EXTRACT FROM

m u s e u m

VOLUME XXX No 3/4 1978

Глубокоуважаемому
Льву Яковлевичу
от автора

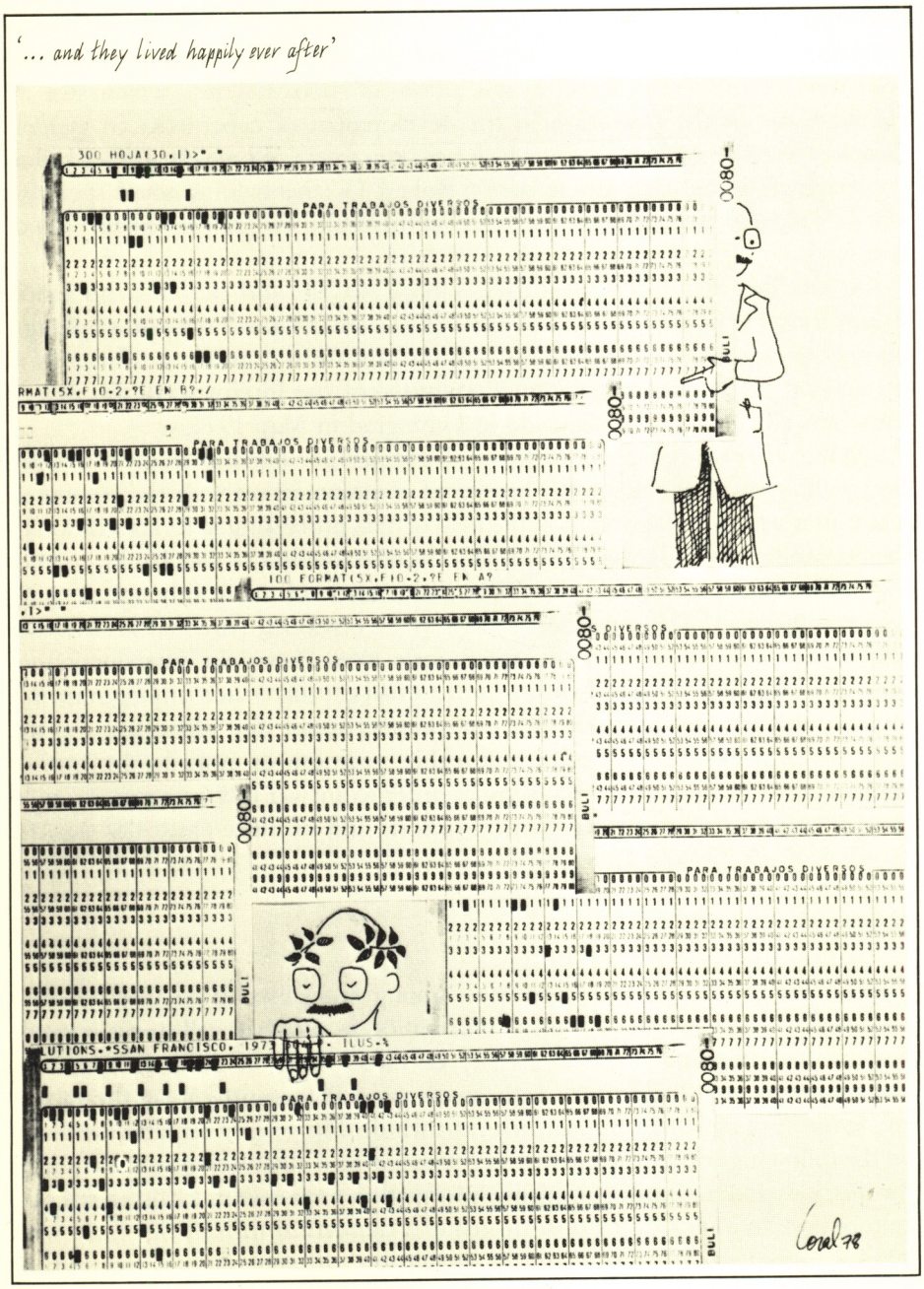
U N E S C O

Editorial

The question of the use of a computer by a museum was already being dealt with in *Museum* in 1970 and 1971. Since that time, the remarkable instrument that is the computer has been considerably perfected. Numerous museums are already using it for various purposes: inventories, management of collections, and research. Others are preparing themselves for the change-over. There still exist those, however, that would benefit from a computer but underestimate its usefulness or think, often wrongly, that they cannot afford one.

