

IBM Automatic Language Translation New York World's Fair 1964/65





Man has been speaking and writing in many tongues for thousands of years. Always, this multitude of languages has been a barrier to man communicating with man, to nation understanding nation. And never more so than today.

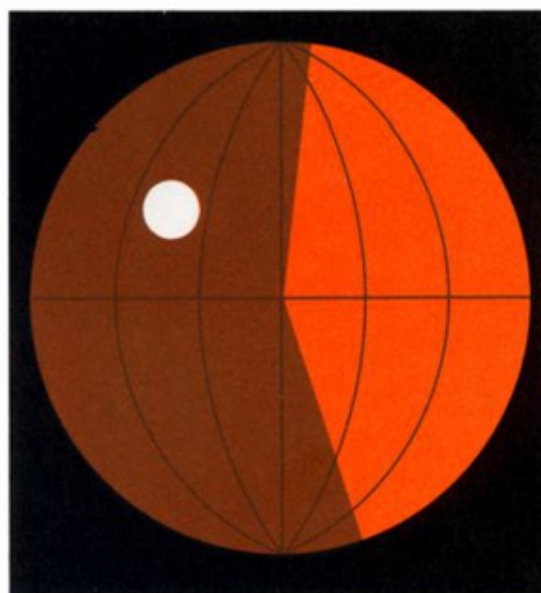
In each age there has been a comparative handful of humans who were proficient in more than one language, who tried to bridge the communications barrier. These few—these indispensable few throughout history—have been the interpreters of spoken words, the translators of written words.

At no point in recorded history, however, have there been enough translators for complete or even adequate understanding among the peoples of the world. And the translators' task became more difficult, century by century, with the ever-increasing accumulation of man's written thoughts and knowledge of the world around him.

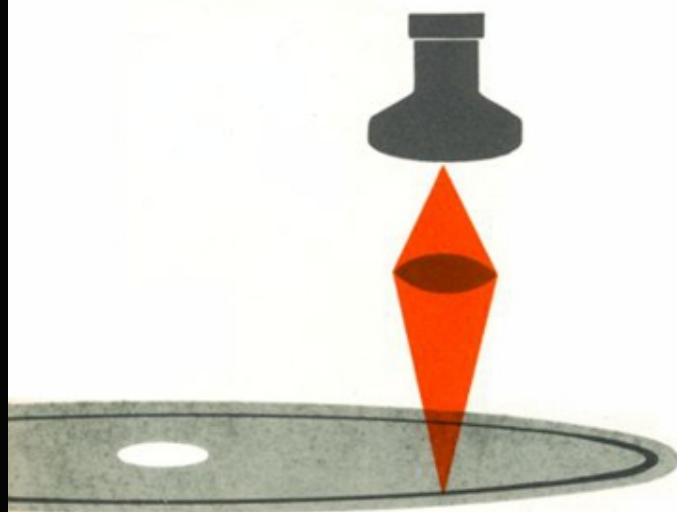
Today, in an age of rapid scientific discoveries, human translators cannot keep up with the flood of technical information rolling off the world's presses in French, German, Russian and many other languages. Ninety percent of all the scientists who ever lived are alive and working today, and the vast majority of their published books, articles, papers and reports are unknown to their colleagues in other lands.

For example, only one American scientist out of every thousand reads Russian—yet more than ten billion words on scientific subjects will be written in Russian this year alone. Less than one percent of this will be read by English-speaking scientists, because of the lack of trained translators.

Additional human translators cannot be trained fast enough or in sufficient numbers to make more than a dent in these billions of words in many languages each year. A practical solution to this problem is the development of a system of rapid, automatic translation of languages by machine.



Today, more than half of the world's technical literature is being published in foreign languages—but less than one-twentieth of this is being translated into English.



A number of research organizations—universities, government agencies, as well as private corporations—are engaged in the development of automatic language translation systems. One of these is IBM.

But...how can a machine translate? The most important requirement, as in human translation, is the ability to recall from memory the meanings of thousands of words. One "memory" device used in automatic translation is a plastic disk that was developed jointly by the U.S. Air Force and IBM. The disk looks much like a transparent phonograph record, and contains coded words and phrases in the language to be translated, together with their English meanings. The words are photographically recorded in circular tracks on one side of the disk. The unique code for each word consists of a sequence of black rectangles of microscopic size—so small that about 200,000 foreign words and their English translations can be stored on a single disk.

