

GRAMMATICAL MEANINGS IN INTERLINGUAS FOR AUTOMATIC  
TRANSLATION AND THE CONCEPT OF GRAMMATICAL MEANING<sup>x</sup>

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Concrete-relational meanings...  
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1. From among the many possible ways of constructing a machine interlingua (i.e. an interlingua for automatic translation) we shall consider the following one in the present report:<sup>1/</sup> our AT machine interlingua should be set up as a system of correspondences between natural languages, or source and target languages, in our translation scheme.

First of all, correspondences are established between the lexical units (words and phraseological collocations) of the languages in question. A cluster of lexical correspondences, i.e., a set of words and word-groups which are mutually equivalent under translation is regarded as a word of the interlingua<sup>2/</sup>.

Correspondences are then established between the syntactic units (so-called configurations, or syntagmas) of the languages considered. A configuration is understood to be the formulaic representation of a set of binary word-groups by which some syntactic relation is expressed.

<sup>x</sup> "Mašinnyj perevod i prikladnaja lingvistika", 4, 1960, pp. 25-45.

A cluster of syntactic correspondences, i. e., a set of configurations of different languages which are mutually equivalent under translation, is said to be a syntactic relation of the interlingua.

It is suggested that the above treatment of a number of natural languages will result in a kind of AT interlingua, which will consist of words and the syntactic relations between them, i. e. syntagmas. We can draw an analogy between such an interlingua and the languages of mathematical logic: the words of the interlingua correspond to the alphabet symbols in logical languages, and the syntactic relations of the interlingua roughly correspond to the formation rules.

2. In the transition from some natural language to the interlingua, the words and syntactic relations of the latter are put into correspondence with the words and syntactic relations, respectively, of the former. But in addition to vocabulary and syntax, a number of languages (indeed, the overwhelming majority of those now being used for automatic translation) have a so-called morphology (morphological, or grammatical, categories). In Russian, for example, the noun is inflected for number and case, the verb for tense, aspect, mood, voice, person, number and gender (in the past tense), etc. All of these categories are different in different languages: the noun in English and Chinese lacks case, and in Chinese it does not even have number; in those languages in which the verb has tense forms, these forms usually have different meanings and usages, etc. Generally speaking, the relationships between the above-mentioned categories in various languages are very complex and it is not clear for the time being how they should be accounted for or reflected in any way in the interlingua we are speaking of. The markers of these categories, however, express some meaning (which is an integral part of the total information contained in a text), are important for translation, and should not, therefore, be lost. Consequently, it is

necessary that the correspondences between the so-called mo. (or "grammatical") categories of the different languages also be incorporated in the AT interlingua. We are faced with the problem how this can be done.

Before we suggest a possible solution, we must first explain what we mean by the words "grammatical", "morphological", etc., and secondly, we must formulate the requirements on the interlingua on the basis of which we are going to proceed.

3. Linguistics has not defined the notion of grammatical categories with sufficient clarity, so there is a certain lack of consistency in the terminology.

Without claiming to have a precise and definitive definition of the notions "grammar", "syntax", "morphology", etc., we will attempt to clarify somewhat the sense in which these terms are used below.

3.1. Everything that is expressed in language, all linguistic meanings, will be called content plane. From the point of view of exactly what is expressed, linguistic meanings (the Saussurean "signifiés", or "signata") are of two types:

1) When a signifié is a syntagmatic relation between linguistic units (morph(eme)s, words, sentences, etc.) in the text, i.e., when a linguistic unit functions as symbol for a relation or link between other linguistic units, we will speak of syntactic meaning.

2) In all other cases, that is, when it is not linguistic syntagmatic relations which are the signifiés, but something outside of language: either some kind of facts of reality (objects, abstract concepts, properties, events etc.), or the relationship of an utterance to reality, etc., i.e., when a linguistic unit functions as exponent of something extralinguistic, we will speak of lexical, or semantic, meaning.

