationsgehalt von Theorien. Ansätze zu einer quantitativen Theorie der wissenschaftlichen Erklärung*. Library of Exact Philosophy. Wien: Springer-Verlag.
- Heilman, Kenneth M.; Watson, Robert T. 1977. The neglect syndrome — A unilateral defect of the orienting response. In: Harnad, Stevan R.; Doty, R. W.; Goldstein, L.; Jaynes, J.; Krauthamer, G. (eds.), *Lateralization in the Nervous System*. New York: Academic Press, 285–302.
- Herculano de Carvalho, José G. 1961. Segno e significazione in João de são Tomás. *Aufsätze zur Portugiesischen Kulturgeschichte* 2: 152–176.
- Hickmann, Hans 1958. La chironomie dans l'Égypte pharaonique. *Zeitschrift für Ägyptische Sprache und Altertumskunde* 83(2): 96–127.
- Hilbert, David 1926. Über das Unendliche. *Mathematische Annalen* 95: 161–190.
— 1928. *Die Grundlagen der Mathematik*. (Hamburger Mathematischer Einzelschriften 5.) Leipzig: Teubner.
- Hjelmslev, Louis 1943. *Omkring sprogteoriens grundlaeggelse*. København: B. Lunos bogtrykkeri. [An authorized and enlarged English translation: 1953, *Prolegomena to a Theory of a Language. Six Publications in Anthropology*. Baltimore: Waverly Press].
— 1959, 1973 *Essais linguistiques*. Travaux du Cercle Linguistique de Copenhague, vol. 10–12. Copenhague: Nordisk Sprog- og Kulturforlag.
- Hocart, Arthur M. 1927. *Kingship*. Oxford: Oxford University Press.
— 1936. *Kings and Councillors*. Cairo: Printing office P. Barbey.

- Hockett, Charles F. 1960. The origin of speech. *Scientific American* 203(3): 88–96.
- Hymes, Dell H. 1960. Lexicostatistics so far. *Current Anthropology* 1(1): 3–44.
- Illich-Svitych, Vladislav M. 1989. The relationship of the Nostratic family languages: a probabilistic evaluation of the similarities in question. In: Shevoroshkin, Vitaly (ed.), *Explorations in Language Macrofamilies*. Bochum: N. Brockmeyer, 111–113.
- 1990. Nostratic Reconstructions. [Transl. and arranged by M. Kaiser.] In: Shevoroshkin, Vitaly (ed.), *Proto-Languages and Proto-Cultures*. Bochum: N. Brockmeyer, 138–167.
- Itani, J. 1963. Vocal communication of the wild Japanese monkey. *Primates* 4: 11–86.
- Ivanov, Vyacheslav V. 1976. The significance of M. M. Bakhtin's ideas of sign, utterance, and dialogue for modern semiotics. In: Baran, Henryk (ed.), *Semiotics and Structuralism. Readings from the Soviet Union*. White Plains: International Arts and Sciences Press, 310–367.
- 1993. The dominant of Bakhtin's work: Dialogue and carnival. In: Shepherd, David (ed.), *Bakhtin: Carnival and Other Subjects. Selected Papers from the Fifth International Bakhtin Conference* (Critical Studies 3(2)–4(1/2)), 3–12.
- 1993a. On the etymology of Latin *Elementa*. *Elementa* 1(1): 1–5.
- 1995. Florensky: A symbolic View. *Elementa* 2(1).
- 1998. Estetika Eisensteina. *Izbrannye trudy po semiotike i istorii kul'tury*, vol. 1. Moscow: Jazyki russkoj kul'tury, 141–378.
- 1999. An ancient name of the Lyre. In: Vine, Brent; Ivanov, Vyacheslav (eds.), *UCLA Indo-European Studies, vol. 1*. Los Angeles: UCLA.
- Jackson, John Hughlings 1958. *Selected Writings*, vol. II. New York: Basic Books.
- Jakobson, Roman 1990. *On Language*. Cambridge: Harvard University Press.
- Kelley, David 1976. *Deciphering the Mayan Script*. Austin: University of Texas Press.
- Kevelson, Roberta 1988. *The Law as a System of Signs*. New York: Plenum.
- Koch, Rudolf 1930. *The Book of Signs*. London: The First Edition Club.
- Kochetkova, Veronika I. 1973. *Paleonevrologiya* [Paleoneurology]. Moskva: Izdatel'stvo MGU.
- Le May, Marjorie 1976. Morphological cerebral asymmetries of modern man, fossil man, and nonhuman primate. In: Harnad, Stevan R.; Steklis, Horst D.; Lancaster John (eds.), *Origins and Evolution of Language and Speech. Annals of the New York Academy of Sciences* 280: 249–366.
- Leroi-Gourhan, André 1964. *Le geste et la parole: vol. 1, Technique et langage*. Paris: Editions Albin Michel.
- 1965. *Le geste et la parole: vol. 2, La mémoire et les rythmes*. Paris: Editions Albin Michel.
- 1983 *Les chasseurs de la préhistoire*. Paris: Métailié.
- 1986. *Les religions de la préhistoire: paléolithique*. Paris: Presses Universitaires de France.