This issue gives an overall view of the present situation without pretending to cover it completely. It presents a number of experiments, proposes some solutions and offers a glimpse of future prospects on the national and international levels.

The subject is indeed complex, but the field holds out such considerable possibilities that it is worth while to take the trouble of looking at them more closely.



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Coral Ordóñez García, architect attached to the National Museum of Anthropology, Mexico City, asked her colleague, Noemí Castillo-Tejero, Chief of the Electronic Machines Section, to describe the arrival of the computer at the museum. The architect then made a graphic interpretation of her impressions of this narrative.

The use of computers in museums: present situation and problems

Jakob A. Sher

The very brief history—so far only one generation—of data processing in museums clearly reflects the excesses and the paradoxes, ranging from total rejection to the extravagant exaggeration of potentialities, which are so characteristic of the first stage in the development of cybernetics in general. Despite the undeniable progress which has been made and which is described in an extremely interesting article by Dr Robert G. Chenhall,[1] a noted specialist whose wide experience can be judged from his book,[2] the picture remains full of contrasts.

On the one hand, a few countries have set up and put into operation information retrieval systems (data banks) and even computer networks linking a number of museums. The substantial achievements in this area were discussed at the session of the Documentation Committee of the International Council of Museums (ICOM), which was held in Leningrad in May 1977.

On the other hand, the vast majority of museum personnel in all countries still find it difficult to overcome the barrier of communication with the computer, while another leading specialist in the field of data processing in its application to the humanities, J.-C. Gardin, in analysing the effectiveness of data banks, reaches the disillusioning conclusion that 'little use is made of them, although nothing could be simpler'.[3] Thus, we come up against an obviously paradoxical situation, which, generally speaking, may significantly slow down the introduction of computers into the work of museums, after it had got off to such a flying start. We might therefore well ask whether our projects make due allowance for the objective and subjective factors that either promote or impede the further application of computers in museums. In order to answer this question, it would be well to examine it in both its more general and its more particular aspects.

General aspects

There is as yet no general consensus among specialists as to whether data processing in museums—'museum informatics' as we shall call it—is a single field of scientific and practical activity or rather a set of different trends in museum work; nor, incidentally, is there any general consensus about the subject and scope of the science of informatics as a whole. The present remarks are based on the following concepts: informatics (information + automation) is the study of the methods and means of optimizing information processes in industry, science, culture and various spheres of management; theoretical informatics deals with general questions of the optimum collection, storage and processing of

1. R. Chenhall, 'Museums and Computers: A Progress Report', *Museum* (Paris), Vol. XXX, No. 1, 1978, p. 47–56.

2. R. Chenhall, *Museum Cataloging in the Computer Age,* Nashville, American Association for State and Local History, 1975.

3. J.-C. Gardin, 'Logical Effects of Data Bases on the Study of Historical Sources', *International Social Science Journal,* Vol. XXVII, No. 4, 1975, p. 761.

information; and specialized informatics is concerned with the optimization of information flow in various concrete branches of practical, scientific and cultural activity.

Museum informatics may be considered as having first seen the light of day in the mid-1950s, with the publication of the findings obtained by J.-C. Gardin in his first experiments dealing with the creation of mechanical systems for the retrieval of information on archaeological objects on hand-punched cards.[4] A milestone in the development of museum informatics was the symposium organized in 1968 under the joint auspices of the New York Metropolitan Museum of Art and IBM.[5]

During the last two decades, specialists have focused their attention on the automatic retrieval of information on museum collections. As those who were involved in this work were mostly archaeologists, emphasis was placed on archaeological and ethnographical materials, and less attention was paid to collections of paintings, drawings and sculpture. Information retrieval is undoubtedly one of the major problems in museum informatics, but it is by no means the only one. The systems approach, which is necessary for the design and development of all forms of computerization, makes it also imperative to bear in mind other aspects of museum activity in which the computer can play a useful role. This would also solve the problem of using computers to full capacity, which would not be the case if their function was limited to information retrieval.

