Chapter 1

What Language Is

A Collection of Statements About Language

It is good form in the sciences to begin a paper with a review classifying and systematizing the earlier formulated conceptions. However, I cannot do this in the present case. Statements about language are so various and sometimes so contradictory that it seems impossible to place them according to a precise scheme — logically developed in historical perspective. The subject is complicated by the fact that linguistics is the most ancient scholarly branch. Its sources can be found not only in ancient Greece but also in ancient India and the Arab world of the past, and, most importantly, these ancient statements about language retain a peculiar interest; even nowadays, they have not become just a property of the archives of the history of science.

Without attempting to overcome this enormous difficulty, I shall confine myself to quoting, in chronological order, a series of statements about language which I have found most interesting.

Sciences develop in time. They grow as trees do: some of their branches wither and fall off, others spread more luxuriantly, and as the tree grows its lower branches become hidden in the earth — they pass into the domain of history. Linguistics, however, does not follow this pattern of development: this is a mosaic of bright colors in a vast field, and the field turns out to be magical. After new flowers have appeared, the old ones do not fade; they do not lose their brightness and freshness. My collection of statements is but a weak attempt to reflect this bright picture.[1]

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[1] The collection of statements about language given below was, in its major part, compiled by A. V. Yarkho. If the year of the first edition of the work in which the statement appeared is known, it precedes

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PLATO (ca. 428–348 B.C.) — the famous ancient Greek philosopher.

> *Socrates*. Then the argument would lead us to infer that names ought to be given according to a natural process, and with a proper instrument, and not at our pleasure. . . . Then, Hermogenes, not every man is able to give a name but only a maker of names; and this seems to be the legislator, who of all skilled artisans in the world is the rarest. . . . Then, as to names: ought not our legislator also know *how to put the true natural name of each thing into sounds and syllables*. . . . And we must not misinterpret the fact that different legislators will not use the same syllables[2] (Plato, 1953)

T. HOBBES (1588–1679) — an English philosopher, one of the founders of mechanistic materialism.

> Everyone knows from his own most authentic experience how human thoughts are vague and transient and how their repetition is random . . . to study philosophy a person must have some sensual objects of recollection whereby the thoughts forgotten may again be revived in memory and as if be, be fixed in a certain sequence. We shall call such objects of recollection marks. . . . If the marks invented by people for the purpose of developing their thinking cannot be communicated to others, all their knowledge will disappear with them. . . . For this reason in order to construct and develop the stock of philosophical knowledge, symbols are necessary whereby the thoughts of one person could be communicated and explained to others. As to the symbols or attributes, objects following one another serve their function since we have remarked a certain regularity in their sequence. . . . Among symbols, some are natural . . . others are arbitrary . . . we shall refer here . . . to words in a definite combination signifying our thoughts and our spiritual movements. . . . If human sounds are connected so that they form symbols of thoughts they are called speech, and their separate parts — names.
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> A name is a word arbitrarily chosen as a mark to arouse in our mind thoughts similar to previous ones and at the same time, if it is *inserted into a sentence and spoken by another person*, serving a sign of what thoughts the speaker possessed at the moment. . . . I believe the names emerged as a result of an arbitrary decision . . . since he who watches the way new names arise and old ones disappear every day, as various nations use various names and that there is no similarity or comparison between names and things, he cannot believe quite in earnest that names of things come from their nature. . . .

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the name. The source of the statement which is given in the References at the end of the book appears at the end of each statement.

[2] Ivanov (1964) has noted an interesting parallel of the Greek tradition with ancient Indian mythology, where it is mentioned that the things have been named as the result of the act of creating speech by the Universal maker. This parallel can be drawn further by including Judaism. In the Old Testament it is also said that Adam gave names to all living creatures.

Besides, it is not at all necessary that every name be a name of a thing.

As people owe their true knowledge to correct comprehension of words, the foundation of their delusions lies in their wrong comprehension . . . language is like a cobweb: weak minds cling to the words and get entangled in them, while stronger minds easily break through. (Hobbes, 1658)

1690   J. Locke (1632–1704) — an Englishman of the enlightenment and philosopher, the founder of materialistic sensualism.

Man fitted . . . to make them [articulate sounds] signs of ideas. – Besides articulate sounds . . . it was farther necessary that he [man] should be able to use these sounds as signs of internal conceptions and to make them stand as marks for the ideas within his own mind; whereby they might be made known to others, and the thought of men's minds be conveyed from one to another . . . It is not enough for the perfection of language that sounds can be made signs of ideas, unless those signs can be so made use of as to comprehend several particular things: for the multiplication of words would have perplexed their use, had every particular thing need of a distinct name to be signified by. To remedy this inconvenience, language had yet a farther improvement in the use of general terms, whereby one word was made to mark a multitude of particular existences. (Locke, 1665)

1749   D. Hartley (1705–1757) — an English philosopher-materialist, physician, and psychologist.

Since words may be compared to the letters used in algebra, language itself may be termed one species of algebra; and, conversely, algebra is nothing more than the language which is peculiarly fitted to explain quantity of all kinds. . . . Now, if every thing relating to language had something analogous to it in algebra, one might hope to explain the difficulties and perplexities attending the theory of language by the corresponding particulars in algebra, where every thing is clear, and acknowledged by all that have made it their study. (Hartley, 1834)

W. von Humboldt (1767–1835) — an outstanding German linguist, the founder of general linguistics.

Language has a certain limit in the completeness of its structure; when it is achieved, neither its organic construction, nor its structure undergo any changes. No language has yet been discovered which would be below the limit of the formed grammatical construction. . . .

Language can emerge in no other way than suddenly and at once, or to be more accurate, language must at every moment of its existence possess everything which makes it an entity. . . .

Language cannot be imagined as something a priori given to hu-

manity since if that were so, it would be perfectly incomprehensible how man could understand this gift and make it serve himself.

If we attempt to compare this unique human ability with anything else we shall have to remember animal instincts and call language an intellectual instinct of the mind. . . .

Attempts were made to replace words of various languages with generally accepted symbols, as in mathematics, where figures, numbers and algebraic equations are in one-to-one correspondence to each other. However, with their help only an insignificant part of the richness of a thought can be exhausted since, due to their nature, these symbols are fit only for the concepts formed by abstract construction or purely by mind. . . .

From the mutual interdependence between thought and word it becomes obvious that languages are not just a means of expressing the cognized reality, but, in addition, they are a means of cognizing the previously unknown reality. Their difference is not just that of sounds and symbols but the difference of outlooks. . . .

Language as a product of the people and its past is something foreign to man, and for this reason man is, on the one hand, tied, but on the other hand, enriched, strengthened and inspired by the heritage left in the language by past generations. Being subjective in relation to the cognized, language is objective in relation to man. (Humboldt, 1843, translated from the Russian)

1851   J. GRIMM (1785-1863) — a German linguist who studied German languages from the viewpoint of their historical development.

Whatever pictures opened before our eyes in studying the history of language, you will see everywhere movement, firmness and amazing flexibility, the everlasting urge upwards and declines, perpetual changeability which has never been allowed to reach completeness; all this testifies to the fact that *language is a human production and that it is marked with the virtues and defects of our nature.* Language stagnation is unthinkable since everything newly appearing and forming needs space unnecessary only in a dull existence. Functioning during an immensely long period of time, words have become potent and polished but at the same time they wore out and partially disappeared due to chance. Like leaves from the trees they fall off their branches to the ground and are supplanted by new ones; those which have upheld their existence had changed their appearance and meaning so often they can hardly be recognized. But in the majority of cases of losses, new formations spring out almost simultaneously which compensate for the lost ones . . . (Grimm, 1864, translated from the Russian)

H. STEINTAHL (1823-1899) — the founder of a psychological trend in linguistics.

Speech is a psychic activity, and, therefore, linguistics is related to the psychological sciences. . . .

Language in its essence is a product of a community of people. When we call language an instinctive self-consciousness, instinctive outlook and logic, that means that language is self-consciousness, outlook and logic of the popular (folk) spirit. (Steintahl, 1855, translated from the Russian)

1862 A. A. POTEBNYA (1835–1891) — an outstanding Russian linguist with a broad range of interests.

. . . a thought once connected with the word is again called into our mind by the sounds of the word. . . . The thought is reproduced if not in its previous form but so that the second and third reproduction may be even more important for us than the first one. . . .

A notion and a word are related in the following way: a word is a means of creating a notion. . . .

Language is not a means of expressing an existing idea but of creating it . . . it is not a reflection of the formed outlook but an activity forming it. (Potebnya, 1926)

A. SCHLEICHER (1821–1868) — a linguist who approached language from the naturalistic or, in modern terms, precybernetic stance and regarded it as a natural organism.

The life of language does not differ significantly from the lives of other live organisms — plants and animals. Like the latter, it has a period of growth from the simplest structures to more complicated forms, and a period of aging when they go farther and farther from the highest stage of development and their forms suffer damage. (Schleicher, 1869, translated from the Russian)

I. A. BAUDOUIN DE COURTENAY (1845–1929) — a Russian linguist, the founder of the Kazan school of linguistics.

My intention is neither to dwell on the statement that language is an organism, nor to criticize it. I shall only remark that an organism, like inorganic substances, is something tangible and space-like, and on the other hand, something which feeds and multiplies, etc. An organism is always on hand, it exists without interruption from the moment of birth up to the beginning of its decay, called death. Language as a whole exists only *in potentia*.

Words are not bodies or bodily members: they emerge as complexes of meaningful sounds, as meaningful consonances only when a person speaks, and they exist as representations of meaningful consonances in the human mind and consciousness only when one thinks with their help. (Baudouin de Courtenay, 1871)

1872 LEWIS CARROLL (pseudonym of C. Dodgson, 1832–1898) — an English mathematician, the author of the popular books *Alice's Adventures in Wonderland* and *Through the Looking-Glass*.

"My *name* is Alice . . ."

"It's a stupid name enough! . . . What does it mean?"

"*Must* a name mean something?" Alice asked doubtfully.

"Of course it must," Humpty Dumpty said with a short laugh: *my* name means the shape I am—and a good handsome shape it is, too. With a name like yours, you might be any shape, almost."

". . . that shows that there are three hundred and sixty-four days when you might get un-birthday presents . . . and only *one* for birthday presents, you know. There's glory for you!"

"I don't know what you mean by 'glory,' " Alice said.

Humpty Dumpty smiled contemptuously. "Of course you don't—till I tell you. I meant 'there's a nice knock-down argument for you!' "

"But 'glory' doesn't mean 'a nice knock-down argument,' " Alice objected.

"When *I* use a word," Humpty Dumpty said in rather a scornful tone, "it means just what I choose it to mean—neither more nor less."

"The question is," said Alice, "whether you *can* make words mean so many different things."

"The question *is*," said Humpty Dumpty, "which is to be master—that's all." (Carroll, 1930)

1886   H. PAUL (1846–1921)—a representative of the Young Grammarians; in his papers their views are represented most completely.

From comparing the language organisms of each individual, something average is received, which determines the language norm, or the language usage. This average is naturally established the more accurately more individuals are embraced by observations and the more completely each of them is observed. . . .

Usage, whose description has been almost exclusively the preserve of grammarians, determines the individual language only to a certain extent; much remains not only undetermined by usage, but proves quite opposite to it. . . .