- Le Roux, Françoise; Guyonvarc'h, Christian 1986. *Les Druides*. La Guerche-de-Bretagne, Rennes: Ouest-France.
- Lévi-Strauss, Claude 1964. *Mythologiques I. Le cru et le cuit*. Paris: Plon.
- Lieberman, Philip 1984. *The Biology and Evolution of Language*. Cambridge: Harvard University Press.
- 1991. *Uniquely Human: The Evolution of Speech, Thought and Selfless Behavior*. Cambridge: Harvard University Press.
- Lotman, Juri M. 1990. *Universe of Mind: A Semiotic Theory of Culture*. London: I. B. Tauris & Co, Ltd. [A posthumous edition of the Russian original including drafts of some parts: 1996, *Vnutri mysljashchih mirov. Chelovek — tekst — semiosfera — istoriya*. Moscow: Yazyki russkoj kul'tury.]
- Majewicz, Alfred F. 1981 Le rôle du doigt et de la main et leurs désignations dans la formation des systèmes particuliers de numération des noms de nombres dans certaines langues. In: Sivers, Fanny de (ed.), *La main et les doigts dans l'expression linguistique 2*. Paris: Selaf, 193–212.
- Malmberg, Bertil 1977. *Signes et symboles*. (Connaissance du langues 11.) Paris: Ed. A. & J.Picard.
- Marshack, Alexander 1972. *The Roots of Civilization*. New York: McGraw-Hill.
- 1976. Some implications of the Paleolithic symbolic evidence for the origin of language. In: Harnad, Stevan R.; Steklis, Horst D.; Lancaster John (eds.), *Origins and Evolution of Language and Speech*. *Annals of the New York Academy of Sciences* 280: 289–311.
- Matheson, Esther; Wheeler, Alva; Jackson, Frances L.; Waltz, Nathan E.; Christian, Diana R. 1972. *Comparative Studies in Amerindian Languages*. The Hague: Mouton.
- Miles, H. Lyn White 1994 [1990]. The cognitive foundations for reference in a signing orangutan. In: Parker, Sue Taylor; Gibson, Kathleen Rita (eds.), *"Language" and Intelligence in Monkeys and Apes. Comparative Developmental Perspectives*. New York: Cambridge University Press, 511–539.
- Miller, Roy A. 1971. *Japanese and the Other Altaic Languages*. Chicago: The University of Chicago Press.
- Misler, Nicoletta (ed.) 1997. *RAKhN: The Russian Academy of Artistic Sciences Experiment. A Journal of Russian Culture* 3.
- Mognihan, Martin H. 1969. Comparative aspects of communication in New World primates. In: Morris, Desmond (ed.), *Primate Ethology: Essays on the Socio-Sexual Behavior of Apes and Monkeys*. Chicago: Aldin, 306–342.
- Monod, Jacques. 1970. *Le hasard et la nécessité. Essai sur la philosophie naturelle de la biologie moderne*. Paris: Editions du Seuil. [The English translation : Monod, Jacques 1971. *Chance and Necessity. An Essay on the Natural Philosophy of Modern Biology*. New York: Alfred A. Knopf.]
- Nagy, Gregory 1990. Greek Mythology and Poetics. In: Nagy, Gregory (ed.), *Myth and Poetics*. Ithaca: Cornell University Press.
- Nikolaev, Sergei; Starostin, Sergei 1994. *A North Caucasian Etymological Dictionary*. Moscow: Asterisk.