The notion of syntactic and non-syntactic meanings (respectively, markers) can be described from the point of view of automatic translation as follows: syntactic meanings (features) are those which

are used only in and for the syntactic analysis of a text, that is, those which are needed only in order to match each word with its governing word and build up a syntactic structure of the sentence; all other meanings are considered to be non-syntactic.

Lexical (semantic) and syntactic meanings are obligatory in all languages (see E. Sapir, Language, 1921,). This means that there is no language in which an utterance is conceivable which would not consist entirely of elements expressing both semantic and syntactic meanings. However, these semantic and syntactic meanings are obligatorily expressed as such only--the expression of any particular, specific meaning is not obligatory. In other words, natural language as a semiotic system demands that both semantic and syntactic meanings be expressed in any utterances, but exactly which ones are expressed in this or that specific utterance is of no importance for Language as such (and for specific languages in particular): this is determined by the content of the utterance, i. e., by extralinguistic factors.

3.2. Linguistic meanings ("signifiés"/"signata") can also be classified from another point of view. It can happen that the expression of a certain perfectly specific<sup>3/</sup> meaning (it can be semantic as well as syntactic) is obligatory in one language whereas it is not so in some other language.

1) A specific meaning whose expression is obligatory in a language L will, if there is at least one language in which its expression is not obligatory, be called a "grammatical meaning of the language L".

Author's note (October 1971). Now I would formulate the definition of grammatical meaning in a slightly different manner. Let us call a set of mutually exclusive (=alternative) meanings a category. Then the category  $\{ 'm_i' \}$  will be called grammatical in language L for the class K of linguistic elements if it meets simultaneously the three following requirements: 1/ Every element of K is always accompanied by an exponent of some 'm<sub>i</sub>'. This takes care of the obligatory nature of  $\{ 'm_i' \}$ .

2/ Class K is large enough - or, at least, it consists of very abstract and important words which can be described as "structural words". This concerns universality, "over-allness" of grammatical meanings.

3/ All 'm<sub>i</sub>' have standard, i.e. sufficiently regular, means of expression. This requirement reflects the "regularity" of grammar.

2) A specific meaning which is not obligatorily expressed in a given language will be called a "non-grammatical meaning of the language L".

The meaning of the statement "The expression of a grammatical meaning of a given language is obligatory in this language" is as follows: there are a number of markers for this meaning, and one of them must appear in any utterance in which there is an element whose meaning can combine from the semantic point of view with this grammatical meaning. Thus, a word of some class in a language cannot be used without the markers of the corresponding grammatical meanings. Markers can also be null, in which case the physical absence of any marker is interpreted as a zero marker. In English, for example, the meaning of number is grammatical, and all nouns must be accompanied by a number marker (zero-us-um for the singular, and s-i-a for the plural). The meaning of number is non-grammatical in Chinese, so that although a noun may be accompanied by number markers (yige and other numeratives for the singular, men for the plural), this is not obligatory: the absence of a marker is not interpreted in Chinese as a zero marker, and if the number marker is physically absent from a Chinese noun, the meaning of number remains unexpressed for this noun<sup>4/</sup>.

The question of whether or not a given meaning is grammatical often boils down to asking whether a zero marker is present among the markers of this meaning.

In other words, some signifying units (the Saussurean "signifiants", "signantes"=markers) are optional from the point of view of the system of a language: their use is determined by extralinguistic factors (content), and their absence is not interpreted as a zero marker.

Other signifiants are obligatory from the point of view of the language itself: their use is determined by the structure of the language, and their absence is also a marker. Non-grammatical meanings correspond to the first type of markers, grammatical meanings to the second.

It is not always easy to distinguish optional markers from obligatory ones (i.e., to ascertain whether there is a zero marker among the markers of a given meaning), since there are many borderline cases. Special research is usually required for each particular meaning (and, accordingly, for its markers), and so this problem falls outside the scope of the present paper; for our purposes it is sufficient to assume that we are able in some way or another to distinguish between the grammatical and non-grammatical meanings of the language under consideration.