At the present time, there are at least four areas in which computers could usefully be employed in museums: education works; research; management of the museum's technical services; planning, budgeting and management.

The first two areas have a direct bearing on museum informatics. It is evident that they apply to two completely different categories of user, the ordinary museum visitor and the researcher (art historian, archaeologist, cultural historian, etc.). The inquiries made by a visitor, quite obviously, differ sharply from those made by a researcher. The information retrieval system must accordingly store information on at least two different levels, which may be conventionally termed 'popular scientific' and 'scientific'. The two other areas where computers may be applied in museums relate to the sphere of management, where standard management packages could be widely used.

Computers and educational work

The museum is no longer just a place for the conservation of works of art and other cultural treasures of the past; it has become a powerful instrument in mass education. The flow of visitors to museums is constantly increasing, and the army of guides is no longer sufficient to provide informed commentaries for all who require them. In 1976, some 133 million visitors passed through museums in the USSR, and of that number only 50 million were members of conducted tours. In the Hermitage Museum, for example, the ratio of individual visitors to members of groups is approximately five to one. Audio-visual aids, captions and other explanatory materials only very slightly alleviate the problem, since they possess neither the flexibility nor the versatility required to furnish answers to each individual visitor's inquiries.

Another problem stems from the fact that no major museum is able to show more than 10 or 15 per cent of its entire holdings, which means that large quantities of artistic and historical treasures are unavailable for visitor education.

Both of these problems can be partially solved by equipping museums with visual terminals displaying colour slides accompanied by explanatory texts. This system is controlled by computer. Unlike electromechanically operated audio-visual devices, which are rigidly programmed, projecting slides and texts in a fixed sequence, the electronic system of terminals can show a wide variety of images and texts in any order, in direct response to the requirements of the visitor. It is capable

4. *Le Fichier Mécanographique de l'Outillage: Outils de l'Age du Bronze, des Balkans à l'Indus*, compiled by J. Deshayes, Beirut, Institut Français d'archéologie, 1956.

5. *Computers and Their Potential Applications in Museums*, New York, The Metropolitan Museum of Art and Arno Press, 1968.