- Nishida, Tatsuo 1979. *The Structure of the Hsi-Hsia (Tangut) Characters*. (Monumenta Serindica 8.) Institute for the Study of Languages and Cultures of Asia and Africa.
- Odin, Roger 1983. Pour une sémio-pragmatique du cinéma. *Iris* 1(1): 67–81.
- Oettinger, Norbert 1976. *Die militärischen Eide der Hethiter*. (Studien zu den Bogazköy-Texten 22.) Wiesbaden: Harrasowitz.
- Patterson, Francine G., Linden, Eugene. 1981 *The Education of Koko*. New York: Holt, Rinehart & Winston.
- Peirce, Charles Sanders 1960, 1966. *Collected Papers*, vol. 2 (1960), vol. 8. (1966). Cambridge: Harvard University Press.
- Penrose, Roger. 1990. *The Emperor's New Mind: Concerning Computers, Minds and Laws of Physics*. New York: Vintage.
- Poizner, Howard; Klima, Edward S.; Bellugi, Ursula 1987. *What the Hands Reveal About the Brain*. Cambridge: the M.I.T. Press.
- Popper, Karl R.; Eccles, John C. 1977. *The Self and Its Brain*. New York: Springer.
- Putilov, Boris N. 1980. *Mif, obryad, pesnya Novoi Gvinei* [Myth, Ritual, Song of New Guinea]. Moskva: Nauka.
- 1997. *Epicheskij skazitel': tipologiya i etnicheskaya spetsifichnost'* [Epic singer: typology and ethnical identity]. Moskva: Vostochnaya literatura.
- Reichenbach, Hans 1947. *Elements of Symbolic Logic*. New York: The Macmillan Company.
- Renfrew, Colin 1991. Before Babel: Speculations on the origin of linguistic diversity. *Cambridge Archeological Journal* 1(1): 3–23.
- 1996. Language families and the spread of farming. In: Harris, David R. (ed.), *The Origins and Spread of Agriculture and Pastoralism in Eurasia*. London: University of London Press, 70–92.
- Rijlaarsdam, Jetske C. 1978. *Plato über die Sprache: Ein Kommentar zum Kratylos, mit einem Anhang über die Quelle der Zeichentheorie Ferdinand de Saussure*. Utrecht: Bohn, Scheltema & Holkema.
- Robins, Robert H.; Uhlenbeck, Eugenius M. (eds.) 1991. *Endangered Languages*. Oxford: Berg.
- Rorty, Richard (ed.) 1992. *The Linguistic Turn*. Chicago: University of Chicago Press.
- Ryan, William; Pitman, Walter 1999. *Noah's Flood: The New Scientific Discoveries about the Event that Changed History*. New York: Simon and Schuster.
- Saint-Guiron, Gérard 1965 Quelques aspects de la musique d'un point de vue linguistique. *Études linguistiques appliquées* 3: 12–36.
- Saussure, Ferdinand de 1916. *Cours de linguistique générale*. Lausanne, Paris.
- Savage-Rumbaugh, E. Sue; Lewin, Roger 1994. *Kanzi: The Ape at the Brink of the Human Mind*. New York: John Wiley.
- Scharfe, Hartmut 1971. *Panini's Metalanguage*. (Memoirs of the American Philosophical Association 81.) Philadelphia: American Philosophical Society.
- Schmandt-Besserat, Denise 1992. *Before the Number*. Austin: Texas University Press. [An abridged version: 1996, *How Writing Came About*.]

