

NOTES AND DISCUSSION

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THE PROBLEM OF DECIPHERING

MAYAN WRITING

In the second half of 1960, a group of associates of the Institute of Mathematics of the Siberian Section of the Academy of Sciences of the USSR undertook to try to decipher Mayan writing with the aid of an electronic calculating machine. The results of this effort were reported at the Conference on the state of development of projects or reports, translation by machine and automatic reading of text, held in Moscow at the end of January 1961; they were published in the volume of Conference Proceedings.¹ At the same time, the Institute of Mathematics published a reading of extracts of Mayan texts.²

Translated by Sidney Alexander.

¹ E. V. Evreinov, Y. G. Kossarev, V. A. Oustinov, "Research on Ancient Mayan Manuscripts with the Aid of an Electronic Calculating Machine. Research Procedures. Algorithms and Programs;" V. A. Oustinov, "Research on Ancient Mayan Manuscripts with the Aid of an Electronic Calculating Machine. Analysis of Writings." *Conference Proceedings on Perfecting of Information, Machine Translation and Automatic Reading of Text*. Part II, Moscow, 1961.

² E. V. Evreinov, Y. G. Kossarev, V. A. Oustinov, *Researches on Ancient*

The importance of the work carried out by the members of the Institute of Mathematics resides in the fact that we now have, for the first time, practical proof that it is possible successfully to study systems of ancient and unknown writings with the aid of calculating machines.³

Theoretically, this problem was posed several years ago, after statistical methods had been successfully employed instead of the former "manual" techniques of deciphering ancient systems of writing. (The Ventris method for Cretan syllabic writing and the procedure of the author of this article with regard to Mayan hieroglyphs). Thus the utilization of calculating machines for deciphering occurs in a logical order; it marks a new stage in the development of the theory of deciphering, characterized by the wide use of statistics.

The Institute of Mathematics' publication provides a reading (more precisely a transliteration without translation) of twenty-six paragraphs of the Madrid Mayan manuscript, and eight paragraphs of the Dresden manuscript. These paragraphs do not follow each other, but were selected among the easiest. Inasmuch as these paragraphs consist of parallel sentences (with repetition of words), the sum of the words of which they consist is small. In all, the interpretation of sixty-four words has been published, written with the aid of eighty-seven signs. It should be pointed out that the total number of readings published by the Institute of Mathematics is much less than that which was published a long time ago,⁴ and that these readings agree almost perfectly with the older readings. New readings have been proposed for only three signs. Thus, deciphering "by machine" of Mayan writing represents a duplication of deciphering "by hand." The agreement of the readings resulting from two separate decipherings should not, of course, be considered merely fortuitous. It shows that

Mayan Manuscripts with the Aid of an Electronic Calculating Machine. Initial Results, Novosibirsk, 1961.

³ In April 1960 a publication announced that an American scholar was undertaking similar work. *American Antiquity*. Vol. 25, No. 4, April 1960, p. 636.

⁴ Cf., for example, Y. V. Knozorov, *The Writing System of the Ancient Mayas*, Moscow, 1955. (This work contained a reading of 150 signs, 200 words and 30 sentences, without parallels).

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objective studies of Mayan writing (as well as any other writing) inevitably give similar results. In cases of differences, it would be erroneous to think that machine-made deciphering is more exact than that obtained "by hand." In both cases, exactitude depends on human, and not machine, planning. (This is now the general rule). The number of errors contained in the readings published by the Institute of Mathematics is very high, but obviously it must diminish as planning is gradually perfected. Many of the errors in the reading are found in readings published earlier, which demonstrates the typical character of certain mistakes.

Unfortunately, popular articles, and even specialized articles often present the current stage of studies in ancient Mayan texts in an erroneous manner, with the result that the question of knowing whether these texts are deciphered or not is still being debated. It is necessary, therefore, to give a definition, in the first place, of the term "deciphering." In the true sense of the word, deciphering must consist of discovering the possibility of replacing unknown signs by known signs; in other words, discovering ways of decoding a communication by replacing an unknown code with a known code.

