

Linguistic and political barriers in the international transfer of information in science and technology *

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The development of data transmission networks has promoted the free flow of information between countries, allowing the diffusion of science and technology. Linguistic and political barriers still remain. The paper analyses the growth of the publication in English of scientific and technical material over the past ten years and examines some of the proposed solutions to translation. The political conflicts of national information policies together with the need for international co-operation are reviewed, concluding with a case study on the advantages and limitations of Euronet.

0. Introduction

With the development of telecommunications networks and computerised information, a free exchange of information zone should come into existence throughout the world. Geographical limits and official borders are overcome and theoretically everybody can get information from any source whatever the location of the source and the location of the user.

It is a revolution in comparison with the past and the present where the viscosity of the information flow is so great. Will the new situation be so ideal? Are there not information barriers preventing a truly free flow of information?

As a matter of fact there are several barriers, namely political, cultural, economical, technical. This paper focuses on the first two and tries to

propose some general recommendations for overcoming these barriers.

1. Linguistic barriers

1.1. The present situation

Breton [1] in his book *Géographie des langues*, gives an estimate of the diffusion of main language families. The data are represented in table 1.

Bearing in mind that the number of people who are fully bilingual or multilingual is extremely low, table 1 shows very clearly the potential linguistic barriers.

As regards scientific and technical literature, only five languages play a significant role: English: 40–80% of articles, Russian, German, French or Japanese according to discipline. Hence, many people somewhat simplistically conclude that only publications written in English are essential and that it is necessary to publish in English. Let us be careful. Such an approach represents a dramatic distortion of reality. The phenomenon must be analysed in detail, and it seems very important to

Table 1
Distribution of language families in 1975 – 4 billion people

Languages	Millions of people	Percentage
Indo-European languages	1950	49
Indo-Aryan (Hindi, Bengali, etc)	590	15
Germanic (English, German, Scandinavian, Dutch)	490	12
Romance (French, Spanish, Italian, Portuguese, Romanian)	490	12
Slavic (Russian, Polish, etc.)	300	8
Other	80	2
Sino-Tibetan languages	1000	25
Chinese	800	20
Other	200	5
Japanese	120	3
Others	930	23

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Table 2

Shift of language used by French authors between 1976 and 1981 (Figures are expressed as percentages.)

	Biology (%)		Chemistry (%)		Physics (%)		Earth sciences (%)		Engineering (%)	
	1976	1981	1976	1981	1976	1981	1976	1981	1976	1981
English	18	25	16	45	31	55	6	16	5	29
French	82	75	84	55	69	45	94	84	95	71

make a clear distinction between scientific literature and technical literature.

In scientific literature, all recent studies have demonstrated that English is more and more used for primary publications in the basic disciplines (Physics, Chemistry, Biology), as illustrated in table 2 (CNRS [2] *Study for Conseil de la Langue Française du Québec*). However, the same table also indicates that in applied sciences such as Earth sciences, Engineering, Medicine, etc. the authors use much more their mother tongue. This trend is accentuated for technical information (reports, patents, standards, technical journals and newsletters, states of the art, etc.).

In Japan the number of scientific and technical journals has grown from 1675 in 1957 to 4929 in 1967 [3], but in the same period the percentage of Japanese serials using languages other than Japanese has decreased from 51% to 30%. In terms of absolute numbers, this means that if in 1957 approximately 80 000 articles were published in Japanese, in 1967 the number was around 350 000. If we compare these data with those in table 3, one can easily understand the loss of information, even in scientific fields, for the international scientific and technical community.

It is important to mention also the distortion introduced by abstracting and indexing services in the flow of information. These are inclined to give priority to primary journals published in their own countries. Ellen [4] has clearly underlined this problem for Earth Sciences (table 4).

As far as patents are concerned, the linguistic barrier is much more important and probably has serious effects. From table 5, one could be very easily convinced that the non-Japanese are probably losing half of the technical information contained in Japanese intellectual properties documents, taking into account that the rest of the information is available through patents claimed by Japanese companies in other Western countries. This example, very striking because of the industrial power of Japan, is not unique. The phenomenon is the same for all non-English speaking countries.

Indeed, the main losers of information through written communication are English speaking people. Among them, only 12% are able to read French documents and 4% German [4], whereas, 97% of French and German scientists are able to read English [3].