Grammatical meanings can be both semantic and syntactic. The meaning of number for the noun in Russian, for example, is rather semantic (differences of nouns in number are, as a rule, connected with extralinguistic -- quantitative -- differences) and grammatical (since the expression of number for the noun is obligatory in Russian). The meanings of gender, number and case for the Russian adjective are also grammatical, but these are syntactic only (because differences between Russian adjectives in gender, number and case are not directly related to any sort of extralinguistic differences, they merely reflect the syntactic dependencies of the adjective).

It is grammatical meanings that determine the "specificity" of a language. The general arsenal of linguistic meanings (i.e., what can be expressed in a language) seems to be much the same for all languages. Languages differ primarily in what must be expressed: one language "prefers" certain meanings and makes them obligatory, i.e., grammatical, another language will prefer other meanings. There can be languages which have no grammatical meanings at all -- ancient (archaic) Chinese was such a language, for example.

3.3. The interrelation of the feature "grammatical", on the one

hand, and the features "syntactic" and "semantic", on the other, be illustrated by the following table:

meanings features	non-grammatical		grammatical	
	sem.	syn.	sem.	syn.
1. Is the expression of this meaning obligatory?	-	-	+	+
2. Are the relations being expressed intralinguistic (syntagmatic)?	-	+	-	+

Accordingly, the theory of language (ignoring for the moment its phonic aspects, etc.) can be subdivided into lexicon, grammar and syntax. Lexicon mostly deals with the expression of extralinguistic relativity, while syntax studies the possible relationships between linguistic units in a well-formed text. Grammar proper should occupy an intermediate position between lexicon and syntax: it studies both lexical, i. e. semantic, and syntactic meanings, but only those whose expression is obligatory in a given language, that is, grammatical meanings.

The term "grammar" is used here in a somewhat narrower and more technical sense than elsewhere: grammar is usually understood to be not only the study of grammatical meanings, but includes also syntax--the study of the syntagmatic relationships between linguistic units in the text. In order to avoid ambiguity in the term and still not come into conflict with the generally accepted terminology, we will use here the word "grammar" in the usual sense, and will call the study of grammatical meanings "grammar proper".

4. All that has been said thus far refers only to the substantive nature of linguistic meanings, and is independent of the formal means by which they are expressed. Let us now turn to these means, which, depending on whether or not a meaning is expressed with their help within the syntagmatic word, can be of two types:

1.) "Morphological" means of expression will be said to be those which consist in the expression of any kind of linguistic meanings within the textual word-form. Affixation, alternation, reduplication, incorporation, etc. belong to these morphological means.

2.) "Non-morphological" means of expression are those which express meanings outside the word--syntactic, or function, words, word order, over-all sentence intonation contours, etc.

(The very complicated problem of word boundaries will not be treated here; for the purposes of the present paper it is sufficient that we somehow define these boundaries. We can consider a word to be a string of letters between two spaces, as is done in AT, all the more so since all of the definitions proposed here are intended for the needs of AT)

The difference between the morphological and non-morphological can be summed up in the following table:

means feature	morphological	non-morphological
Does this means express any meanings <u>within</u> the word?	+	

5. As we have seen, "the lexical", "the syntactic", and "the grammatical" are contrasted to each other with respect to two different dimensions and describe meanings independently of the means of their expression. These terms belong to the content plane.

"The morphological" and "the non-morphological" are contrasted with respect to another dimension and describe the formal means of expression independently of expressed meanings. These terms refer to the expression plane.



The first and second contrasts lie on different planes. The generally accepted subdivision of language theory into lexicon, morphology and syntax, therefore, seems not too fortunate from the point of view of terminology. Even irrespective of the definitions proposed above, "morphology", as the term is traditionally used, is usually taken to mean the study of word-forms, i. e., the ways of expressing meanings of any kind and by any means within the word-form, while the lexicon and syntax are concerned with the study of the respective meanings. That the term "morphology" is widely used instead of "grammar" can be explained by the fact that in the languages on the basis of whose study the terminology of modern linguistics was founded (first and foremost highly inflected Indo-European languages of the Latin and Greek type), grammatical meanings are expressed mainly by morphological means, and vice versa: the morphological means of expression in these languages serve primarily to express grammatical meanings. Hence the confusion of the terms "morphology" and "grammar" (more precisely, "grammar proper"), the terminologically inaccurate expression "morphological categories", etc.