Grammar and logic diverge primarily due to the fact that language formation and usage takes place not on the basis of strictly logical thinking, but as a result of natural and disorderly movement of notions which, depending on natural gifts and education, follows or does not follow the laws of logic. (Paul, 1937, translated from Russian)

A. POTEBNYA (see above)

Language is a form of thought, but such a form which does not occur anywhere but in language. Thus the formality of linguistics is material as compared with that of logic. (Potebnya, 1926)

1894–1895   F. F. FORTUNATOV (1848–1914)—a Russian linguist, the founder of the Moscow school of linguistics.

Language consists of words and words are spoken as symbols for

our thinking and for expressing our thoughts and feelings. Separate words of the language in our speech are combined in various ways and become parts of other words; due to this, not only separate words are facts of the language but also words in their combinations and their divisability into various parts. (Fortunatov, 1897)

I. A. BAUDOUIN DE COURTENAY (see above)

We acknowledge the correctness of Humboldt's statement that "language is a creative organ for thoughts," but it is only with stipulations that we can accept other statements of this thinker, such as "there are no thoughts without language; human thinking is possible only because of language," or that language consists in "continuously repeating spiritual activity aimed at making the voice express thoughts" — we know that thinking is possible without language, and deaf-mutes can never express their thoughts with their voice. In return, we without any stipulation agree with Humboldt's opinion that every language is a kind of Weltanschauung. . . .

Strictly speaking, the term "language" in the sense of something homogeneous and inseparable may be applied only to the individual language. A homogeneous tribal language is but a fiction. (Baudouin de Courtenay, 1907)

1910–1911   *Encyclopaedia Britannica*

Language — the whole body of words and combinations of words as used in common by a nation, people or race, for the purpose of expressing or communicating their thoughts; also, more widely, the power of expressing thought by verbal utterance.

1915   F. DE SAUSSURE (1857–1913) — an outstanding Swiss linguist, the founder of structural linguistics.

1. *Language is a well-defined object in the heterogeneous mass of* speech facts. It can be localized in the limited segment of the speaking-circuit where an auditory image becomes associated with a concept. It is the social side of speech, outside the individual who can never create nor modify it by himself; it exists only by virtue of a sort of contract signed by the members of a community . . .

2. Language . . . is something that we can study separately. . . .

3. Language is a system of signs in which the only essential thing is the union of meanings and sound-images, and in which both parts of the sign are psychological.

The bond between the signifier and the signified is arbitrary. Since I mean by sign the whole that results from the associating of the signifier with the signified, I can simply say: *the linguistic sign is arbitrary* . . . . This principle dominates all the linguistics of language; its consequences are numberless. (de Saussure, 1959)

1921   B. RUSSELL (1872–1970) — an English philosopher, logician, mathematician, and public figure.

Ordinary speech does not distinguish between identity and close similarity. A word always applies, not only to one particular, but to a group of associated particulars, which are recognized as multiple in common thought or speech.

. . . a host of . . . notions . . . are thought to be profound because they are obscure and confused. . . .

Vagueness and accuracy are important notions, which it is very necessary to understand. Both are a matter of degree. All thinking is vague to some extent, and complete accuracy is a theoretical ideal not practically attainable. . . .

A word is vague when it is in fact applicable to a number of different objects because, in virtue of some common property, they have not appeared, to the person using the word, to be distinct. . . .

A word is not something unique and particular, but a set of occurrences. . . .

The essence of language lies, not in the use of this or that special means of communication, but in the employment of fixed associations (however these may have originated) in order that something now sensible—a spoken word, a picture, a gesture, or what not—may call up the "idea" of something else. Whenever this is done, what is now sensible may be called a "sign" or "symbol," and that of which it is intended to call up the "idea" may be called its "meaning."

. . . To say that a word has a meaning is not to say that those who use the word correctly have ever thought out what the meaning is: the use of the word comes first and the meaning is to be distilled out of it by observation and analysis. . . .

There is no more reason why a person who uses a word correctly should be able to tell what it means than there is why a planet which is moving correctly should know Kepler's laws. (Russell, 1921)

1921 L. Wittgenstein (1889–1951)—an Austrian philosopher and logician, who after 1929 lived in Great Britain. A vivid exposition of the evolution of Wittgenstein's philosophical views on the background of his dramatic life may be found in Bartley (1973).

3.25. There is one and only one complete analysis of the proposition.

3.251. The proposition expresses what it expresses in a definite and clearly specifiable way: the proposition is articulate.

3.26 The name cannot be analyzed further by any definition. It is a primitive sign.

3.262. What does not get expressed in the sign is shown by its application. What the signs conceal, their application declares.

3.263. The meanings of primitive signs can be explained by elucidations. Elucidations are propositions which contain the primitive signs. They can, therefore, only be understood when the meanings of these signs are already known.

3.3 Only the proposition has sense; only in the context of a proposition has a name meaning.

4.002. Man possesses the capacity of constructing languages, in which every sense can be expressed, without having an idea how and what each word means—just as one speaks without knowing how the single sounds are produced.

Colloquial language is a part of the human organism and is not less complicated than it.

From it, it is humanly impossible to gather immediately the logic of language. (Wittgenstein, 1955)

O. E. MANDELSHTAM (1891–1935)—a Russian poet.

A live word does not denote an object but chooses freely, as if for an abode, this or that object notion, thingness, a dear body. And around the thing, a word wanders freely, as a soul around the abandoned but not forgotten body. (Mandelshtam, 1921)

L. BLOOMFIELD (1887–1949)—a representative of the American school of descriptive linguistics which elaborated methods of studying human verbal behavior on the basis of behaviorism.

The totality of utterances that can be made in a speech-community is the *language* of that speech-community. (Bloomfield, 1926)

S. O. KARCEVSKY (1884–1955)—a Russian linguist, the representative of the second generation of the Geneva school, later a member of the Prague circle of functional linguistics.

A sign and its meaning do not completely cover each other. Their boundaries do not coincide in all points. One and the same sign has several functions, one and the same meaning is expressed by several signs. Every sign is potentially a "homonym" and a "synonym" simultaneously, i.e. it is formed by crossing these two rows of thought phenomena.

If signs were fixed and each of them fulfilled only one function, language would become a mere collection of labels. But it is equally impossible to imagine a language with such movable signs that they would not signify anything outside the limit of concrete situations. (Karcevsky, 1929)

Theses of the Prague Circle of Linguistics (translated from the Russian) 1929

Being a product of human activity, language at the same time has a purposeful orientation. The analysis of verbal activity as a means of communication shows that the most common purpose of a speaker revealed most vividly is expression. For this reason one has to approach the linguistical analysis from the functional viewpoint. From this viewpoint *language is a system of expressive means serving some definite purpose.*

A word considered from the functional viewpoint is a *result of nominative linguistic activity* sometimes inseparably connected with syntagmatic activity [generation of syntagmas—word combinations which form a phrase].

E. SAPIR (1884–1939)—an American linguist and anthropologist, one of the authors of the "Sapir-Whorf" hypothesis forming the nucleus of ethnolinguistics.

Language is a purely human and non-instinctive method of communicating ideas, emotions, and desires by means of a system of voluntarily produced symbols. . . .

Language is a fully formed functional system within man's psychic or "spiritual" constitution. We cannot define it as an entity in psychophysical terms alone. . . . The essence of language consists in the assigning of conventional, voluntarily articulated, sounds, or of their equivalents, to the diverse elements of experience. . . .

Most people, asked if they can think without speech, would probably answer, "Yes, but it is not easy for me to do so. Still I know it can be done." Language is but a garment! But what if language is not so much a garment as a prepared road or groove? . . .

Once more, language, as a structure, is on its inner face the mold of thought. . . . There is no more striking general fact about language than its universality . . . we know of no people that is not possessed of a fully developed language. . . .

Our first impulse, no doubt, would have been to define the word as the symbolic, linguistic counterpart of a single concept. We know now that such a definition is impossible. In truth it is impossible to *define the word from a functional standpoint at all, for the word* may be anything from the expression of a single concept—concrete or abstract or purely relational . . . to the expression of a complete thought. . . . In the latter case the word becomes identical with the sentence. The word is merely a form, a definitely molded entity that takes in as much or as little of the conceptual material of the whole thought as the genius of the language cares to allow. . . .

The word is one of the smallest, completely satisfying bits of isolated "meaning" into which the sentence resolves itself. (Sapir, 1929)

This is the constant interaction between language and experience which excludes language from the lifeless series of such pure and simple symbolic systems as mathematical symbolics or signalling flags. (Sapir, 1933, translated from the Russian)

K. BÜHLER (1879–1963)—a representative of the German school of the psychology of thinking. He regarded language from a psychological standpoint.

Now a brief explanation on the double unity of a word and a sentence. It will never occur to any linguist that there can exist sentences without words, though it sounds no more paradoxical than a suggestion of words existing without sentences. In reality a word and a

sentence are two correlative factors in speech construction. The question of what a word is may be satisfactorily answered only by a person who, pronouncing the word, keeps in mind the sentence, and vice versa. . . . A word must be a sound symbol which may be included in the field. When Meillet remarks that it should be grammatically applicable, he formulates the same idea. (Bühler, 1934, translated from the Russian)

L. BLOOMFIELD (see above)

A free form which is not a phrase, is a *word*. A word, then, is a free form which does not consist entirely of (two or more) lesser free forms; in brief, a word is a *minimum free form*. (Bloomfield, 1935)

I. I. MESHANINOV (1883–1967) — a Soviet linguist, the pupil of N. Ya. Marr.

These two principal speech units, a word and a sentence, are inseparably connected. A word does not practically exist outside the sentence. (Meshaninov, 1940).

1940   B. L. WHORF (1897–1941) — an American ethnolinguist, graduated as an engineer–technologist.

Languages have grammars, which are assumed to be merely norms of conventional and social correctness, but the use of language is supposed to be guided not so much by them as by correct, rational, or intelligent thinking . . .

We dissect nature along lines laid down by our native languages. . . . We cut nature up, organise it into concepts, and ascribe significances as we do, largely because we are parties to an agreement to organise it in this way — an agreement that holds throughout our speech community and is codified in the patterns of our language. The argument is, of course, an implicit and unstated one, *but its terms are absolutely obligatory.* (Whorf, 1956)

V. MATHESIUS (1882–1945) — a Czech linguist, the founder of the Prague circle of functional linguistics.

. . . language appears as a complicated system of inseparably connected mutually dependent facts which cannot be referred to independent categories by the most accurate linguistics. (Mathesius, 1942)

1944   *Enclyclopedia Americana*

Language in its broadest sense is any means of expressing thought. The cries of the lower animals are language in so far as they give expression to their state of mind, there is a language of flowers and so on.

C. MORRIS (b. 1901) — an American philosopher; he was the first to formulate clearly basic concepts and principles of a new science, semiotics.

For the term "language" the following five criteria are suggested as those to be embodied in the definition.

First, a language is composed of a plurality of signs. Second, in a language each sign has a signification common to a number of interpreters. Over and above the signification of language signs which is common to members of the interpreter-family, there may of course be differences of signification for individual interpreters, but such differences are not then regarded as linguistic. The fact that a sign is to some degree personal is compatible with the requirement that a language sign be interpersonal, but all that is required is that the signs in a language have some degree of interpersonality.

Third, the signs constituting a language must be comsigns, that is, producible by the members of the interpreter-family and have the same signification to the producers which they have to other interpreters. Comsigns are either activities of the organisms themselves (such as gestures), or the products of such activities (such as sounds, traces left on a material medium, or constructed objects). An odor, for instance, might be interpreted in the same way by a number of organisms in a given situation, and hence be interpersonal, and yet would not be a comsign. Odors would be language signs only if in addition to being interpersonal they were producible by their interpreters.