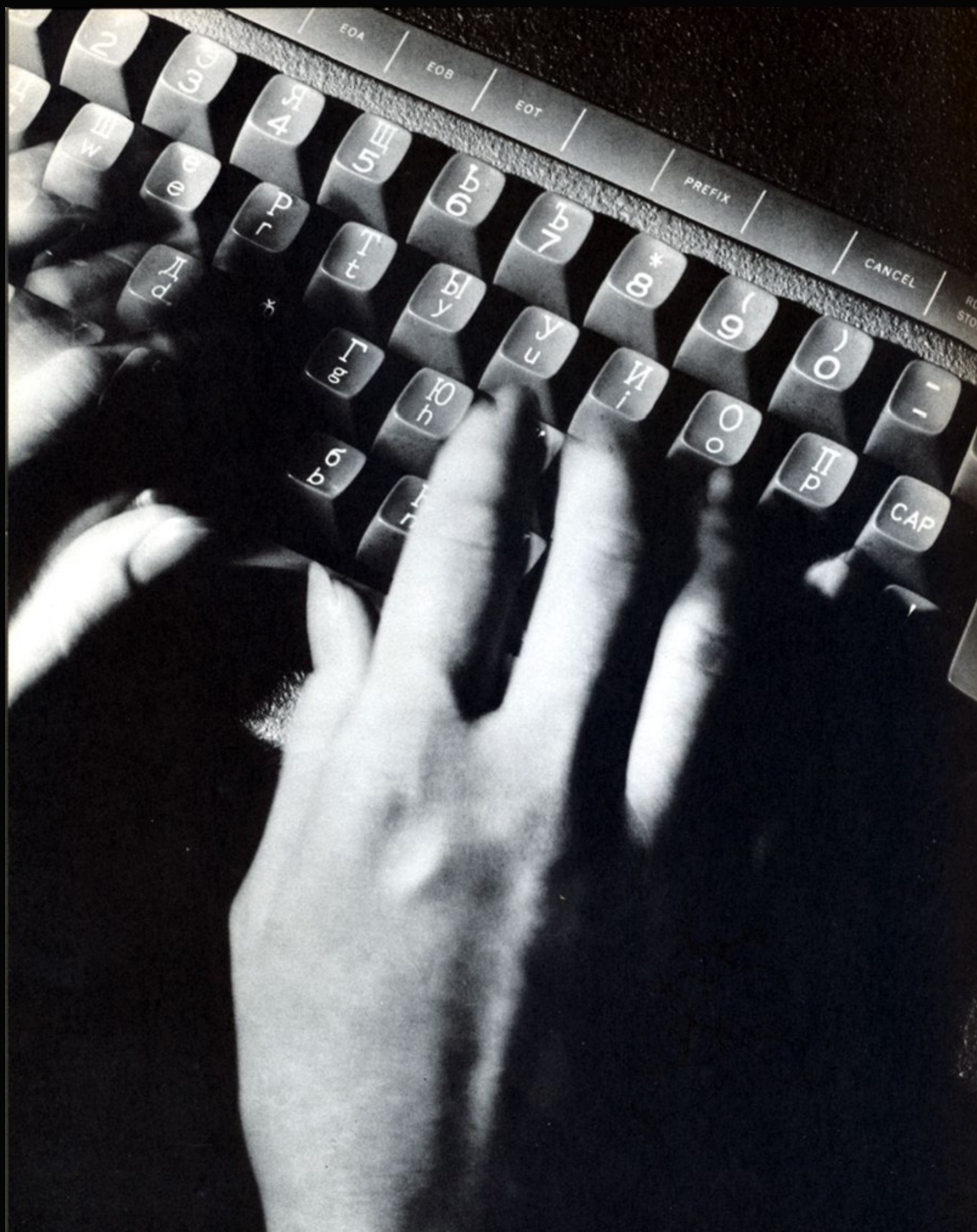
In the IBM automatic translation system, this "dictionary" disk rotates in front of a moving beam of light. As a foreign language sentence is fed into the machine, the beam searches the disk for the location of each word to be translated. First the light beam skims over some of the thousand tracks on the disk, sampling a small portion of the tracks until it comes to the one that contains the word to be translated; this method is similar to the procedure of a human translator who flips through the pages of a dictionary until he finds the right page. Then the light-beam searches the individual track until it finds the exact word and its translation; this corresponds to scanning a single page of a dictionary to find a particular word and its meaning.

IBM's automatic translation system takes about *1/40th of a second* to find any translation on this disk.

A portion of the track on the "memory" disk, showing the code for the Russian word **da**, meaning **yes**. The track is magnified over 200 times.