We must consistently draw a distinction between types of meanings (semantic/lexical vs. syntactic and grammatical vs. non-grammatical meanings) and types of meaning expression (morphological vs. non-morphological means of expression).

The facts of language can be classified according to these contrasts, whereby 8 groups are obtained:

N<sup>o</sup> 1. Morphological expression of grammatical semantic meanings. Example: number of the noun in French, English, Russian and a many other languages; tense of the verb, etc.

N<sup>o</sup> 2. Morphological expression of grammatical syntactic meanings. Example: gender, number and case of the Russian adjective (gender and number of the French adjective).

N<sup>o</sup> 3. Morphological expression of non-grammatical semantic meanings. Here we find the incorporation of lexemes in polysynthetic languages, compounding in German, Hungarian and other languages, and also various instances of word-formation (=derivation) in Indo-European, Finno-Ugric, Semitic and other languages. The changes of the stem-form or the suffixed pronouns in the Arabic verb are also examples of the morphological expression of semantic meanings.

N<sup>o</sup> 4. Morphological expression of non-grammatical syntactic meanings. Example: any optional intra-word marker (affix) of syntactic links; cf. in Russian Moškva-reka, Moskvy-reki, Moskvoj-rekoj, etc. ('the Moscow-river' in different cases) or simply Moškva-reka, Moskva-reki, Moskva-rekoj, etc. where the appositional role of Moškva can be marked by formal accord or left unmarked as well.

N<sup>o</sup> 5. Non-morphological expression of grammatical semantic meanings. Examples: the articles or the compound tenses in French, English, and German; the separate words rnam and dag as plural markers in old Tibetan; etc.

N<sup>o</sup> 6. Non-morphological expression of grammatical syntactic meanings. Example: the particle to before the infinitive in English.

N<sup>o</sup> 7. Non-morphological expression of non-grammatical semantic meanings. This group includes the most widespread and common cases: semantic meanings are expressed mostly by separate words.

It might seem that if some sort of semantic meanings are expressed each by an individual word, then they are expressed within the word and we should speak of a morphological means of expression. This is not the case, however. We should explain what we mean by expression "within the word". Suppose that we have the word door; some meaning is expressed by it. Now assume that we have to add the semantic meaning 'openness' to the meaning expressed by this word (i. e., say that 'the door is open'). We have to do this with the help of another word open, and not with the help of any

marker within the first word (as would be the case if we were to the meaning of plurality: 'doors' =doors). For this reason we speak of the non-morphological means of expressing non-grammatical semantic meanings through separate words.

N<sup>o</sup> 8. Non-morphological expression of non-grammatical syntactic meanings--optative conjunctions, prepositions, copulae, etc. in constructions like lat. Eo Romam 'I go to Rome' vs. Eo in Romam id where in can always be omitted with no change in meaning.

6. The above classification and the examples cited seem to explain the meaning of the terms analyzed. We can take the following step: we can formulate two conditions to be imposed on an AT interlingua in connection with the problem of grammatical meanings.

(1) In translating from any language to an interlingua, no information which is encoded by means of the source language should be lost, since such information can be needed for translation into one of the target languages.

(2) In translating from any language to an interlingua, no information should be generated which is not expressed in an explicit form by the means of the source language, since the generation of such information can prove to be a useless waste of time and effort if this information is not needed for translation into a target language.