Fourth, the signs which constitute a language are plurisituational signs, that is signs with a relative constancy of signification in every situation in which a sign of the sign-family in question appears. If the term "odor," for example, signified differently each time the sign occurred it would not be a sign in a language even though at a given occurrence it was interpersonal. A sign in a language is thus a sign-family and not merely a unisituational sign-vehicle.

Fifth, the signs in a language must constitute a system of interconnected signs combinable in some ways and not in others in order to form a variety of complex sign-process.

Uniting these requirements we reach the proposed definition of a language: a language is a set of plurisituational signs with interpersonal significata common to members of an interpreter-family, the signs being producible by members of the interpreter-family and combinable in some ways but not in others to form compound signs. Or more simply, *a language is a set of plurisituational comsigns restricted in the ways in which they may be combined.* If the restriction as to combination be embodied in the word "system," we can say that a language is a system of plurisituational comsigns. And since a sign-family is plurisituational, the simplest foundation would be that *a language is a system of comsign-families.* (Morris, 1946)

R. WELLS (1854–1941) — an American linguist.

De Saussure ascribes . . . to linguistic signs two fundamental properties: they are arbitrary and they are arranged in a line. But he

neglects to mention in this place another essential trait . . . to wit that linguistic signs are systematic. . . . "Arbitrary" and "systematic" are the two fundamental properties of signs. (Wells, 1947)

V. SKALIČKA (b. 1909) — A Czech linguist, a member of the Prague circle.

Linguistic theory should be aimed at cognizing language not as an aggregate of non-linguistic (i.e. physical, physiological, psychological, logical and sociological) phenomena, but as a structure closed in itself, as a structure *sui generis*. . . . Hjelmslev does not allow anything which is not a pure relation to enter language. Thus, language, in his opinion, is nothing else but a set of relations which he calls functions. . . .

The linguistics problems are complicated phenomena. If one takes into account the position occupied by language he will see three types of relations and three different problems: 1. First of all, the relation of language to the extralinguistical reality, i.e. a semasiological problem. 2. The relation of language to other languages, i.e. the problem of linguistic differences. 3. The relation of language to its constituents, i.e. the problem of language structure. (Skalička, 1948, translated from the Russian)

1932   C. BALLY (1865-1947) — a representative of the Geneva school, a pupil of F. de Saussure.

Within a system everything is interlinked; this is true of a linguistic system to the same extent as of all other systems. This principle proclaimed by F. de Saussure, preserves its value for us. . . . But it would be utterly wrong if such a general view resulted in presenting language as a symmetrical and harmonic construction. The moment one starts to demount the mechanism, he is seized by the horror of the disorder reigning there, and he asks himself how it can be that so mutually entangled systems of wheels produce such a coordinated motion.

General views of languages are penetrated with many errors, which are sometimes several centuries old and which are supported not only by our ignorance but also, in many instances, by our desire (unconscious or reflective) to conceal or distort the reality. . . . (Bally, 1932)

L. HJELMSLEV (1899-1965) — a Danish linguist, the founder of glossematics (Danish structuralism).

The novel and fruitful in F. de Saussure's work is his understanding language as a pure structure of relations, as a scheme, as something opposite to the random (phonetic, semantic etc.) realization whereby this scheme is presented.

. . . the linguistic sign is bilateral — it possesses a plan of contents and a plan of expression, both sides being able to become the object of a purely structural analysis.

... de Saussure understood quite clearly that the structural definition of language should lead to recognizing as languages certain structures hitherto not regarded as such by traditional linguistics, and considering languages regarded as such by traditional linguistics as a kind of language in general.

It would be very interesting to study linguistic structures which are not languages in a traditional meaning of the word with the help of a purely linguistic method first of all because such structures would give us simple samples—patterns revealing the elementary language structure without all the complication typical of a highly developed structure of everyday languages. . . .

A. Sechehaye noted in 1908 that language might be presented as an algebraic expression or geometrical images and that language elements may be expressed in any arbitrary way, if only their individuality be preserved, but not their material character.

Language is an hierarchy, whose every part allows further division into classes determined by mutual relations, so that each of these classes may be dissected into derivatives determined by mutual mutation. (Hjelmslev, 1950-1951, translated from the Russian)

G. A. MILLER (b. 1920) — an American psychologist and linguist, an expert in the theory of verbal behavior.

Verbal behavior is not a simple function of time that makes it possible to predict the behavior exactly from one moment to the next. If a man's words could be predicted in advance, he would not need to speak them. On the other hand, verbal behavior is not like the gambler's dice, nor like the urn full of marbles that the statistician uses to discuss the probability of equally improbable events. It is a function lying somewhere between the completely determined and the completely random—the connections between successive events limit the range of possibilities, but they do not hold the events strictly to a single path. These connections constitute what we call the verbal context. (Miller, 1951, retranslated from the Russian)

W. ENTWISTLE — a British linguist with a broad range of interests.

. . . When we *know* anything we hold the right language about it. . . . There is verbalism in all knowledge and no knowledge without words. . . . Language is an art, and the arts are best defined as languages. . . . Music may perhaps constitute an exception, . . . but the remaining arts are all marked by the intrinsic unlikeness of the signifier and the signified, as between certain lengths of lines on paper and natural distances, or of stone and human flesh. (Entwistle, 1953)

L. WITTGENSTEIN (see above)

23. . . . Here the term "language-*game*" is meant to bring into prominence the fact that the *speaking* of language is part of an activity or of a form of life.

Review the multiplicity of language games in the following examples, and in others:

Giving orders, and obeying them—

Describing appearance of an object, or giving its measurements—

Constructing an object from a description (a drawing)—

Reporting an event—

Speculating about an event—

Forming and testing a hypothesis—

Presenting the results of an experiment in tables and diagrams—

Making up a story; and reading it—

Play-acting—

Singing catches—

Guessing riddles—

Making a joke; telling it—

Solving a problem in practical arithmetic—

Translating from one language into another—

Asking, thinking, cursing, greeting, praying.

31. . . . *One can also imagine someone's having learnt the game* without ever learning or formulating rules.

43. For a *large* class of cases—though not for all—in which we employ the word "meaning" it can be defined thus: the meaning of a word is its use in the language.

77. . . . In such a difficulty always ask yourself: How did we *learn* the meaning of this word ("good" for instance)? From what sort of examples? in what language-games? Then it will be easier for you to see that the word must have a family of meanings.

108. . . . The question "What is a word really?" is analogous to "What is a piece in chess?"

138. . . . we *understand* the meaning of a word when we hear or say it, we grasp it in a flash, and what we grasp in this way is surely something different from the "use" which is extended in time!

203. Language is a labyrinth of paths. You approach from *one* side and know your way about, you approach the same place from another side and no longer know your way about.

206. . . . . The common behaviour of mankind is the system of reference by means of which we interpret an unknown language.

255. The philosopher's treatment of a question is like the treatment of an illness.

329. When I think in language, there aren't "meanings" going *through my mind in addition to the verbal expressions; the language* is itself the vehicle of thought.

340. One cannot guess how a word functions. One has to *look at* its use and learn from that.

384. You learned the *concept* "pain" when you learned language.

496. Grammar does not tell us how language must be constructed in order to fulfill its purpose, in order to have such-and-such an effect on human beings. It only describes and in no way explains the use of signs. (Wittgenstein, 1953)

N. WIENER (1894–1964) — an American mathematician and physicist, the founder of cybernetics.

> Naturally, no theory of communication can avoid the discussion of language. Language, in fact, is in one sense another name for communication itself, as well as a word used to describe the codes through which communication takes place. . . . What distinguishes human communication from communication of most other animals is (a) the delicacy and complexity of the code used, and (b) the high degree of arbitrariness of this code . . . language is not exclusively an attribute of living beings but one which they may share to a certain degree with the machines man has constructed. (Wiener, 1954)

G. RYLE (b. 1900) — a British philosopher.

> The story of twentieth-century philosophy is very largely the story of this notion of sense or meaning. Meanings (to use a trouble-making plural noun) are what Moore's analyses have been analyses of; meanings are what Russell's logical atoms were atoms of; meanings, in one sense but not in another, were what Russell's "incomplete symbols" *were bereft of; meanings are what logical considerations prohibit to* the antinomy — generating forms of words on which Frege and Russell had tried to found arithmetic; meanings are what the members of the Vienna Circle proffered a general litmus-paper for; meanings are what the *Tractatus*, with certain qualifications, denies to the would-be propositions both of Formal Logic and of philosophy; and yet meanings are just what, in different ways, philosophy and logic are *ex officio* about. (Ryle, 1956)

G. J. WARNOCK (b. 1923) — a British philosopher.

> I suppose the most immediately striking feature of Logical Positivism was its iconoclasm, its short and apparently lethal way with the ponderous enigmas of metaphysicians. . . . *If any one thing* is characteristic of contemporary philosophy, it would be precisely the realization that language has *many* uses, ethical, aesthetic, literary, and indeed metaphysical uses among them. There is no tendency to say "You must not (or cannot) say that"; there is a readiness to appraise on its merits whatever may be said and for whatever purpose, provided only that something *is* said and words are not used wildly. (Warnock, 1956)

D. POLE — a British philosopher.

> Wittgenstein's thesis is that a language, like a mathematical system, consists of a complex set of procedures, which may also be appealed to as rules. (Pole, 1958)

A. M. QUINTON (b. 1925) — a British philosopher.

> Where the "Tractatus" saw language as a logically rigid essence concealed behind the contingent surface of everyday discourse, a

skeleton to be excavated by penetrating analysis, in the "Investigations" language is accepted as it actually and observably is, as a living, unsystematic, and polymorphous array of working conventions for a large and not simply classifiable range of human purposes. . . .

The fundamental point of Wittgenstein's new theory of meaning is that the meaning of a word is not any sort of object for which the word stands. . . . To say of a man that he has learned or understands the meaning of a word is simply to say that he has learned or understands how to use it, that he has become party to a certain established social convention. (Quinton, 1966)

1970   Soviet *Philosophical Encyclopaedia* ("Language" by A. Spirkin.

Language is a system of symbols serving the means of human communication, thinking and expression. By means of language the world is cognized; in language the self-consciousness of an individual is objectivized. Language is a specific social means of information storage and transfer, as well as of controlling human behaviour. (*Filosofskaya Entsiklopediya*, 1960-1970)

P. V. Kopnin (1922–1971) — a Soviet philosopher.

A most general definition of language embracing the so-called ordinary, or natural languages operating with words and sentences, as well as artificial scientific languages with peculiar symbolics, may be formulated as follows: language is a form of existence of knowledge as a system of symbols. Hence the knowledge itself is always viewed as a language. (Kopnin, 1971)

G. V. Stepanov (b. 1919) — A Soviet linguist.

Semiotics is a science of symbol systems in nature and society.
It stands close to cybernetics which studies the processes of relations and control in a living organism, nature and society.

Semiotics is also close to linguistics, since the latter studies the most complete and perfect system of relations: human language.

H. Hesse (1877–1962) — a German writer, a Nobel-prize winner.

Alphabet

From time to time we take our pen in hand
And scribble symbols on a blank white sheet.
Their meaning is at everyone's command;
It is a game whose rules are nice and neat.