- Sethe, K. 1918. Ein altägyptischer Fingerzählreim. *Zeitschrift für Ägyptische Sprache* 54: 16–39.
- Sommerfelt, Alf 1938. *La langue et la société*. Oslo: H. Aschehoug & Co.
- Spitzer, Leo 1961. *Stilstudien*. 2 vols. München: Max Huber Verlag.
- 1988. *Representative Essays*. Stanford: Stanford University Press.
- Springer, George P. 1956. Language and Music: Parallels and Divergencies. In: Halle, Morris (ed.), *For Roman Jakobson*. Hague: Mouton, 504–513.
- Starostin, Sergei A 1991. *Altayskaya problema i proishozhdenie yaponskogo yazyka* [Altaic Problem and the origin of the Japanese Language]. Moskva: Nauka.
- Swiggers, Pierre 1987. Eric Buysens' *Les Langages et le discours*: A functional analysis of man's use of signs. In: Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.), *The Semiotic Web 1986*. Berlin: Mouton-de Gruyter, 103–119.
- Szilárd, Léo. 1929. Über die Entropieverminderung in einem thermodynamischen System bei Eingriffen intelligenter Wesen. *Zeitschrift für Physik* 53: 840–856.
- Tarski, Alfred 1956. *Logic, Semantics, Metamathematics: Papers from 1923 to 1938*. Oxford: Clarendon Press.
- Terrace, Herbert S. 1984. Apes who “talk”: Language or projection of language by their teachers? In: De Luce, Judith; Wilder, Hugh T. (eds.), *Language in Primates*. New York: Springer Verlag, 19–42.
- Tomkins, William 1969. *Indian Sign Language*. New York: Dover.
- Turner, Victor 1982. *From Ritual to Theatre*. New York: PAJ Publications.
- 1992. *The Anthropology of Performance*. New York: PAJ Publications.
- Watkins, Calvert 1995. *How to Kill a Dragon. Aspects of Indo-European Poetics*. Oxford: Oxford University Press.
- Weng, Zili; Sokal, Robert R. 1995. Origins of Indo-Europeans and the spread of agriculture in Europe: Comparison of lexicostatistical and genetic evidence. *Human Biology* 67: 577–594.
- West, Martin Lichtfield 1981. The singing of Homer and the modes of Greek music. *Journal of Hellenic Studies* 101: 113–129.
- 1994. The Babylonian musical notation and the human melodic texts. *Music and Letters* 75(2): 161–174.
- Wilson, Edward O. 1975. *Sociobiology: The New Synthesis*. Cambridge: Harvard University Press.
- Wollenden, Stuart N. 1931. On the Tibetan transcriptions of Si-Hia words. *The Journal of the Royal Asiatic Society*, January, 48–52.
- 1934 On the prefixes and consonantal finals of Si-Hia as evidenced by their Chinese and Tibetan transcriptions. *The Journal of the Royal Asiatic Society*, October, 745–770.
- Yang, Chen Ning 1996. Symmetry and physics. *Proceedings of the American Philosophical Society* 140(3): 267–288.
- Zhirmunskij, Viktor M. 1962. *Narodnyj geroicheskij epos* [Folk heroic Epic]. Moskva-Leningrad: Gosudarstvennoe izdatel'stvo hudozhestvennoj literatury.

Семиотика XX века

Семиотические и лингвистические исследования XX века были важны главным образом в двух смыслах — (1) они открыли дорогу для сравнительного исследования происхождения и развития языка и других систем знаков, добавив новое измерение к истории культуры; (2) они показали возможность объединения различных областей гуманитарных наук вокруг семиотики, предлагающей способ нарушить обособленность и раздробленность различных дисциплин, занимающихся исследованиями культуры. В XXI веке можно надеяться на большую интеграцию семиотики и точных и естественных наук. Пункты пересечения с математической логикой, информатикой и информационной теорией, которые уже существуют, могли бы привести к реструктурированию теоретической семиотики, превращая ее в последовательную и методологически стойкую дисциплину. В то же время, продолжение нейросемиотических исследований обещает прорыв в понимании тех частей работы мозга, которые наиболее тесно связаны с культурой. С этой точки зрения семиотика может играть выдающуюся роль в синтезе биологической науки и гуманитарных наук. Полагаю, что это делает семиотику особенно важной областью будущих исследований.

Kahekümnenda sajandi semiootika

XX sajandi semiootilised ja lingvistilised uurimused olid olulised eelkõige kahes mõttes: (1) nad avasid tee keele ja teiste märgisüsteemide päritolu ja arengu võrdlevatele uuringutele; (2) näitasid kätte võimaluse erinevate humanitaarteaduse valdkondade ühinemiseks semiootika ümber, mis pakkus välja mooduse seni eksisteerinud distsiplinaarsete piiride ületamiseks. XXI sajandil on veelgi suurem lootus integreerida semiootika ja täppis- ning loodusteadused. Olemasolevad lõikepunktid matemaatilise loogika, informaatika ja informatsiooniteooriaga võiksid tuua endaga kaasa teoreetilise semiootika restruktureerumise, muutes ta järjekindlaks ja metodoloogiliselt pädevaks distsipliiniks. Samas lubab neurosemiootiliste uuringute areng läbimurret kultuuriga tihedalt seotud ajuosade tööprintsibiist arusaamises. Sellest vaatepunktist võib semiootikal olla otsustav roll bio- ja humanitaarteaduste sünteesis, mis on minu jaoks eriti oluline tulevaste uuringute valguses.