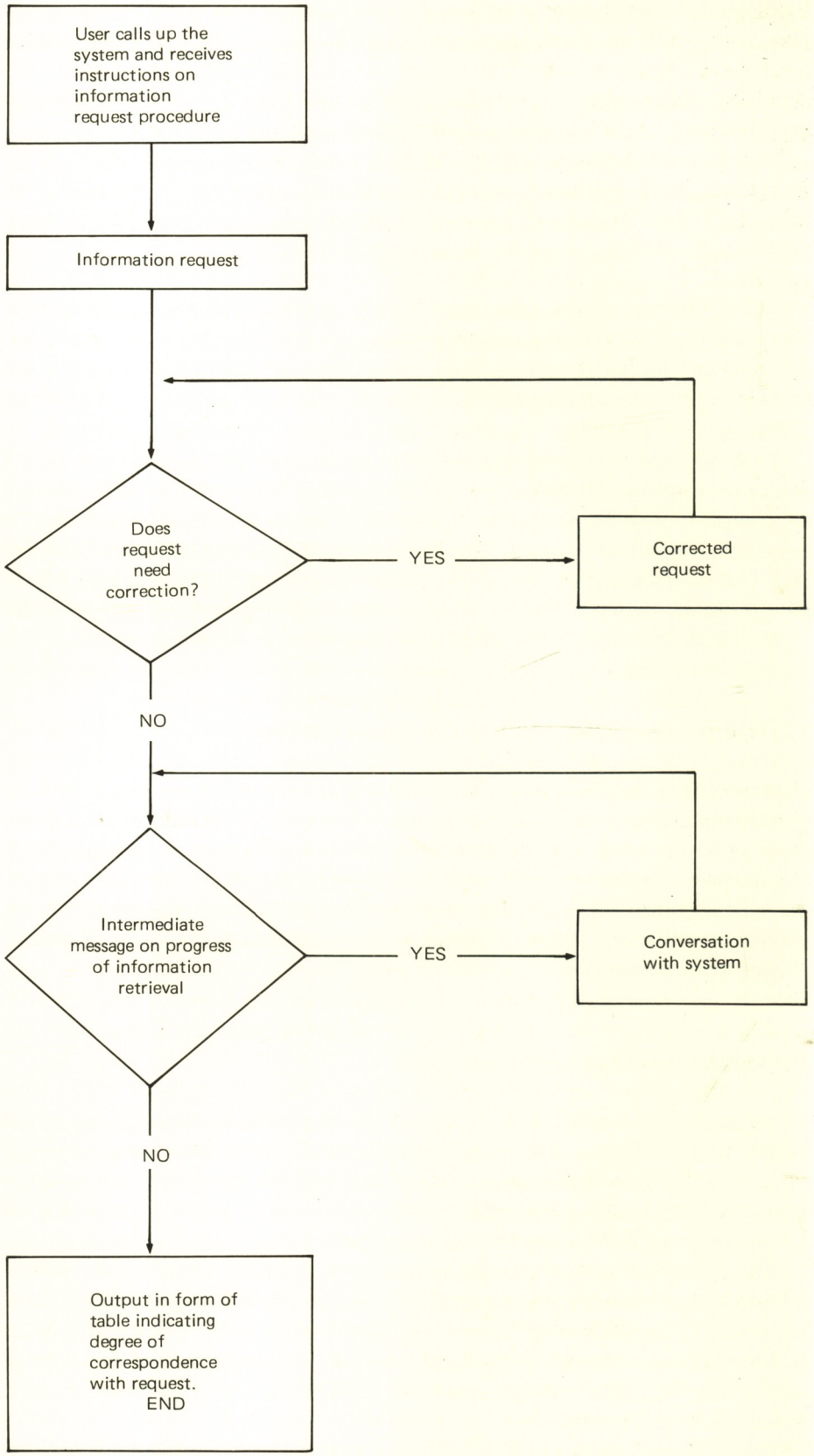

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Diagram showing the functioning of a model data bank while 'conversing'.

of carrying on a 'conversation' with the visitor, putting specific test-questions to him and, depending on the answers, 'advising' him on what to look at, read, etc. Moreover, the fact that certain things may not be on exhibition or are in the holdings of other museums, even foreign museums, no longer creates any obstacles.

Of course, no electronic system, no matter how sophisticated, can replace a qualified guide, art expert or cultural historian, his spoken word, his learning or the emotional impact he has on a visitor. The idea is not, however, to replace a

living guide by an electronic guide but to provide the guide with an assistant to take over part of this work: the preliminary sifting of visitors according to their level of knowledge, directing them towards one or another line of further inquiry, supplying them with general information and showing short audio-visual programmes to supplement the information provided by the guide.

This system makes it possible to do two things at the same time; it provides the individual visitor with an invisible 'guide', and makes works of art and culture that are not on show, or works in other museums, available for use in the museum's educational activity.

It could also help museum staff to assess the widely diverse needs of the broad masses of visitors. The computer can store all inquiries in its memory and arrange them according to a required set of criteria, thereby providing valuable material for museum sociologists and other specialists engaged in the study of the behaviour of visitors and of improvement of methods and means of educational work.

Another area in which the computer can be adapted to the educational activities of museums is in the analysis of the flow of visitors, of the itineraries and schedules of conducted tours and of methods of planning them to best advantage. Obviously, the number of visitors to museums increases sharply at certain periods of the year, during public holidays and school holidays, and the provision of adequate facilities gives rise to difficulties that could be partially overcome if the flow of visitors were to be modelled and estimated in advance.