But if a savage or a moon-man came
And found a page, a furrowed runic field.
And curiously studied lines and frame:
How strange would be the world that they revealed.
A magic gallery of oddities.
He would see A and B as man and beast,

As moving tongues or arms or legs or eyes,
Now slow, now rushing, all constraint released,
Like prints of ravens' feet upon the snow.
He'd hop about with them, fly to and fro,
And see a thousand worlds of might-have-been
Hidden within the black and frozen symbols,
Beneath the ornate strokes, the thick and thin.
He'd see the way love burns and anguish trembles,
He'd wonder, laugh, shake with fear and weep
Because beyond this cipher's cross-barred keep
He'd see the world in all its aimless passion,
Diminished, dwarfed, and spellbound in the symbols,
And rigorously marching prisoner-fashion.
He'd think: each sign all others so resembles
That love of life and death, or lust and anguish,
Are simply twins whom no one can distinguish . . .
Until at last the savage with a sound
Of mortal terror lights and stirs a fire,
Chants and beats his brow against the ground
And consecrates the writing to his pyre
Perhaps before his consciousness is drowned
In slumber there will come to him some sense
Of how this world of magic fraudulence,
This horror utterly behind endurance,
Has vanished as if it had never been.
He'll sigh, and smile, and feel all right again.

(Hesse, 1961)

With this wonderful poem by Hesse I am breaking off the collection of statements about language. It certainly cannot replace an essay on the history of linguistics and in no way claims to give a complete and adequate picture of the history of linguistics. I have selected the brightest and most contrasting formulations. Without trying to systematize them in detail, we are still able, though altogether roughly, to trace two principal trends in developing views on language in European thought, going back to ancient culture. One of them is a view of language as a very *hard structure*, in some indubitable way linking the sign with the referent. The second tendency is a view of the language as a *soft structure*[3] so complicated that the rules of ascribing meaningful content to signs or their com-

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[3] I am using here terminology broadly accepted in the scientific slang of today, which ascribes to the two extreme tendencies in science and technology word combinations borrowed from everyday language: hardware and software. Thus, e.g., in computer technique, everything connected immediately with a machine will be called *hard*, and programs will be called *soft*; in the science of science branches of knowledge with a well-organized system of bibliographic references will be called hard sciences, and those with a disorderly system of references, soft science.

binations do not lend themselves to a clear arrangement, into the logical schemes familiar to European thinking.

The first of these trends clearly manifests itself in the ancient Greek tradition: the word there is *the name of a thing*; thus, sign and meaning prove to be linked in a natural and the only possible way. If we address corresponding sources, this tendency is easily traced in the gnostics who developed the teaching of the mysterious and magic properties of names. To a certain degree it was preserved in the philosophy of the Middle Ages, where the name was considered not as an arbitrary sign but as something symbolically immanent to the named. The reader can easily trace this tendency generated in the ancient world in the statements made about language in modern times, but here stronger statements occur as well: Hartley considered language as a kind of algebra, and we can hardly believe his statements (see above) to refer in fact to the middle of the eighteenth century.

In modern times, as a consequence of scientific development, the concept of a hard language structure has acquired a new interpretation: an opinion has been formulated that this is rather a property of some ideal language, and scientific language seemed destined to become such a language in the first place. Cartesian philosophy demanded that words in the scientific language should possess precise and unambiguous meanings. Leibniz tried to develop an idea of universal symbolics and logical calculus: the rules of operating with these signs. In order not to overload an already lengthy collection, I have not included the statements about language formulated by the representatives of this school.

In modern times, the concept of a hard structure has become peculiarly reflected in the program *of the logical positivists*. This trend of thought was formed in the 1920s almost simultaneously in Austria (the famous philosophical Vienna circle), Germany, Great Britain, and Poland, and to a great extent had exhausted itself already by the 1960s. Its most prominent representatives are Schlick, Carnap (usually considered the leader of the trend), Neurath, and Wittgenstein, as well as Russell in his early papers; Popper, who is well known to everybody interested in the general problems of the philosophy of science, was for a time close to the positivists at some points. A constructive program of the logical positivists was directed at a reconstruction of science, at its formalization. And it is only natural that a central feature of the program was the idea of creating a universal language with ideal terms, which would be clearly understood as distinct from vague terms of speculative constructions. In accordance with this program, the scientific terms were divided into *theoretical* and *non-theoretical*. The latter, in their turn, were divided into *primitive* terms, understandable immediately (without definition) in the process of studying an experiment or a

theory, and *precise* ones, to define which necessary and sufficient conditions are given, and the primitive terms of the system are used. Further postulates (rules of correspondence) are introduced, and mixed phrases are created; these contain at least one theoretical and one non-theoretical term and are part of the theory. Theoretical terms are not defined directly; their meaning is given by the theory which links them with well-defined non-theoretical terms. The theory in this system of thought is formed from a set of phrases consisting of non-axioms and theorems. Theoretical texts may contain both mixed phrases and phrases consisting only of theoretical terms; such phrases are subject to testing and serve to support the theory.

Scientists have not apprehended these conceptions which seem very precise. It has proved practically impossible to construct such a logically precise hierarchy of scientific terms; nonetheless, even now attempts are still made to create such a scientific terminology, but this futile activity is carried on outside any general theoretical ideas. Neopositivism has been subjected to sharp criticism by philosophers of various schools (cf., for example, Shvyryov, 1966, and Kozlova, 1972). According to Achinstein (1968), it is almost impossible to divide terms into theoretical and non-theoretical. For example, can one assign the term "temperature" to non-theoretical terms: this is only the change of the height of mercury that we observe in a thermometer. As another example, Achinstein proposes that the notion of King Arthur proves more theoretical that that of "electron," since our knowledge about King Arthur is less experimental than our knowledge of an electron.

The concept of a hard language structure was revived with the effort to achieve machine translation from one language into another. There emerged a temptation to reduce linguistic semantics to logical semantics. Abstract models of natural languages are built consisting of certain initial object–atoms and rules for constructing complex objects from them. A concept of a universal semiotic system is introduced which would be an invariant of the world languages. Such a *genotypical* language not revealed to us by a direct observation is stated to exist objectively (Shaumyan, 1971).

The second trend of linguistic thought is the view that a soft structure of language is not its defect but, on the contrary, the reflection of its variety and inner power. This trend may be easily traced during the whole history of modern time. From the collection presented above, it is readily seen that this idea has been formulated more and more clearly and boldly. It was already formulated quite distinctly by Humboldt; in any case, it was obvious to him that the variety of human thinking could not be expressed with any calculus constructed as a mathematics. Then in Schleicher's papers, we find the statement that the life of language is as

complicated as the life of other biological organisms. By and by the idea appeared that the meaning of something said should be sought not in words, names of things, but in phrases built from words. The word began to be interpreted as a symbol linked associatively with a field of meanings. Even utterly heretical statements are made of the arbitrary understanding of a word meaning — as Carroll's Humpty-Dumpty puts it. An especially clear indication of the soft structure of language is found in the papers of representatives of the Geneva school: Bally says that he is seized with horror by the disorder reigning in the language mechanism. Reading the statements of linguists, we cannot but wonder how an opposite conception could develop simultaneously: belief in the possibility of giving language a hard structure. It is curious to note that the criticism of the language program of the neopositivists began from inside: Wittgenstein became the first dissident. His principal early paper, *Tractatus Logico-Philosophicus,* published in 1921, is usually considered to be of a neopositivist trend, and, indeed, the construction of an artificial, logically perfect language in the spirit of Frege–Russell, where symbolics would submit to "*logical* grammar, logical syntax," was broadly discussed. But, as a matter of fact, everything is not so simple with this early paper. It is written in separate, sometimes paradoxical statements, and many of them contain extremely sharp judgments about language that in no way fit the doctrines of logical positivism. In any case, the *Tractatus* has evoked a large number of comments,[4] as if it were not a scholarly paper but a revelation. In his last work, *Philosophical Investigations,*[5] published posthumously, Wittgenstein (1953) proceeds already from a notion of the enormous complexity and confusion of human language. The game model of language is considered by him as an initial, basic model. Thus, Wittgenstein became one of the founders of a new trend of thought, the *British school of linguistic philosophy,* which formulated the concept of a soft language structure more precisely than ever before. Strictly speaking, the formation of this trend should first of all be associated with Moore, a British philosopher who began critical analysis of language from a philosophical standpoint as early as the beginning of our century. Later, we shall return to an examination of the ideas of this philosophical

[4] Some of these comments were of a very caustic character. Thus, Carnap (1959) regards *Tractatus* as a collection of "more or less vague statements which the reader should later acknowledge as pseudophrases and reject." In any case, it is rather common to question the inner inconsistency of *Tractatus* (see, for example, Achinstein, 1968).

[5] This paper, written in German, was published in 1953, two years after the author's death, in two languages: the German original on the left pages and an English translation on the right ones. According to Wittgenstein, the book appeared as a result of a 16-year meditation. He himself was not satisfied with the paper, but there was no time for corrections, he wrote. Indeed, in *Philosophical Investigations* we no longer come across those brilliant formulations which are abundant in the *Tractatus*. But in return we find there examples of a refined semantic analysis of separate statements made in our everyday language, which begot numerous subsequent studies in semantics.

school. These two trends, logical positivism and the British analytical school, are often unified under one heading of *analytical philosophy*. The reason for this is not the community of doctrines but that of approaches. This critical analysis of the meaning of judgments acquired in the analysis of philosophical texts a character of iconoclasm. In any case, the philosophy of linguistic analysis is not a clearly formulated conception but an intellectual state in the frame of which there can appear completely uncoordinated and deeply individualized judgments. There is no dominant figure there.

However, the concept of the hard structure has not faded into the background. The famous novel *Das Glasperlenspiel* by Herman Hesse has become a peculiar symbol of the tendency toward the construction of a universal language. In this book, an Order is described, the keeper of a specific universal language, the cryptography of the Game of glass beads. Every sign there is ". . . really all-embracing, every symbol and every combination of symbols leads not somewhere, not to a separate instance, or experiment, or proof, but to the centre, to the most secret mystery of the world, to the basis of all knowledge." The language was, indeed, universal; it contained ". . . a formula of astromathematics, the principle of composing an ancient sonata, a dictum of Confucius and so forth — everything expressed in the language of the Game: in symbols, cyphers, abbreviations and signatures." Language games were played as nation-wide celebrations. There were two types of Game: formal and psychological. "Game formalists directed all their efforts to create out of the components of every game — mathematical, linguistic, musical, etc. — a compact, rounded and formally perfect integrity and harmony. . . . On the contrary, the psychological school strove for integrity and harmony, cosmic completeness and perfection not so much through the selection, systematization, interlacing, conjugation and juxtaposition of themes, as through the meditation following each stage of the Game, which they considered most important. . . . The world of the Game, abstract and evidently withdrawn from time, was flexible enough to correspond, in a hundred of nuances, to the spiritual make-up, voice, temperament and other aspects of personality. . . . After the meditation is completed. . . . the Game . . . encircles the player as the surface of a sphere encloses its heart, and makes him feel that a certain faultlessly harmonious world has accepted him and withdrawn him from the world of the random and confused."

The language of the Game, as distinct from the everyday language was closed, or almost closed: new symbols and rules were introduced there only in rare and exceptional cases, which is quite natural for a language with a hard structure.

The book by Hesse has many facets: sometimes there can be noted a

fine irony concerning the idea of universal language, and in other places there is a dream of creating such a language.