For example, if in a text one replaces letters by numbers or any other signs, obviously a reader will not be able to read that text. Utilizing one method or another,⁵ one may discover what sign corresponds to a particular letter, and establish a list of such correspondences (the "key"), by means of which, unknown signs may be substituted by known signs. Deciphering means just that. Confronted with another text drawn up in the same way, no one, of course, would decipher it anew; one would make use of a key already obtained.

There might also be another possibility: the writing being known, the language in which the text is written is unknown. For example, knowledge of the Latin alphabet in no way gives one the possibility of reading Finnish or Hungarian, just as knowledge of the Greek alphabet does not make possible the reading of Etruscan inscriptions. In this case, the problem and the

⁵ Cf., for example, C. E. Shannon, "Communication Theory of Secrecy Systems", *The Bell System Technical Journal*, vol. XXVIII, no. 4, October 1949; J. Friedrich, *Entzifferung verschollener Schriften und Sprachen*, Berlin, 1954.

methods toward its solution, are different: one must not only study the writing, but the language (that is to say, familiarize oneself with the vocabulary and grammar which are the "keys" of any language). The term "deciphering," especially when applied to a concrete text, is in this instance absolutely out of place. If a foreigner knows French well enough to read its literature, it would be absurd to say, for example, that he has already "deciphered" Stendhal but not yet "deciphered" Mérimée. It would be just as absurd to say that a researcher has already "deciphered" the Madrid Mayan manuscript, but not yet "deciphered" the Paris manuscript. If the language were sufficiently known, one could read no matter what Mayan manuscript.

Nevertheless, if the term "deciphering" must be used in so manifestly absurd a sense, one would have to say that up to now it is the language (*and not the writing*) of the ancient Mayans which no one has "deciphered" as yet, and that consequently, up to the present, no one has "deciphered" a Mayan manuscript. To put it simply, we do not now have at our disposal either a dictionary or a grammar of the ancient Mayan tongue. It may be unhesitatingly affirmed that studies in this language are likely to continue for many more years, in view of the scarcity of material and the immense gap of time separating ancient Mayan from the Mayan language of the 16th century, known to us. The comparative study of languages of the Quetchua-Mayan family must be developed, and methods of "internal reconstruction" must be applied to the Mayan tongue of the 16th century etc., not to speak of studies of the hieroglyphic texts themselves which we cannot at present transcribe with any certainty because of their confused design, bad state of conservation, and complexity of decorative motifs in the inscriptions.

As for the deciphering of Mayan writing (*not the language*), or to put it in another way, the possibility of replacing Mayan signs by Latin, Russian or other known letters, this may be achieved "by hand" as well as "by machine" (with like results). The signs are read with varying degrees of precision. The reading of syllabic signs utilized for the phonetic redaction of words, is most exact. (This exactitude is confirmed by cross references). The reading of numerous ideographic signs (that is to say, morphemes) is based on the substitution of a corresponding

morpheme in the language of the 16th century, taking no account of possible phonetic changes; this reading is conventional (hence, it can be more precisely rendered). More conventional yet is the designation of ideographic signs when it is not known which synonym is to be chosen from among those existing in the language of the 16th century. Finally, certain ideograms have no correspondence in the language of the 16th century but nonetheless it is often possible to establish their meaning.

It is therefore clear that in the main points it is possible to provide a transliteration of Mayan texts, that is to say "read" them, but actually only those words conserved in the language of the 16th century can be read and understood, especially if laws of phonetic change have been established and taken into account. The significance of unknown words may be determined by various methods. (The statistical method among others), but one must not lose sight of the fact that this is a long term task involving the participation of numerous scholars.