Computers and the museum's research work

A principal feature of museum informatics is that it is particularly concerned with the humanities (sciences of man and social sciences). This introduces at least two difficulties that complicate the automation of data processing, as compared with the problem in the natural sciences and technology: first, the difficulty of establishing a formalized description of historical and cultural objects and works of art, as well as of the whole language employed by the museological sciences (history, archaeology, ethnography, art history); second, the difficulty arising from the fact that the majority of museum personnel are not, as a rule, professionally qualified to use computers, or data-processing equipment in general, without undergoing special training.

The first difficulty is gradually being overcome thanks to the increasing interest of social scientists in formalized methods of description and analysis and to the refinements that have been made in the structure of information-retrieval languages. The second difficulty is being overcome at a much slower rate, and is present in all countries, as emerged from the discussions of the Documentation Committee of ICOM at its meeting in Leningrad in 1977.

This prompts the question whether it is easier to teach museum staff machine language or to teach the computer the language of museum science. Experiments conducted by the Hermitage Museum, in conjunction with the Computer Centre of the USSR Academy of Sciences, indicate that the latter is the more effective approach. This conclusion is apparently borne out by experience in other countries in the use of museum computer networks and data banks. To obtain a clearer general picture of this problem, we must take a closer look at some museum information-retrieval systems already in operation.

The work of the data bank or museum computer network

A museum data bank (for example, the New York and Washington Museum Computer Network) functions in general outline as follows:

Catalogue (descriptive) data (author, title, date, size, price, inventory number, display record, etc.) are stored in the computer's memory. Because of the difficulties involved in establishing a formalized description of scientific data, they

are either disregarded entirely or taken only slightly into account. The direct result is that a body of facts of great importance to the museum worker is outside the scope of automatic retrieval.

To be able to use the information stored in the data bank, the museum worker must have a 'translator'. The information request, written in natural language, reaches the computer operator and at this point is translated into machine language; the translation is not always immediate and may require further consultation with the user. Thereafter, the request is processed by the computer and the answer is translated from machine into natural language and is transmitted to the user.

The waiting time for an answer is much longer than the processing time and is commensurate with the time spent on the manual retrieval of an answer from conventional information sources (books, card catalogues, archives, etc.). Whereas with manual retrieval constant adjustments can be made to the request for information, machine retrieval, operating in the batch-processing mode, precludes this possibility. If the user has not formulated his request with sufficient precision (or the programmer in translating it into the machine code language has not properly understood it), then the answer will be unsastisfactory, and the question will have to be reformulated and processed a second time. Even then there is no guarantee that the computer will provide the user with exactly what he was looking for; it may come up with something similar in form but quite different in substance. After a series of such reformulations, the total waiting time would considerably exceed the corresponding time for manual retrieval. This is undoubtedly the main reason why specialists are so reluctant to resort to the services of data banks, as J.-C. Gardin has noted. This is probably one of the major paradoxes of the present stage in the development of museum informatics. As the followings experiment[1] shows, the situation changes considerably when the user has direct access to the computer in the same way as he has access, for example, to reference works.

A mini-bank operating in the conversational mode

The *Catalogue of Ancient Bronzes* in the Hermitage collections was used as an experimental data base. The document description was designed to reflect not only the museum cataloguing data but also other particulars of a scientific character that enabled the computer to retrieve and classify objects according to various criteria: iconographic, stylistic, chronological, etc. Researchers and personnel in the cataloguing and conservation departments collaborated in the experiment.

This multidimensional description creates certain difficulties, especially in the initial stage, but these difficulties affect the programmer, not the user.

The main problem was that of providing the user with direct access to the computer, bypassing the intermediate 'translation' from natural to machine language. As in the case of SYNTOL (Syntagmatic Organization Language), words and expressions are initially registered in the form of natural-language words, and the transition to machine registration is 'hidden' from the user and does not impede him.