Characteristics of Symbolic Language Systems

From the above collection of statements about language, it is easily seen how difficult it is to give a pithy definition revealing the concept of language. Difficulties arise primarily as a result of the fact that traditionally disposed linguists and, after them, all the encyclopedias of the world confine themselves to studying the most complicated system, everyday language. But linguists–dissenters attached to semiotics have assumed a different, enormously broad stance: they began to consider all conceivable symbol systems, and natural language was of interest to them only because it was part of such symbol systems. Non-linguistic scientific thought has perceived everything in quite another way: new systems turned out to be related to the category of language. There has emerged a notion of the language of a biological code and the language of music; languages of programming have been created. Quite a curious situation developed: linguists–semioticians went from studying a particular language to studying symbolic systems in general, while scientific thought concentrated on studying language, having widened this concept by including other systems similar to it in some sense. I believe that such a widening of the concept of language allows us to understand its nature better. Considering systems simpler than our everyday language, which has undergone an extremely complicated and prolonged evolutionary history, we can better understand some of its peculiarities: they may find their extreme expression in certain languages and in other ones may be present in a degenerate form which does not hamper observation.

Let me try to formulate the structural characteristics and functional properties of the symbolic systems which we would intuitively regard as languages. To do so, I shall resort to a kind of argument related to inductive forms of thinking. It seems pertinent to remember here a remarkable formulation from the *Tractatus* by Wittgenstein:

> The process of induction is the process of assuming the simplest law that can be made to harmonize with our experience. This process, however, has no logical foundation but only a psychological one. (Wittgenstein, 1955, paradoxes 6.363 and 6.3631)

Functional characteristics.   Let us begin with an analysis of the functional characteristics of language. Following the commonly accepted tradition (see, for example, Mel'chuk and Frumkina, 1966), we shall assume language to function first of all as a means of communication,

that is, a system serving to transfer information.[6] Information transfer in the process of human communication may be effectuated not only with words but also with other symbols. Dance, music, symbols of religious cults, and abstract paintings all are symbolic systems performing the function of communication. Exchange of information may take place not only among people but also between a human being and a computer; hence, it seems quite natural to speak of the languages of programming. The next step is the possibility of communication between inanimate mechanisms, e.g., between two computers. Having made this step, it is natural to go farther and to think that exchange of information is possible between any inanimate objects. But such an assertion confronts an opposition even on the intuitive level of our ideas. Many phenomena of the physical world can be regarded in terms of the receipt and transfer of information. However, we would hardly like to interpret a photoelectrical effect in physics as a response to the monologue of a light source addressed to the metal, and quanta of light as words of this monologue. If we adhere to this strategy, physics and chemistry will immediately turn into linguistic disciplines, and the term "linguistics" will become synonymous with the word "science." Fulfillment of the communication function cannot be considered as a necessary and sufficient requirement for elevating a symbol system to the rank of language. This is rather only a necessary demand. Sufficient conditions will fulfill some limitations imposed on the symbol systems by specific structural language characteristics which I shall describe a bit later. These sufficient conditions cannot simultaneously be necessary since they may sometimes acquire a degenerate character: we cannot demand that all traits characterizing a language be fulfilled with an equal degree of precision.

Now we shall examine another functional characteristic of language: information reduction, storage, and retrieval. This aspect of language has not received much attention in traditional linguistics papers. Indeed, in everyday practice, information is stored without reduction: books have been written in a slightly changed conversational language, and, therefore, no special problems connected with information storage have arisen. This problem was clearly formulated for the first time in mathematical statistics when it became necessary to present the results of observations in a compact form fit for publication. Indeed, there is no point in publishing all the results of observations if, say, they are a sample from the normally distributed universe. In this case, it would suffice to publish sample parameter estimates, namely, mathematical expectation and

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[6] We cannot define what "information" is, and we shall consider it to be a complicated concept whose meaning is revealed by its context. Such an approach should not surprise anybody. Even in attempts to strictly formalize mathematics, concepts have to be introduced whose meaning becomes clear from axioms formulated by use of the same concepts.

variance, and to give the number of observations underlying the computation of parameters. However, here we immediately face a set of complicated problems: parameter estimates should be unbiased, i.e., devoid of systematic errors, and efficient; i.e., they should be received with the maximal accuracy. There arises a problem of constructing such algorithms of reduction which would elicit all information contained in the observed results. After the work of Ronald Fisher, many statisticians hold the opinion that information reduction is one of the central problems of mathematical statistics. This problem has become especially acute since the appearance of computers. Imagine, for example, the problem of specifying various constants. This work is being done almost continuously. Novel data are introduced into the computer from year to year; they are obtained sometimes under rather different conditions, and they should be presented well reduced so as to enable the computer to produce reasonably specific results. Later, quite a grandiose task appeared: using computers for the storage and retrieval of all information contained in scientific papers. A more modest task is that of searching some publications on the basis of certain groups of data. All these tasks are indubitably linguistic; computers gradually become the means of our communication, and language acquires new functions.

The reduction function is of exceptionally great importance in the language of a biological code. The whole somatic and, probably to a great extent, psychic structure of an organism is coded in the genes of sex cells in an amazingly compact way. It is hard to tell how many times information is reduced here, but it seems perfectly fabulous. Another peculiarity here attracts our attention: the mechanism of restoring reduced information. It seems surprisingly accurate: one-egg twins, at least in early age while the influence of environment is restrained and code errors have not accumulated in the process of cell restoration, are absolutely ·identical.

According to the Kolmogorov definition, the complexity of a message is determined by the information necessary to restore it (for details, see the review by Zvonkin and Levin, 1970). If, say, we deal with a sequence of digits consisting of zeros and unities, the complexity will be characterized, roughly speaking, by the minimal number of binary symbols necessary to substitute for the sequence in transferring it along the communication channels. Such a definition of complexity is well perceived intuitively. Imagine that we must transfer such numbers as π and e. It is clear that there is no need to transfer the whole computed set of figure symbols giving the approximate value of the numbers; it will suffice to transfer the algorithm of computation. If, however, these figure symbols are presented as a sequence of numbers, then, applying all known statistical methods of analysis, we shall not be able to distinguish them from a

random sequence of numbers put down by, for example, a counter measuring radioactive decay. In some algorithms, figures were used to generate pseudorandom numbers, forming the numbers e and π, and random numbers thus obtained were successfully used in the problems of simulating by the Monte Carlo method. However, only the sequence of numbers received in registering radioactive decay is truly complicated: it cannot be expressed with a shorter symbol sequence. In this sense it is a random sequence (if we, after Kolmogorov, call random the elements of a large finite universe of symbols with the maximal complexity). Another example: imagine that we are generating a pseudorandom number by successively putting down the last symbol in five-digit logarithms of natural numbers. At first sight we seem to be dealing with a good generator of randomness, but if we bear in mind the above-mentioned criterion, the generator no longer seems good enough since the sequence is easily put down by an accurate description of the generating procedure.

Now let us turn to analyzing texts of everyday language. Imagine that we deal with a literary work. It cannot be transferred along communication channels with the help of a briefer text of a résumé character. Thus, we must acknowledge this work to be complicated, the complexity being so great that we cannot relegate it to the category of random texts. This is also true of any somewhat serious scientific publication: its content cannot be restored from the abstract. Carry out the following mental experiment: an abstract of a new paper yet unpublished is handed over to a group of scientists working in the same field with a request to restore the original text. It is not too difficult to imagine the way the new texts will differ from one another. Here a question arises unintentionally: Is it possible to state that abstract journals can replace original ones? Even a purely mathematical article cannot be unambiguously given by its abstract. From Gödel's proof (which is to be discussed later in greater detail) it follows that, in the language of commonly used formal systems, it is impossible to give a strictly formalized definition to the notion of proof inside the same system in mathematics. Still, every author has to convince the reader of the correctness of the method of proof that he has found, and this, as a rule, cannot be done in a text of a résumé (abstract) character. Now let us return to the biological code. We have already mentioned the striking identity of one-egg twins. Despite the complexity of biological organisms, information concerning them is reduced with almost faultless precision. Therefore, organisms should be viewed as simple non-random texts: the language of the biological code is truly amazing.

Thus, we see that the notion of *randomness*, one of the principal philosophical categories, may be viewed from a purely linguistic standpoint, if

information storage and retrieval is recognized as a language function. Assigning any phenomena to the category of *randomness is determined only by our linguistic potentialities*. It may turn out that the phenomenon described today as a random one will in time, when new linguistic means for its description and analysis are found, be regarded as non-random. Special attention should always be paid to the relativity of statements associated with the peculiarities of using language means. It is quite possible that the first messages from other worlds—if received at all—will be perceived merely as random and, therefore, senseless signals (this has also been emphasized by Kolmogorov). So far, we have been speaking about intralinguistic reduction; now let us try to look upon the problem of reduction from a broader standpoint. If we oppose language to thinking, then is it not possible to consider language itself as, perhaps, a not too compact, but still coded, system? Albert Schweitzer (1960), the well-known philosopher, brilliantly explained this idea:

> Thinking being necessarily connected with language absorbs abstractions and symbols fixed within the latter. This coin is in use only so far as it allows us to present things in a short way instead of introducing them substantially as they are given themselves. But then it appears that thinking operates with these abstractions and symbols as if they denote something actually given. Such is the general temptation.

Linguistic structure: alphabet and grammar.   Now let us pass to describing structural traits of language. First of all, it seems pertinent to speak of subelementary linguistic symbols, morphemes, for the written language of the alphabet whereby the elementary signs, "words," forming the language vocabulary, are built, and of "grammar," i.e., the rules whereby texts are built from words.

One might ask here: Is the presence of alphabet and grammar sufficient and necessary for a symbol system to be regarded as a language? Answering this question is not so easy as it might seem. We may point, for example, to a symbol system intuitively perceived as a language but at the same time void of explicitly expressed alphabet or grammar: i.e., the language of bibliographic references in scientific publications. This is a specific language in which every reference is associated with ideas contained in previously published papers corresponding to the reference. There is no need for a scientist to repeat the content of the papers he is referring to; it is enough to refer to them. Looking through a journal, we first of all pay attention to the article bibliographies, and it is on this basis that we make a decision whether the paper is worth reading. By means of references, information is coded very compactly and restored very accurately: we just find the publication from the reference. Let us try to analyze the structure of this language. The reference as a whole

seems to be an elementary symbol here. Its constituents — authors' names, their initials, the title and the number of a journal, the title of an article (if any) — have no independent meanings and may be regarded as subelements of a symbol, resembling lines and other letter elements of our everyday alphabet. Every new publication is coded with a specific new symbol. The primary symbol system is open and, strictly speaking, cannot be regarded as an alphabet since an alphabet is usually defined as a closed or almost closed subsymbol system, i.e., a system where the set of possible subsymbols is given beforehand and remains unchanged for a long time. It is even more interesting that in this language one can hardly observe any grammar, i.e., the rules whereby certain operations are made with the symbols. True, we know how to use the symbols of this language, but these quite vague procedures can hardly be called grammar. In any case, they lack the rules for constructing complex logical structures.