In view of the first condition, it is necessary that in the interlingua there be means for the expression of everything that can be expressed in any of the source languages. The noun plural is expressed in a number of languages--it should also be expressable in the interlingua; Arabic has the dual--it should also be expressable in the interlingua (clearly, if Arabic is envisaged as an eventual source language); the articles of French, English, German and other languages, the expository and debitive moods in Latvian, the potential mood in Hungarian, the versions of the verb in Georgian (kcevebi), the subtle aspectual differences in a number of languages--all this should have a place in the interlingua. In other words, the interlingua

can be thought of as the union (in the sense of set theory) of all the natural languages under consideration.

This means that every element of a given source language (no matter what kind of element: full/autonomous lexemes, syncategoric/function words, morphemes) should be representable by some element of the interlingua. However, this must not be understood to mean that all the elements of the source language are to be rendered in the interlingua in a direct, immediate manner. Markers of lexical meanings are matched by separate units of the interlingua; as far as the markers of syntactic meanings are concerned, they as such, in the form of separate "lexical" symbols, are not incorporated into the interlingua, but instead are taken care of by the incorporation of the corresponding syntactic relations (= syntagmas).

Due to the second condition on the interlingua, we should not introduce grammatical meanings in it ("grammatical" as defined on p. 98). If we did this, our translating device would have to determine special obligatory markers (of the grammatical meanings we had incorporated) for every word belonging to certain word class of our interlingua. When a grammatical meaning of the interlingua is also grammatical in the source language, this operation is very simple: the marker of the interlingua is matched with the corresponding grammatical marker in the source language (this marker can also be a zero one). But if a grammatical meaning of the interlingua is non-grammatical in the source language, then it is usually not expressed at all in the text and has no overt marker. In this case it is necessary to resort to a number of complex operations to determine this meaning in the interlingua: a broad context of mainly lexical meanings has to be searched and analyzed, and often only a very approximate solution can be obtained. Thus, if we make the meaning of number (of nouns) grammatical in the interlingua, then when we translate from, say, Japanese (where nominal number is not grammatical), the operation of a special set

of rules based on lexico-semantic, statistical and/or other criteria, using a broad context, and maybe an encyclopaedia will be needed in each case to be able to determine number of the nouns in the interlingua<sup>5/</sup>. If we now translate from Japanese into Chinese, all of this work will turn out to have been in vain: the meaning of nominal number does not require any special and obligatory expression in Chinese, either, i. e. it is non-grammatical there as well.

7. An attempt to satisfy both the above conditions leads to the following solution.

On the one hand, the interlingua should contain means of expressing all of the meanings of the languages under consideration.

On the other hand, the interlingua should not contain grammatical meanings, but only non-grammatical ones (both lexical and syntactic).

The grammatical meanings of actual languages should therefore be considered non-grammatical in the interlingua: the obligatory markers of natural language (corresponding to grammatical meanings) should be transformed into optional markers of non-grammatical meanings of the interlingua.

To put it differently, the clusters of translation correspondences between the markers of grammatical meanings of different languages under translation are considered to be words of the interlingua: grammatical meanings of the source language are transformed into non-grammatical meanings of the interlingua.

The grammatical markers<sup>6/</sup> of actual languages, which serve to express syntactic meanings, merely indicate the relations, or links, between words in the text. In text analysis, they are used in the source language to reveal the so-called word configurations, or syntagmas. By themselves these markers are not needed for translation. Thus, we do not need to know the gender, number or case of a Russian adjective to be able to translate it correctly into German or French. The appropriate markers help us beforehand to find a noun with which the translated adjective agrees since it depends on the noun. It is knowledge of this relation that is necessary

(and sufficient) to be able to construct the correct form and compute the correct position of the adjective in the target language text (making it agree with the appropriate noun if necessary). Thus, grammatical markers of syntactic meanings do not figure as such on the interlingua level: it is as if they "dissolve" in the syntagmas, and these syntagmas are represented in the interlingua by the labeled arrows of the corresponding syntactic relations. The case of the noun is an example, as are gender, number and case of the adjective, person and number of the verb, etc. All of these markers are used merely to reveal syntagmas in text analysis in an actual input text; special word-like symbols should not be used in the interlingua to express the corresponding meanings, but only arrows representing the corresponding syntactic connections (=dependencies).