Да

yes



...ion to ...
...electronic computers...
...ation in our country started
...cs and computer technology and mathem
...ience of USSR, in work of which later
...y of Science of USSR. Leningrad Univ
...ne translation. Computer center of A
...Electronics, Automation and Telemec
...other collectives.

...ce of work during the first stage wa
...anslation. So that machine was able
...necessary for this action it is nece
...ese rules should be accurately formu
...ent and to form/educate system, log

...was create... of algorithms- Fr
...rman-Russian, Japa...se-Russian, Hung
...n algorithms...



Вся эта страница является машинным переводом русского текста, который напечатан на предыдущей странице. Эта страница перевода с русского на английский не совершенна вследствие нерешенных вопросов грамматики.

Прежде чем машина может перевести с одного языка на другой, лингвисты должны ввести в запоминающее устройство машины большое количество грамматических правил, которые повышают понятность данного перевода. Но потому, что в языках существует значительное разнообразие и сложность, все грамматические правила любого языка не разработаны полностью в настоящее время для использования вычислительными машинами.

Система для автоматического перевода языков должна также учитывать проблему слов, имеющих одинаковое написание, но разные значения. (В ан-

глийском языке существует большое количество таких слов: can, will, type, store, fair, through, content, rule, port, even, mean и т.д.) В таких случаях лингвисты должны находить правила для разрешения конфликтов в значении слов на основании анализа речевого и других видов контекста.

Однако, если необходимых грамматических правил нет, машина может напечатать несколько значений, разделенных чертой.

Как видно из этой страницы, многие лингвистические проблемы машинного перевода еще не решены. Но сегодня переводы с одного языка на другой, произведенные вычислительными машинами, помогают научным работникам узнать немедленно содержание иностранной технической литературы и определить необходимость дальнейшего изучения этой информации.

Machine Output

All this page is machine translation of Russian text, which is printed on preceding page. This page of translation from Russian into English is not perfect due to unsolved problems of grammar.

Before machine can translate from one language into another, linguists have to introduce in memory unit of machine large quantity of grammatical rules, which increase intelligibility of given translation. But because in languages exists significant variety and complexity, all grammatical rules of any language are not developed completely at present time for use by computers.

System for automatic translation of languages must also consider problem of words, having identical spellings, but different meanings. (In English language, exists large quantity of such words: can, will, type, store, fair, through, content, rule, port, even, mean etc.) In such cases linguists have to find rules for resolution of conflicts in meaning on the basis of analysis of speech and other forms of context.

However, if necessary grammatical rules is/are lacking, machine can print several meanings, divided by line.

As can be seen from this page, many linguistic questions of machine translation still are not solved. But today translations from one language into another, performed by computers, help scientists to recognize immediately contents/allowance of foreign technical literature and to determine necessity of further study of this information.



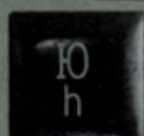
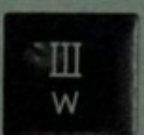
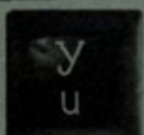
Portion of IBM translation equipment at Kingston, New York. Memory unit containing the "dictionary" disk is at center.

IBM's demonstration of automatic language translation at the New York World's Fair is designed to show the effectiveness of machine translation today—and also to show how a computer can be used by people many miles away from the machine itself.

1 At the IBM World's Fair Pavilion, a typist at an input keyboard copies sentences from Russian technical reports. The typist does not understand Russian, but has learned to recognize letters of the Russian alphabet. **2** As each Russian sentence is typed, it is transmitted instantly over telephone lines via IBM Tele-Processing® equipment to a computer at Kingston, New York, 90 miles from the World's Fair site. The computer is linked to the "dictionary" disk. **3** The light-beam searches the disk until it matches each word or phrase in the sentence with its coded equivalent on the disk. The light-beam instantly relays the English translation and pertinent grammatical information back to the computer. **4** The computer follows the rules stored in its memory, clarifies meanings, and in some cases inserts prepositions, articles and auxiliary verbs so that the translation will conform more closely to English grammar. **5** The final English translation is transmitted back to the World's Fair site, where it is printed out on an automatic typewriter.

When the typist feeds an average Russian sentence into the computer, the machine translates the entire sentence in one to two seconds. Then it takes about six seconds for the computer to print out the translation on an automatic typewriter.