Black (1962), criticizing the concept of universal grammar, draws our attention to the fact that familiar grammatical categories are not always observed in our everyday speech. Here is one of his examples: a full verbal report of a chess move, such as might be found in nineteenth century manuals, has the form: "The king moved from this square to another square." Here the word "king" is clearly the subject. But in the modern recording of the game, "e2-e3," it is very difficult to discern a subject and a predicate. Further, referring to Entwistle (1953), Black points out that Chinese, which is fully equipped for every sort of civilized communication, makes no use of the formal categories devised for the Indo-European languages. Even more interesting is his allusion to Whorf (1956): in polysynthetic languages of American Indians, an isolated word is something like a sentence, and a sequence of such words–sentences makes a kind of compound sentence. Let us try to imitate such a compound sentence in English.

> "There is one who is a man who is yonder who does running which traverses it which is a street which elongates." The exotic sentence consists simply of the predicate lexemes "one," "man," "yonder," "run," "traverse," "street," and "long," and the proper translation is, "A man yonder is running down the long street."

Of such a polysynthetic tongue it is sometimes said that all the words are verbs, or again that all the words are nouns with verb-forming elements added. Actually, the terms "verb" and "noun" in such a language are meaningless. Such construction in a way resembles the language of references: it is void of common grammatical categories.

The final conclusion from our system of judgments is as follows: alphabet and grammar are, of course, the structural elements of the language; they are clearly seen in the majority of symbol systems perceived

as languages, but in certain cases they may become degenerate. Later, we shall have to face more than once the fact that certain probably quite essential language traits become degenerate in some linguistic systems; therefore, this will no longer be a sufficient criterion for regarding such degenerate systems as not being languages. The very attempt to formulate precisely the requirements necessary and sufficient for recognizing a symbol system as a language category seems doomed to failure. Language refers to some notions which we can speak about but cannot define.

Symbol and meaning.   I shall try now to examine the way a symbol is used to transfer the meaning of a message. First of all, we are not able to give any precise definition of what a "symbol" is. Again, we have to confine ourselves to stating that this is a complex conception whose meaning is revealed in its usage. What is obviously worth discussing is the problem of the connection between a symbol and a meaning. Recall again the statement by Ryle cited above that twentieth century philosophy has been largely the story of the idea of sense or meaning. It is not too difficult to understand the source of such extreme judgments: human culture is expressed in symbols, and the study of symbol systems is an analysis of the spiritual content of culture and delusions connected with it.

From the standpoint of those holding to the model of a hard language structure, a symbol should be in one-to-one correspondence with the referent. This demand has probably been most precisely formulated in the *Tractatus* by Wittgenstein. According to him, in order to avoid fundamental errors abundant in philosophy

> . . . we must employ symbolism which excludes them, by not applying the same sign in different symbols and by not applying signs in the same way, which signify in different ways. A symbolism, that is to say, which obeys the rules of *logical* grammar—of logical syntax. (Wittgenstein, 1955, paradox 3.325)

And further:

> In the proposition there must be exactly as many things distinguishable as there are in the state of affairs, which it represents (Wittgenstein, 1955, paradox 4.04)

Everyday language indubitably lacks such correspondence between the symbol and the referent: under some circumstances we may use one symbol to signify something usually signified by two essentially different, antisynonymous symbols. To illustrate this thought, I borrow an example from the book by Black (1962). Imagine that a person learning to drive is steering a car. Instead of telling him "stop" and "go," you may whistle and he would by all means understand you since he will start the car and stop it at necessary moments. The whistle substitutes for two

seemingly different words. The fact is that the symbol system is organized so that the whistle means the necessity to "change the state"; in another symbol system this action would have been signified by two different words depending on the state of the car at a given moment. This is an example attractive for its paradoxical nature, but there are many other less paradoxical examples which often occur in our everyday communication. This gives rise to many questions: What is the cause of this symbolic polysemy? Whether it is good or bad, should we, following the early ideas of Wittgenstein, seek to overcome it, at least in the language of science? These are crucial problems in teaching about language, and I shall devote the next chapter to their discussion.

The matter stands no better in terms of understanding the semantic role of grammar. When it is stated that grammar is rules for operating with symbols, it is not quite clear what is meant here: pure grammar, i.e., syntax operating with symbols independently of their content, or the classification of symbols according to their meaningful usage as well? Wittgenstein (1955) in his *Tractatus* wrote:

> In logical syntax, the meaning of a sign ought never to play a role; it must admit of being established without mention being thereby made of the meaning of a sign; it ought to presuppose only the description of the expressions. (paradox 3.33)

> What does not get expressed in the sign is shown by its application. What the signs conceal, their application declares. (paradox 3.62)

But if the symbol meaning is revealed in its usage, grammar, then, cannot be separated from the meaning of the symbols. Indeed, the grammar of everyday language is indubitably based upon the latter. At the same time, the grammar of abstract languages entering mathematical logic and the theory of automata has to deal only with operations performed with symbols lacking meaning in the common sense of the word. Later, I shall use the word "grammar" in various senses, assuming that the reader will have no difficulty in catching what particular meaning I intend to convey.

Hierarchical structure of language.   Language structure can be analyzed from another standpoint, namely, considering its hierarchy. One of language's peculiarities is that one and the same language can be presented with several symbol systems forming a hierarchical system of several levels. For example, for an everyday language (say, written Russian) we have a system of levels consisting of letters, morphemes (a morpheme is a meaningful part of a word: the root and the affix — prefixes, suffixes, etc.), words (a word is a fragment of a text between spaces), segments (a segment is a fragment of a text between two punctuation

marks), and phrases (a phrase is fragment of a text between full stops), etc. Shreider (1966) even thinks that this language property may serve as its definition. In his terms it sounds as follows: "A category of equimorphous symbol systems will be called a language."

Certainly we could go even farther and try to build a hierarchical classification of the language's logical structure. An attempt can be made to look for certain units of sense which would be analogous to words, units of speech. Wittgenstein in his *Tractatus* tried to analyze the hierarchical structure of the logic of statements introducing the terms name, proposition, structure, saying, showing. Such an approach seems very tempting but, as a rule, in practice it proves unrealistic. Just as was the case with the sense hierachy of words, suggested by the neopositivists, where words were divided into theoretical and non-theoretical, and the latter, in their turn, were divided into primitive (for these necessary and sufficient conditions were not formulated) and precisely defined (for them these conditions were formulated). I have already mentioned that it is practically impossible to observe such a structure of terms without falling into logical traps.

It should be acknowledged that the logical hierarchy of statements exists in the language, but it is so concealed that in practice it cannot be directly observed. One has to limit oneself to analyzing a symbol hierarchy. The presence of the latter, indeed, may be viewed as a condition necessary for regarding a symbol system as a language. This is a bridge linking language and thinking. Phenomenologically, thinking is a process of constructing complicated symbol systems from simpler ones, which is outwardly reflected in the hierarchical structure of language. It should be noted that we understand thinking in a broad sense, assuming that this process takes place during the functioning of a computer and during the development of an organism from an impregnated cell, with the symbol system acquiring more and more complicated hierarchical structure.

If we raise the hierarchical structure of symbols to the rank of the language's principal trait, we shall immediately be able to exclude from the linguistic categories simple informational processes occurring in inanimate nature, such as the above-mentioned photoelectric effect in physics; we shall have enough formal reason not to include physics and chemistry in linguistics.

True, when using this criterion, one must take precautions. In separate cases the hierarchical structure of the language, like all its other properties, may prove quite degenerate. Let us return once more to the language of bibliographic references mentioned above.

At first sight it lacks a hierarchy. But, as a matter of fact, this is not so. Selecting articles with common subject matter by proceeding from the
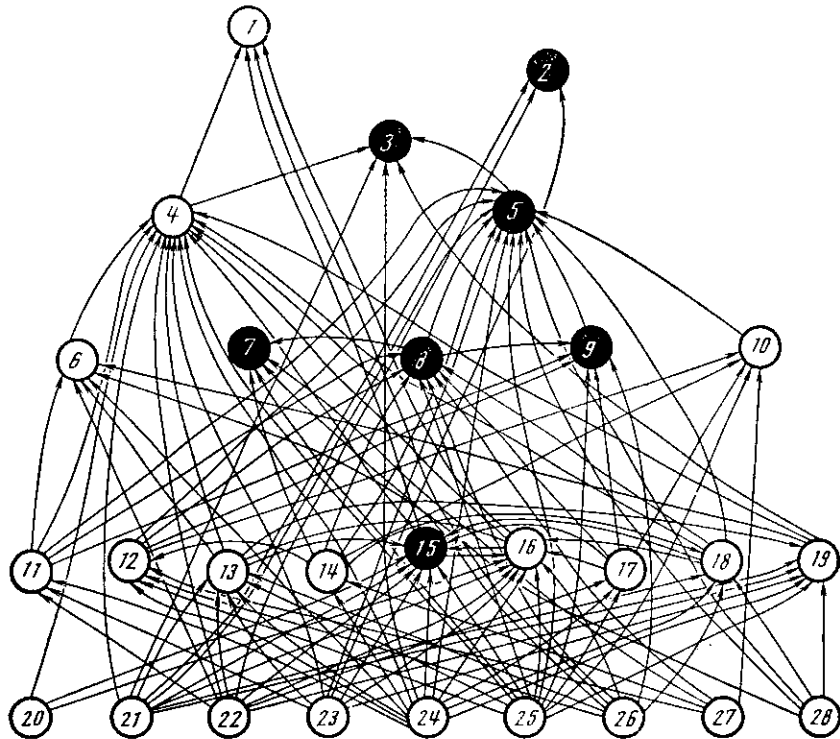
FIG. 1. *Paradigm, formed by the net of bibliographic citations (Garfield, 1970). To construct this paradigm only those publications have been used which are cited in a wide range of papers on DNA not less than five times. Blackened circles indicate publications most frequently cited. Numbers in circles allow identifications of the particulars as to place and date of publication. Paradigms of this kind can be used for practical purposes: beginning studies in the new field of knowledge, the researcher worker can fix his attention on the nucleus formed by associatively connected publications.*

community of their references, we are performing the procedure of hierarchical arrangement. Figure 1 shows a paradigm[7] of references in the review of literature on DNA (Garfield, 1970). The first level in the hierarchical structure of the reference language is a single reference, the second level will be paradigms analogous to those in Fig. 1, and the third

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[7] Paradigm is a very polysemantic scientific term. The literal translation of the word from Greek is "example," "model." When considering an example, we usually expect that some associations are generated. For this reason, in its most general sense the term "paradigm" means an explanation of elements on the basis of association, and it is in this meaning that I shall use the term. It is also common to speak of a proof from paradigm, which is based only on comparison with a well-known example. Paradigm as a grammatical term is a pattern of speech formation.

level will consist of SCI (Science Citation Index) by Garfield, which is nowadays well known. In this publication all references to a given article are arranged, which allows one to observe quite clearly a high degree of hierarchical arrangement of the elementary symbol — references.

Having acknowledged hierarchical structure to be a criterion for raising a symbol system into the rank of a language, we also exclude from the linguistic category almost all information created by the art of images. In particular, abstract painting may be regarded as a language, since there the observer can easily find an alphabet, grammar, and hierarchical structure (for details, see below), but representational painting can hardly be called a language, at least on this level. For representational painting it is difficult to build a sufficiently compact alphabet and grammar and trace the hierarchical structure. If we try to present a picture of this type, say, one by Rubens, as a sequence of certain elementary signs, an alphabet of painting handled according to some grammar, we shall get something oddly cumbersome. In ordinary representational painting, the image itself is simultaneously the primary and the finite sign.[8] An image may turn into a sign only in specific instances, e.g., in surrealistic painting: if female breasts are placed other than where they ought to be, they turn from an image into a sign. An image may acquire a partial likeness to a symbol because of the style of painting. This is especially clearly manifested in icon painting. Experts can immediately tell the Pskov school of icon painting from the Moscow school. As far as I know, the linguistic analysis of style has not so far received much attention. True, Florenskii (1967) understood that contemporary rules of painting perspective which had been formed during the Renaissance were but a peculiar set of expressive means not excluding other systems of painting. He analyzed one of them, the so-called reverse perspective in ancient Russian icon painting. This question was later elucidated by Zhegin (1970).