As soon as the system is called up, brief instructions to the user appear on the display screen, listing the sequence of steps to be taken for putting an information request. The user himself puts his question by typing out on the keyboard the list of characteristics that interest him. These are recorded in natural language with a minimal number of conventional symbols: beginning and end markers, semicolon to separate words, or, for example, '6' to designate sixth century B.C. The end marker automatically switches in the programme of retrieval and sorting. At the end of the run, the answer appears on the display screen in natural language in the form of a list of titles of objects, each accompanied by cataloguing information and other data that are stored in the memory. This list is in the form of a table which the

1. The author expresses his sincere gratitude to Professor V. M. Ponomarev, Director of the Leningrad Computer Centre of the U.S.S.R. Academy of Sciences, to Dr V. V. Aleksandrov, Head of Department, and especially to Dr A. O. Polyakov, who was directly responsible for working out the programmes of the mini-bank, for their extremely valuable contribution.

3
A guided visit to the Hermitage Museum in Leningrad. No electronic system can replace the guide, but it can provide him with a valuable assistant.

machine has already checked for degree of correspondence with the information request. Thus, if the object corresponds in all particulars with the characteristics indicated in the question, it is indexed '100 per cent', while if it corresponds in only certain respects, the percentage indicated is accordingly lower. If a characteristic referred to in the request is not stored in the computer's memory or is recorded in another way, the display unit asks the user to correct the request (Fig. *2*).

As the user becomes used to communicating with the computer, the mode of operation can also be refined. Thus, the beginner finds it easier at the beginning to read on the screen messages like: 'Do you wish to make any corrections to your request?' or 'Are the concepts *kouros* and naked ephebus equivalent?' etc. Later on he will himself find it easier and quicker to get answers like: 'corrections?' or 'corr.?', 'kouros = nak. ephebus?', and so on. At first, the user may prefer to see on the screen a detailed list of exhibits and to make a more rigorous selection himself. Later, he can entrust this selection to the computer by means of an additional programme. Consequently, the data-bank model under consideration is adaptable to the level of the user and, like an experienced teacher, allows him to undertake assignments of greater complexity as he becomes more experienced.

The development of these external aspects of communication between the user and the computer is not the only problem solved by the model in question. In designing systems of data retrieval, one of the most time-consuming and

labour-consuming preparatory phases is usually the compilation of a thesaurus. This model provides for the automatic compilation of a thesaurus, proceeding gradually as more and more source data are stored in the computer's memory, and the semantic links between them are analysed as the computer registers more and more questions with their corrections. The solution of this problem is just as important as that of providing the user with direct access to the data bank.

Other applications of the computer in museums

The use of the computer for storing museum catalogues by no means exhausts its potentialities for use in other branches of activity in art and historical museums. For example, the computer can be applied to the field of infrared and X-ray photography to improve the contrast of images, which may lead to new discoveries in establishing the authorship of paintings and in art studies.

Another example that may be cited is X-ray structural and spectral analysis of objects in museums (including analysis of pigments). At the present time, manual work and the intuition of the specialist play the predominant role in the processing of findings, whereas the automatic decoding of spectra is just the right sort of job for a computer.

Once museologists—who are not computer specialists—have mastered the simple skills of communicating with computers for purposes of data retrieval, they will feel encouraged to set themselves and the computer more sophisticated informational and logical problems of research.

Certainly, it is a far cry from a model of a data bank to a full-fledged data bank with a store running to several tens of megabits. The transition from a minicomputer, like the one used in the experiment described above, to a medium or large computer would involve additional difficulties, but in all likelihood they would be technical snags rather than difficulties of principle.

There are other potential applications of the computer in a large museum. They could be used for the organization of temporary and permanent exhibitions; the composition and printing (using phototypesetting machines) of catalogues of temporary exhibitions; the regulation of temperature, humidity, etc., in storerooms and galleries; the control of lighting and signs, planning and budgeting the optimization of administrative decisions, etc. Detailed consideration of these applications falls outside the scope of this article.

In conclusion, it was quite natural that, in the early stages of museum informatics, major attention should have been devoted to information retrieval, one of the major and more labour-consuming problems. The time would now appear to have come to consider a systems approach to the use of data-processing equipment to contribute to the optimization of other important branches of museum activity as well.

[*Translated from Russian*]