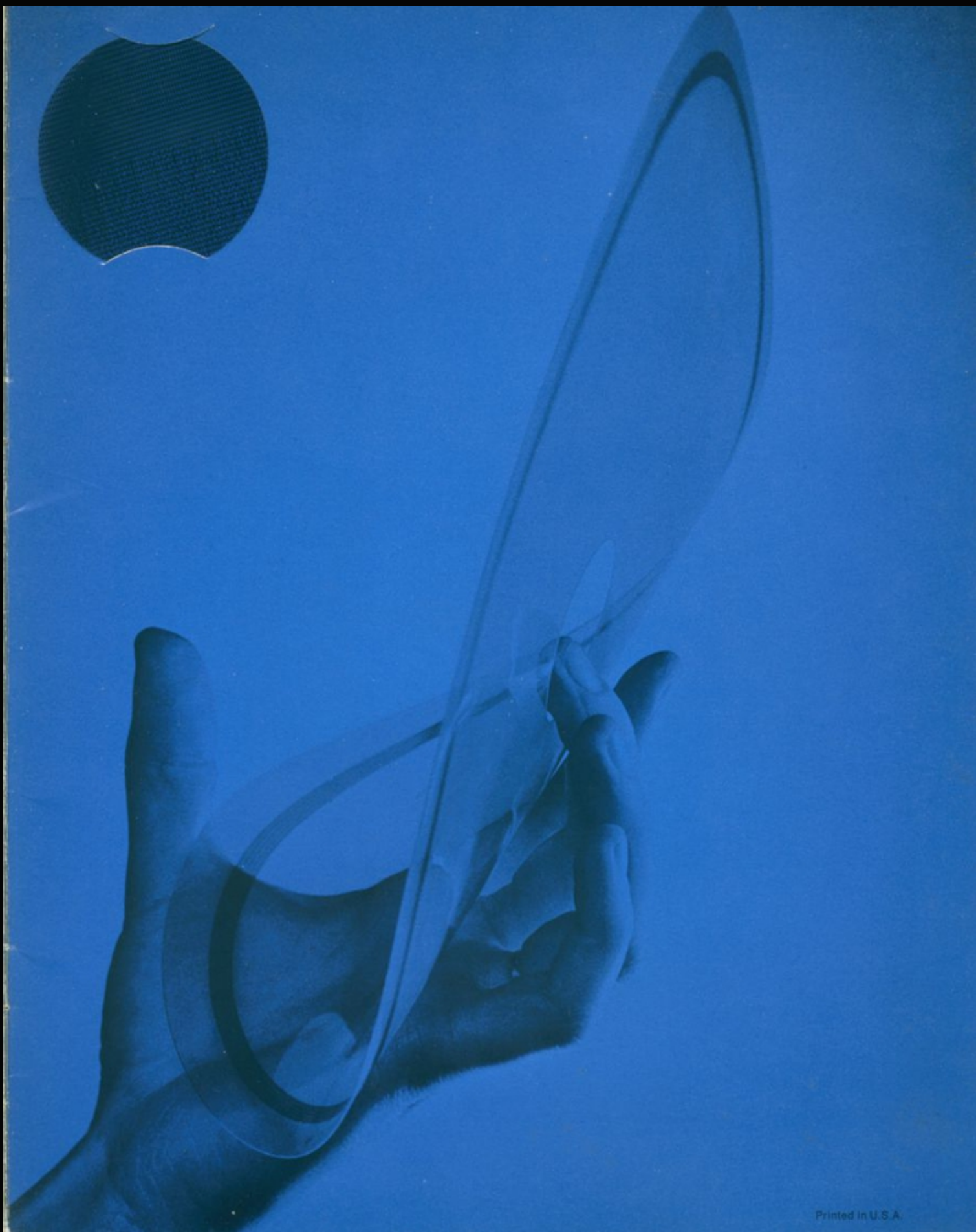
In one minute, the computer is capable of translating 1000 words—or about 3 pages—of complex technical material from Russian to English. When a high-speed IBM printer is used, this 3-page translation can be printed in about 12 seconds.



Automatic language translation

represents a stride forward in man's never-ending effort to reach and understand his neighbors in other lands. IBM is also studying automatic translation systems for French and Chinese, and the techniques that have been learned can be applied to other languages as well. With the help of computers, man today is beginning to overcome the ancient and baffling language barriers that have been plaguing the world since the days of the biblical tower of Babel. Automatic language translation promises to provide a means for better communication among men, to help meet man's need for better understanding among nations.

This enlargement of a portion of the track on a language translation "memory" disc contains approximately 25 coded Russian words and their translations. It has been magnified 50 times. The black rectangular codes for the Russian and English words can be seen more clearly when the sample is held up to the light or placed under a microscope.



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