Excluding image-generated information from the language category may arouse certain objections. Word constructions structurally resembling images are used in some branches of knowledge, not only in the humanities but also in certain sciences, e.g., in biology. Reading a serious paper on the theory of evolution, one may come across an interruption of logical exposition with a spacious insertion describing, say, a gray hamster. Authors try to supplement the logic of their judgments with certain images created in the reader's consciousness. Can

[8] It is probably pertinent to make the following statements: an image is not a sign but a symbol, an integral representation of something, which cannot be subjected to logical operations. Voluminous literature is devoted to the theory of symbolism. The papers by Langer seem especially interesting; e.g., see her book (Langer, 1951). One may get an idea of her conception from the article by Ye. M. Nemirovskaya (1972).

this method be considered extralinguistic? The image is here created by means of signs, but the need to supplement the logic of judgments with an image still seems rudimentary. Another example is the pictographic and, probably, the hieroglyphic art of writing, which is an experience of constructing a language with an explicit hierarchical structure where, at the same time, an image plays the role of the elementary sign. Perhaps the hieroglyphic art of writing is a transfer of a certain symbol system from image thinking to logical thinking, the latter demanding symbols of abstract structure to be used, in accordance with its nature, while the hieroglyphic symbol system reflects the pre-symbolic, image thinking.

Hierarchy of languages; metalanguages. Languages with highly developed logic have another peculiarity: emergence of a hierarchy of languages. This happens when a language becomes the object of another hierarchically higher one or, as it is customary to say nowadays, of a metalanguage whereby we may judge the correctness of statements made in the object–language. The idea of metalanguage entered science in connection with the papers of Hilbert, the well-known German mathematician (1862–1943). In his papers he discussed the problem of creating metamathematics, a metatheory[9] dealing with the proper method of constructing judgments in mathematics.[10]

Mathematics and its logical foundations are discussed in the metamathematical language. The goal of mathematics is certain structures — a collection of inwardly consistent axioms and logical inferences from them made in the language of formulae. The object of metamathematics is statements about such formal systems; e.g., the statement "arithmetic is consistent" belongs to metamathematics.

Our everyday language is a metalanguage in relation to the "language" of things surrounding us. In terms of everyday language, we operate not with things but with their names. Making judgments about the things of the outer world, we try to arrange them in some consistent structures, which is equivalent to searching for logical foundations of the world of things.

It is possible to go farther and to demonstrate that our everyday language is constantly fulfilling two different functions: sometimes it is used to formulate statements; other times, to judge the precision of these

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[9] The term "metatheory" was created after the term "metaphysics," and the latter had first been used by Andronicus of Rhodes, an Alexandrian librarian. When classifying the works by Aristotle, he introduced the term "metaphysics" to put philosophical papers by Aristotle on the prime causes on the library shelf behind his papers on physics. The Greek word μετα means "after," "behind."

[10] Historically, the notion of metalanguage emerged for the first time in ancient India. In a paper by ancient Indian scholars, a special grammatical language was used to describe Sanskrit (see the article "Language" in *Filosofskaya Entsiklopediya*, 1970). Indian logicians were aware of the necessity to discriminate between statements made in the object–language and in the metalanguage.

statements. This gives rise to contradictions unsolvable by the means of the same language. The contradiction will immediately disappear as soon as we understand that the statements concerning the correctness of judgments belong to another language, metalanguage, while the judgments analyzed are made in the object-language. The simple non-hierarchical union of two of these statements into a phrase may formally generate contradictions intuitively perceived as not existing in reality. When common laws of formal logic are applied to the semantically closed language, this gives rise to semantic paradoxes (this was well explained by Tarski,[11] *though Russell had touched upon the problem earlier*).

Russell introduced the idea concerning the types of words and types of statements relating to different hierarchical levels. Vulgarizing a little, we can say that the words "a table," "a chair," and "a sofa" are words of a lower level than the word "furniture"; at least, it is impossible to say, "I see two things: a chair and furniture" (see Hutten, 1956). Russell's concepts had a powerful influence on the development of modern logic. It became clear that not every grammatically correct phrase was a meaningful statement. It became necessary to introduce limitations to expressive elements of a theory (and not only to deductive ones as it had been earlier). This helped to overcome some paradoxes of the naïve theory of sets in mathematics.

Let us examine several examples of semantic paradoxes. In the novel *Rudin* by Turgenev an argument is described during which Pigasov declares that there are no convictions. His opponent is Rudin:

> "Very well," Rudin murmured. "You assert, then, that there are no convictions?"
> "No—they do not exist."
> "Is that your conviction?"
> "Yes."
> "Then how can you say they do not exist? Here you have one for a start."
> Everyone in the room smiled and exchanged glances.

This kind of argumentation is often resorted to in scientific discussion as well. Black (1949), controverting Lewis, the author of the book *Mind and the World Order* (New York, 1929), declares that if Lewis is right then it is only he himself who is in a position to understand his own statements, claiming that all statements are collections of indefinite symbols. Lektorskii (1971) draws our attention to the fact that, in its fight with

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[11] A. Tarski (b. 1901), a Polish scholar, one of the principal representatives of the Warsaw school of logic. In 1933, he emigrated to the United States, where he became a professor of mathematics at the University of California. For details about Tarski's statement on logical semantics, see Smirnova and Tavanets (1967).

metaphysics, analytical philosophy has gone so far as to regard the principal declaration of "anti-metaphysical nature" as metaphysics. Then he adds, "Thus analytical philosophy in linguistic analysis comes to the boundary when it denies itself, as a matter of fact, and surpasses its own limits." I consider this quite a natural way of reasoning—the boundary in question is a demarcation line between statements made in the object-language and in a metalanguage. The British school of philosophy has crossed the boundary. Strictly speaking, this is no longer philosophy but only metaphilosophy. From the standpoint of traditional philosophy, this direction seems empty since it does not consider philosophical problems proper.

We come across paradoxical statements like those above both in everyday conversations and in scientific discussions, and, as a rule, we do not pay special attention to them. We respond to them as if we realize that in our speech the object–language and metalanguage are mixed illegally. I should like here to quote Wittgenstein (1955):

> That which mirrors itself in language, language cannot represent.
> That which expresses itself in language, we cannot express by language. (from paradox 4.121)

A number of difficulties in constructing our system of judgments are connected with the necessity of formulating in everyday language statements related to the class of judgments possible only in metalanguage. Everyone who is familiar with the problem of optimization knows how difficult it is to formulate the concept of goal. Once the goal has been formulated, it is quite easy to construct the procedure for optimal actions; but the more complex the system to be studied or controlled, the more difficult it is to formulate the goal. Formulating the goal is part of the problem whose solution is to be searched for only in metalanguage. These are the words of Wittgenstein (1955) concerning the matter:

> The sense of the world must lie outside the world. In the world everything is as it is and happens as it does happen. In it there is no value—and if there were, it would be of no value. (paradox 6.41)

We often prove not to have sufficient grounds to formulate a meta-statement, and the search for goal turns into an unsolvable problem. We want to do something well, but we do not know what "well" is. We always have to face such a task in organizing experimental research. It is not so easy to define what a good experiment is. Usually it becomes quite clear after the experiment has come to an end. Then we have at our disposal its description made in the object-language, and discussing what is formulated in this language, we may go up a hierarchical step and understand what a good experiment is.

Analytical philosophy gave up the construction of Weltanschauung doctrines. Its task is action, *or therapy*: critical analysis of our philosophical language by means of special, technically ingenious rules. This activity is of a purely metalinguistic nature. The task of analytical philosophy might be reformulated as follows: to build metaphilosophy and to create a suitable metalanguage. Any efforts aimed at comprehending the way judgments are built in science should be a metascience: a special metalanguage should be created for them.

Dialectical materialism, since it explains the development of science, its logic and structure, should also be considered as a metatheory though, as opposed to the analytical school, it remains a substantive philosophy as well.

Here are several formulations by Wittgenstein (1955) in which he attempts to reduce philosophy to a metatheory:

> The object of philosophy is the logical clarification of thoughts.
> Philosophy is not a theory but an activity.
> A philosophical work consists essentially of elucidations.
> The result of philosophy is not a number of "philosophical propositions," but to make propositions clear.
> Philosophy should make clear and delimit sharply the thoughts which otherwise are, as it were, opaque and blurred. (paradox 4.112)

It is noteworthy that the role of metamathematics and its relation to mathematics can be described with the same words. But it is also important that Wittgenstein remains fairly consistent. Here is what he says of his own statements in his next to last paradox:

> My propositions are elucidatory in this way: he who understands me finally recognizes them as senseless, when he has climbed out through them, on them, over them. (He must so to speak throw away the ladder, after he has climbed up on it.) (paradox 6.54)

Wittgenstein realized quite clearly the insufficiency of linguistic means for explanation of something which is situated one step higher in the hierarchical level of thinking. *Tractatus* finishes with the following phrase:

> Whereof one cannot speak, thereof one must be silent. (paradox 7)

There have been attempts to establish rules for the formulation of metalanguages.

Attention should first of all be paid to the opposition of the language of mathematics to the language of metamathematics. Mathematics is a strictly formalized system: logical operations within it are performed without giving any kind of interpretation in terms of the phenomena of

the external world. A mathematician deals with a specially invented system of signs; he watches only those signs and not what can be found behind them. In contrast to mathematics, metamathematics proves to be intuitively consistent (though it can also be formalized), and its statements are formulated in the everyday language. Kleene (1952) writes to this effect in his well-known book *Introduction to Metamathematics*:

> The assertions of the metatheory must be understood. The deduction must carry conviction. They must proceed by intuitive inferences and not, as the deductions in the formal theory, by applications of stated rules. Rules have been stated to formalize the object theory, but now we must understand without rules how these rules work. An intuitive mathematics is necessary even to define a formal mathematics.

Below I shall demonstrate that the properties of metamathematical language stated above are not those which are obligatory for any meta-language. Mathematics (as will be shown in the discussion of mathematics *as the language of physics in Chapter 4) may be a metalanguage itself* as related to other fields of knowledge, and in this case the metalanguage proves to be formalized to a greater extent than the object-language.

Tarski puts in other claims for a metalanguage. I have already mentioned above that he sees the cause of semantic paradoxes in the semantically closed nature of language. Therefore, the notion of semantically unclosed language is introduced. Then the statements about semantic properties of the given object-language are worded not within this language, but in the metalanguage. Semantic notions may be introduced into a metalanguage in two ways: as primary notions, the properties of which are given by means of a system of axioms, or as notions for which the definitions are formulated. The second way is more interesting for us: it is closer to the real phenomena of our everyday language. A metalanguage should be richer than the object one—only then can we define in it such notions of logical semantics as the truth, the denotation of definability, etc. It means that it must contain a logical vocabulary no less rich than that of the object-language, and it must also have supplementary variables belonging to a higher logical type. (Logical variables are signs which may serve to denote various concrete ideas; logical constants serve to denote a single idea.) A metalanguage should be so rich that everything stated in terms of the object-language could be said in the metalanguage; particularly, it should have the means for constructing names of the object-language.