The grammatical markers of semantic meanings (for example, number of the noun, tense and mood of the verb, etc.) is another matter. These markers are needed for translation irrespective of syntactic relations. Thus, in order to translate correctly a noun from French into German, Russian, Hungarian, etc., it is not enough to know in which syntagmas it is included. This gives only its case (or the preposition governing it) and its position in the sentence, while the number of this noun must also be known.

For this reason correspondences are established between the grammatical markers of semantic meanings in different languages (correspondences between numbers, tenses and aspects, articles, etc.), and it is these clusters of correspondences which are considered to be words of the interlingua in much the same manner as the clusters of correspondences between words of different languages. In exactly the same way, the clusters of correspondences between the markers of non-grammatical word-formative elements are considered words of the interlingua. To sum up, a word of the interlingua can be:

1 ) either a set of words and phraseological collocations (of different languages) which are equivalent under translation;

2 ) or a set of markers of grammatical semantic meanings (of different languages) which are equivalent under translation;

3 ) or a set of markers of non-grammatical word-formative meanings (of different languages) which are equivalent under translation.

A caveat: one should not think that the very essence of what has been suggested above consists in transforming a number of markers which are morphemes within the word into separate words--that is, we do not merely have to do with substituting a non-morphological means of expression for a morphological one. The substitution of non-grammatical markers (optional markers independent of the form of expression) for grammatical (obligatory) markers is what seems important. The noun in Russian, English, French and other languages is unconceivable without the number marker, because in each of these languages the use of number markers with all nouns is obligatory. As concerns an interlingua, its system should not require the obligatory use of these or any other specific markers. They are all words, and, just like other words, they appear in the interlingua expressions only as a result of a transformation of linguistic elements actually encountered in the source text.

The English noun stone (in the contexts like He took up a stone, etc.) gives two words in the interlingua text; a word with the meaning 'stone' and a word with the meaning 'singular', where the second word determines the first. The Chinese word litou, on the other hand, corresponds only to one word of the interlingua with the meaning 'stone' (since number is not expressed in Chinese).

When some information is needed for the target language which is not expressed in the source text, and, consequently, in the interlingua, it is generated in the text synthesis process, i. e. in the target language. Thus, in translating Chinese into a European

language, noun number has to be generated by means of an analysis of a whole text during translation from the interlingua to this language. Certain parts of synthesis may prove to be common to a number of languages (for example, the generation of information about noun number, verbal tense and mood, etc.).

The approach described above makes it possible to include new languages into our translation scheme without any fundamental changes in the interlingua: new grammatical meanings are transformed into words of the interlingua and cause its lexicon to grow quantitatively without affecting its structure.

Thus, both of the conditions formulated above have been met: no information is lost during translation into the interlingua--the markers of all the grammatical meanings of the source language are transformed into words of the interlingua; no information is produced needlessly--the markers of grammatical meanings which are not expressed in the source language are only generated when this is necessary for the target languages.

Hence, there will be no grammatical meanings, and consequently, no grammar proper in the AT interlingua: "Concrete-relational (in our terms, "grammatical semantic"-LM.) meanings should not be represented in the grammar, but rather in the lexicon, of a machine language"<sup>7/</sup>.

We have finally arrived at the thesis which we took as our starting point at the beginning of this paper (see the motto).

8. It is important to point out that our conclusion, which was prompted by rather practical requirements (convenience in automatic translation to and from natural languages from and to an interlingua), agrees with a view expressed earlier by V.V. Ivanov, who proceeded from general assumptions of a theoretical nature. "It seems desirable," he wrote, "to have information coded in an abstract language, where a significant part of the grammar of a concrete specific language is translated by means of the lexicon, that is, is reflected in the inventory of elementary meanings of the abstract language"<sup>8/</sup>. This is explained