We must here introduce an important correction to the announcement made by the press that the work of the members of the Institute of Mathematics was based upon a theory that we were supposed to have made with regard to the hieroglyphic character of Mayan writing. Such a hypothesis had actually been advanced not by us but by an eminent French scholar Léon de Rosny, in 1876.⁶ Indeed, we are, with regard to various theories of deciphering, resolute partisans of the Newtonian principle, "hypotheses non fingo." It seems to us that it is in no way necessary to have recourse to theories when facts may be established with absolute precision. The type of a system of writing may be determined by various methods, among others, statistical, without recourse to hypotheses. Writing is undoubtedly a phenomenon linked to stages of evolution (as Friedrich Engels pointed out), making its appearance during the period of formation of a political state, or a little later. The most ancient form of writing is hieroglyphic. That is why the existence of hieroglyphs in ancient

⁶ Léon de Rosny, *Essai sur le déchiffrement de l'écriture hiératique de l'Amérique Centrale*, Paris, 1876. We think it is indispensable to note that we became aware of this work only in 1956, at the time of the 32nd International Congress of Americanists at Copenhagen; therefore, our articles prior to that date do not refer to it.

Mexican and Peruvian societies (as in Egypt, Sumer, India and China) is not due to chance, but conforms to a law. One may affirm a priori (and this is in no way a hypothesis) that in the oldest societies of India (Mohenjo-Daro) writing was hieroglyphic, and we may affirm this although it has not yet been deciphered. The type of a system of writing may be determined according to indirect evidence, for example, according to the designs accompanying the text, for pictorial art is also a phenomenon connected with evolutionary stages, and for every particular period in its development there is a corresponding particular period in the evolution of writing. Methods of statistical research provide the possibility of precisely determining the character of a system of writing without having recourse in any way to hypotheses.

If, for example, the writing involves about thirty signs (like contemporary European alphabets) we are actually dealing with a system of phonematic reference (that is, the sign generally reproduces a phoneme). If the number of signs in the writing reaches several hundred, this indication alone leads us to conclude that we are dealing with a system of morphematic reference (hieroglyphic writing). Of course, a system of real writing, formed historically, is mixed; it is not homogeneous. Thus, in contemporary French writing certain phonemes are transcribed by two letters, and systems of hieroglyphic writing utilize determinative words and a syllabic script (with the result that a morpheme is transcribed by two or more signs). But these exceptions can be revealed equally well by statistical analysis.

After having defined the system of writing (which in general presents no particular difficulty) one finds oneself facing the problem of the language of the texts under consideration. In analysing these, one may establish (not hypothetically, but exactly) certain particularities of the language and one may choose the known language which is closest to it. For example, hypotheses have been put forward with regard to the Indian or Peruvian origin of texts from Easter Island. However, it is sufficient to take cognizance of the percentage of duplicate signs (corresponding to duplicate morphemes) in these texts to prove their Polynesian origin. When the system of writing has been defined and the nearest known language selected, one may then proceed to deciphering, strictly speaking; that is, to connect the signs of the

unknown writing to particular units of the known language. In the course of this work, statistical methods known for a long time may be widely employed; these methods give results which are in no way hypothetical; they have been picturesquely described by Edgar Allan Poe in *The Gold Bug*. However, Edgar Allan Poe's hero would have been blocked if he had had to deal, for example, with the Beowulf saga ciphered in the same way. The divergence of languages would have made direct comparison impossible and it would have been necessary to perfect statistical methods. The fundamental difficulty in deciphering systems of ancient writing lies in just such situations, when the language of the texts is only partially known (assuming that it is known at all). In order to accomplish any deciphering, all the words coinciding in both languages are first utilized (that is, the language of the texts under study and that of the nearest known tongue). In the language of the ancient Mayan texts the number of such words is reduced and naturally those were read first, such as they were, without any necessity of setting up hypotheses. The specificity of statistical methods of deciphering resides precisely in the fact that preliminary theories become unnecessary.

The use of calculating machines opens broad perspectives in the field of deciphering systems of ancient writing. Crowned with success, the first attempt of the associates of the Institute of Mathematics shows that the problem of the practical utilization of contemporary techniques in this field is already resolved.