Certainly, this is an idealized scheme aimed at the rigid solution of semantical paradox problems formulated in the frames of logical semantics. I shall demonstrate below that in reality there exist many languages which do not satisfy Tarski's requirements, though indubitably they are

all placed hierarchically higher than the object–language and to some extent they always contain stronger statements. Remaining at the formal level, we must assume that we are dealing with a metastatement each time this or that theory is discussed or when several theories are compared. Some metastatements may seem to us absolutely dull, but formally they are stronger than the object ones, for object theories are a subject to be discussed here. To estimate metastatements, we must build a system of metareasoning. We often come across complaints that our culture is more and more littered with statements about statements, which replace the original statements.

As was already mentioned above, in our everyday language in some hardly distinguishable way, the statements in the object–language are constantly mixed with statements in a metalanguage. The metalanguage of everyday speech uses the same sign system and the same logical means as the everyday language, which is here the object of statements. On the basis of psychological criteria, we often ascribe more weight to metastatements than to object ones, and, as a rule, we never compare these two types of statements from the viewpoint of their logical compatibility. The paradox, if you like, lies in the fact that semantic paradoxes disturb nobody but logicians. The latter did not notice the difference between the statements of different levels for a long time. Here again, we can see two approaches to language — the hard one and the soft one. Only by considering language as a hard structure can we reveal semantic paradoxes, and in this case the hard system of overcoming them should be built in a manner similar to that used by Tarski.

The teaching about hierarchy of language — or, in the terms of Russell, about types of statements — must be, evidently, considered the most serious result of post-Aristotelian formal logic.

The interpretability of sense content expressed in a sign system. A sign system has a right to be called a language if it can be interpreted into another language (into terms of another language which can be either more rich in its expressiveness or, for one reason or another, more comprehensible for a certain group of people). It is with awareness that I speak here only about interpretability, but not about translation from one language into another. Strictly speaking, such a translation is impossible even for absolutely hard languages (I shall return to this question later). Our whole language behavior is permeated with interpretation procedures. Speaking to a foreigner, we interpret our mother tongue in the system of another language, and actually it is not a translation but a mere interpretation. Considering serious physical problems, scientists interpret abstract symbols of the mathematical language of physics. The performance of musical plays is the interpretation of texts written in

notes. We face the problem of interpretation in our everyday language. This kind of interpretation can be illustrated by theatrical performances. Books, even of fiction, are often accompanied by interpretation expressed in graphic illustrations. A play — the text written in the everyday and, it would seem, absolutely understandable language — needs, in the author's opinion, interpretation in another, richer language, which uses supplementary expressive means: voice intonations, gestures, and, perhaps of primary importance, the images created by the actor's stage play. Here we return to pre-sign, image-bearing transmission of information. Any serious play — let it be "Hamlet" — can be interpreted absolutely differently by two directors without any distortion of the lexicographic text. (This example was suggested to me by Prof. Doerffel from the German Democratic Republic.) The image-bearing embodiment of a sign text can in its turn be interpreted in a sign system, that is, in critical reviews. But, like all the characteristics of a language, the possibility of interpretation can become degenerate; below I shall give an example of non-interpretability or, to be very cautious, of poor interpretability of a term in the language of physics.

Non-entropy of language.   Certainly, the analysis of a sign system may be approached from quite different positions. I consider the thermodynamic approach to the analysis of symbols in the book by Kobozev (1971) to be very interesting. The question is formulated there in the following way: "Which mechanism allows an entropic physico-chemical apparatus of the human brain to create idealized non-entropic constructions; to perform with their help logical thinking, precise coding and unmistakable recognition of symbolic recording of any thought production?" According to the author, "it is not a physico-chemical or morphological body of symbols itself that is non-entropic, but only its *recognition* by consciousness or by a mechanism which is assigned the function of this consciousness." Non-entropy of the perception of symbols releases human consciousness for activity on a higher level, and here, according to Kobozev, lies the basic distinction between human and animal psychics, since for the latter, the intensiveness of information of physico-chemical signals plays a great, often crucial role. The animal's consciousness is completely filled with "perception and analysis of sounds, colors, smells and with estimation of their intensiveness and direction." Non-entropy of language is not a peculiarity of human consciousness, but only of a sign system. Imagine that we deal with a computer. We can put some information in its memory. Naturally, some energy would be spent on it. The storage of information will be connected with preservation of a certain ordering. But all these energetic processes do not depend upon the kind of information put in, be it very serious or very frivolous; the

observable relation between the morphological complexity of an object and its informativity is absent here. Only in this sense can we speak about non-entropy of sign systems.

Now we can formulate the following statement: a sign system turns into a language when signs are perceived without entropy or almost without it. This is one of the characteristics of language. And, like all its other characteristics, it can become degenerate; e.g., this happens in musical language, where loudness of reproduction of certain sounds is already a distinctive feature of a sign. The approach discussed here allows one to regard language as a sign system which enables the thinking apparatus of a human being, functioning without the external negative informational entropy, to reconstruct the order which would be broken spontaneously if thinking were organized in the same way as the physical world.

Language dimension and non-linearity.   Evidently, Bally (1932) was the first linguist to note one peculiarity of human everyday language — its *non-linearity*, resulting from its two-dimensional sign system. "Signs are linear, when they follow each other without penetrating each other during the speech," he wrote, and to exemplify a nonlinear[12] sign combination he gives the French expression "tout à coup," where the words "tout," "à," and "coup," taken separately, are deprived of any sense. The sense of this expression is given only by the *interaction* of elementary symbols; the text proves non-linear. Here, a *two-dimensional* sign appeared to be expanded into one line of written speech, a sign which we must have included in a phrase something like:

il a aperçu tout un . . .
à
coup

Only in this case the sign would enter our speech linearly; it would have the same status as all other signs of speech. If we want to consider our speech to be linear, then we must acknowledge that at least some figures of speech are of two-dimensional character.

It is notable that Bally in this discourse about non-linearity of speech had foreseen those important practical problems which we face when translating the language of chemical formulas into a code suitable for input of information into a computer. The language of chemical formulas is two-dimensional, and sometimes even three-dimensional, while the language of computers is linear. Many an algorithm was suggested which

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[12] Here we use the analogy: if a polynomial $y = b_0 + b_1x_1 + b_2x_2$ contains a term characterizing interaction of variables, we shall already have a non-linear (along the variables) model $y = b_0 + b_1x_1 + b_2x_2 + b_{1,2}x_1x_2$.

could transform two-dimensional recording of chemical formulas into a linear sequence of signs. The trouble is that, in the process of coding, the personnel make too many mistakes — up to 20%. In writing chemical formulas as linear sequences of signs, we lose the clarity of two-dimensional representations which allows one to avoid mistakes in the ordinary records. A two-dimensional language, from the viewpoint of a human receptor, possesses more possibilities than a one-dimensional language.

The language of note recording also proves to be two-dimensional.

It turns out that in our everyday life we deal with languages of even higher dimensions. The language of our color perception is an example of a three-dimensional language. Grossman's law of addition of colors has been proven experimentally (see Fedorov, 1939). It is formulated as follows: if some four intensively colored stimuli are given, a color equation between the multiples of those stimuli can always be composed. Marking the unities of the four stimuli as W, X, Y, and Z, we can find coefficients whereby the equation

$$wW = xX + yY + zZ$$

will be satisfied. Coefficients x, y, and z may be negative as well. Physically, it can be interpreted as follows: if some stimulus F is given which is subject to reproduction, it may turn out that in order to receive the same impression on a color photometer we must mix in a definite proportion two stimuli Y and Z on one field, and on the other field mix the analyzing stimulus and the third standard stimulus X, which can be symbolically written as follows:

$$F + xX = yY + zZ$$

In accordance with a certain convention, the monochromatic flows are chosen as isolated symbols X, Y, and Z.

Thus, the language of color perception proves to be three-dimensional, though the language of the external world — the energetic spectrum — is two-dimensional. But here there is a peculiarity: in the language of spectrum presentations, we should have written any color stimulus as a part of a continuous straight line, marking frequencies on the abscissa and energies on the ordinates. In the language of color perception, the continuous two-dimensional recording is interpreted in a discrete three-dimensional recording. The dimension of the language of color perception does not coincide with the dimension of the world it describes (if the world is built in the way physicists present it).

We have no reason to think that the dimension of a language reflects the dimension of the world of things described in this language.

Classical physics was satisfied by the naïve notion of three-dimensional space existing independently from time. A relativistic physics could not be rendered in the language of these conceptions — hence, the language of four-dimensional space-time continuum. But space-time distance in Minkowski's world

$$ds^2 = dx^2 + dy^2 + dz^2 - c^2\, dt^2$$

with the imaginary time axis could hardly be interpreted in terms of everyday language. Kant's notion of space and time as innate categories which are not given to us experimentally came in obvious conflict with modern physics, which filled these notions with entirely new, extraordinary content. This new content has come from experience or, to be more precise, from the necessity of finding a language for the description and interpretation of experience. And Kant's statements must have been no more than a guess about space-time categories having a linguistic nature.

The linguistic character of concepts of multidimensional space is very clearly seen in mathematics. Let us consider the problem of the classification of objects according to a variety of properties. Assume that we must classify the world powers according to a variety of different properties which are typical of them or classify some biological or social (human) population according to a set of properties characterizing, say, the physical state of their organisms. All such problems are of purely linguistic character. We want to divide the individuals subjected to classification into certain groups so that it will be convenient to speak about them from some definite positions. It is far from being an ontological problem: we are not at all disturbed by the fact that the discovered groups of homogeneous (in some respect) people or states do not actually form actually existing, independently acting systems. To solve such a language problem, we must develop a proper taxonomic vocabulary. The problem of classification, then, consists in uniting individuals into some groups in this property space. The metrics of this space can be arranged in different ways. The properties may be given in different scales: some of them may be linear, and for others — for highly dispersed properties — the logarithmic ones, we may proceed from the space of properties given by the matrix X, to the space of covariances, given by the matrix $(X^*X)^{-1}$. The results of classification will depend on the way we organize the metrics of the space of independent variables just as any other statement of ours made in everyday language depends upon our point of view. Arranging *the space metrics differently, we can look at one and the same system in* different ways.

So far, we have spoken about the symbolic, or semiotic, dimension of language. We may also speak about the semantic dimensions, set by lan-

guage polymorphism. It is only the language of strictly definite words which could have been semantically unidimensional. The meaning of multidimensional polymorphic words reveals itself in their interaction during their use. Consequently, we may say that our everyday language is semantically non-linear. The language receiver, the human being, acts as a non-linear transformer.

Concluding the first chapter of this book, I plead with the reader not to be irritated by certain instabilities of the whole system of reasoning. Language is too complicated an organism, preserving and curiously combining everything gained during a long period of evolution. Its description cannot be put into the framework of simple logical schema. And, at the same time, we can describe nothing without turning to logical constructions. We cover a fine ornamentation with a rough net of our constructions. Certainly the net can be made more and more intrinsic, but we would risk blurring the coherence of the judgments.

In this chapter I had to place certain limitations upon the meaning of certain words. However, this should not be regarded too seriously, since the ideas emerging in these cases have no stable meaning. I shall readily give them up the moment we need this in some other place.