by the fact that the grammar of natural languages corresponds extremely poorly to the logical syntax of the language of science. If all of the various specific meanings which are grammatical in actual languages are translated into the grammar of the interlingua, it will be difficult if at all possible to create a logical syntax for this language. The same idea can be formulated in yet another way: the formal languages of mathematical logic do not have grammar proper, i. e. grammatical meanings; they are characterized by a set of elementary symbols--an alphabet (which corresponds to the lexicon) and formation rules for combining the symbols into expressions (which correspond to syntax). If, therefore, we want our interlingua to be comparable to formal logical languages<sup>9/</sup>, that is, if we want it to be as close as possible to a formal logical language, we must exclude grammatical meanings from the interlingua but since we cannot simply exclude these grammatical meanings (this would result in a loss of information), we must substitute non-grammatical meanings for them.

And now we would like to add one more remark to the above arguments. An interlingua which is constructed in the way described above will better satisfy the requirement of universality: on the one hand, it includes only that which is inherent to all possible languages (i. e., lexicon and syntax), and on the other hand, in translation from any language, it can express everything that is expressed in one way or another in this source language.

Postscript. This paper was written in 1958, before the stimulating article by R.O. Jakobson on the same topic ("Boas' view of grammatical meaning", in "The Anthropology of Franz Boas...", Menasha, 1959, 139-145) came to the author's attention. Much water has since flowed under the semantical and grammatical bridge, and should the present report to be written today it would be worded differently. However, it seems to me that distinctions and a few assertions made here can be still helpful, so I did not change my old text beyond purely editorial polishing: some short passages not very pertinent for our discussion

were omitted, a couple of examples and terms replaced by better ones, etc.

As is obvious, the author's main interest at the time lay in constructing an interlingua for automatic language translation - an issue not too popular with theoretical linguists in 1973. But after the advent and triumph of generative grammar, I feel that the core of the matter can be safely re-interpreted as the quest for the essence of deep text representation (or deep structure, to put it in more familiar terms). And this is a problem that fully retains its vitality and relevance in automatic language processing (cf. the pivot language of the Grenoble Russian-to-French automatic translation project, known through many publications), as well as in theoretical linguistics, in particular-- in modern generative semantics. Attention is centered here around the problem of constructing a metalanguage for a deep, that is - semantic description of natural languages. May I suggest that this is exactly the goal I was pursuing (though not fully aware of it) more than 12 years ago? As for the very core of the above conception of grammatical meanings (Grammatica - ars obligatoria), its origins can be easily traced back to F. Boas and E. Sapir; the respective ideas are developed and elaborated with maximal lucidity in the above mentioned paper by R. O. Jakobson.

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#### NOTES and REFERENCES

- 1/Read at the Mathematical Linguistics Conference (Leningrad, April 15-21, 1959); published in Mašinnyj perevod i prikladnaja lingvistika 4, 1960, pp. 25-45.
- 2/The words of an AT interlingua should actually be not only a cluster of lexical correspondences; see below, p. 108-109. Since the system of correspondences which an interlingua represents is described here in the most general terms (fully sufficient for our purposes here), a number of important details are omitted, certain notions are not clarified, etc.
- 3/Here and elsewhere "specific" is used in the sense of "given", "particular", "just this".
- 4/"In Chinese as well as in Japanese, any noun can be used to refer both to an actual singular and an actual plural number of objects. In other words, the noun contains within itself no specification of number" (A.I. Ivanov, E. D. Polivanov: "Grammatika sovremennogo kitajskogo jazyka", 1930, pp. 218-219).
- 5/Cf. "Materialy po mašinnomu perevodu", I, Izd. LGU, Leningrad, 1958, pp. 214-215.
- 6/More exactly, "markers of grammatical meanings".
- 7/Vjač. Vs. Ivanov, "Bjulleten' ob'edinežija po MP", 1957, No. 5, p. 7.
- 8/"Materialy po mašinnomu perevodu", vyp. I, Izd. LGU, 1958, p. 24.
- 9/Putting it more exactly, if we want the system of the interlingua to be isomorphic to the systems of various formal logical languages.