On the other hand, in oral communication the

Table 3

Linguistic distribution of scientific and technical publications in abstracting services - 1977

	English (%)	Russian (%)	German (%)	French (%)	Japanese (%)	Other (%)
CAS	47	27	9	3	8	6
BIOSIS	79	8	3	3	1	4
INSPEC	87	6	2	2	1	2
Engineering Index	83	6	6	2	1	2
Index Medicus (78)	76	8	6	3	1	6
Math. Reviews	65	18	5	6	0	4
Pascal	63	10	8	12	2	5

Table 4

Linguistic distribution of primary publications in Earth Sciences A.I. services - 1977

1977	English	Russian	German	French	Japanese	Other
Bibliography and industrial biology	72	14	2	3	1	8
Pascal - Geode	60	9	8	14	0	9
Referativniji zhurnal - geologiya	29	48	5	9	2	7

linguistic barrier is dramatic for non-English speaking people. A significant part of these, when attending a meeting, do not understand the half of what is said, and are unable to participate in any discussion.

This situation is clearly reflected in the citation behaviour of scientists. According to Garfield, it takes 5 times longer for an article written in any language other than English to have an impact equivalent to that of an English article. Measuring outside-of-country citation, it is found that the United States is most highly cited by the outside world. The U.K. ranks next, and then in order West Germany, Japan, France and USSR. USSR receives the fewest citations by far from the outside world.

It should also be mentioned that the *Science Citation Index* itself is introducing a significant distortion in picturing science and in measuring the impact of scientific work because this data base, due to the selection criteria used, is strengthening the linguistic barrier. The vicious circle develops as follows:

The best publications are the most cited articles.
The most cited publications are articles which are the most read.

English is the most common language in the scientific community. In order to be cited, it is better to publish in English. Therefore, publications in En-

glish are probably the best ones and will have to receive top priority in selection.

This position is very dangerous and is progressively creating a kind of English speaking community ghetto, in which many people determined to get the most valuable information are very reluctant to take into account any non-English written documents. We are far from scientific objectivity.

1.2. How to solve the problem

The first step in solving the problem of the linguistic barrier is to recognise its existence. Too often many people refuse to recognise the facts. Everybody is losing information due to the linguistic barrier. The main losers are the English speaking people who read only their own language.

If for the time being the English language is *de facto* a kind of Esperanto for basic research (with all the limits we have tried to show), it will never be the common language for applied science and technology, for the generation of knowledge, know how, data and information used directly in economic development.

Therefore, linguistic barriers must be overcome. It is not the place here to discuss in detail ways of solving the problem. However, it is clear that actions must be conducted in the following fields:

- Terminology;
- Multilingualism of journals and A and I services;
- Learning of several languages;
- Development of translation activities (man made translation and computer aided translation).

2. Political barriers

2.1. Present situation

This paper is limited to the situation within the occidental world, the exchange of information with

Table 5

Japanese patents distribution

	Total in Japan	From Japan (%)	From Abroad (%)
Patents	150 000		
Examined	75 000	75	25
Unexamined	75 000	100	-
Utility models	150 000		
Examined	75 000	75	25
Unexamined	75 000	100	-

socialist countries being very specific and well analysed.

Apparently, scientific and technical information is circulating very freely in the occidental world. There is no restriction in the circulation of primary publications, abstracts, journals, books, etc. From the beginning of the seventies use of on line services has grown dramatically and telecommunications traffic between all Western world countries is expanding very fast. Data base searching activity is becoming more and more common, and nobody is now surprised by the possibility of having access from Europe to a computer located in the States or *vice versa*. It is a true revolution. Ten years ago the on line network concept in Europe was considered as science fiction.

The benefits of a free flow of information are evident for countries where true democracy is the common rule and which are economically interdependent. Moreover the sharing of knowledge has dramatically contributed to technical progress and to the economic development of our countries. However, the fantastic development of transborder data flow has drawn the attention of policy makers to serious dangers. A report, recently published in France by A. Madec [6], is bringing a new view to this problem.

Free flow of information is valuable if it is balanced. Developing a free exchange zone of information is excellent if the exchange is actually operating. But the risks are potentially high.

First, there is the danger of the telecommunications or telematics breakdown. What would happen if some unique computer centre, handling unique data, was destroyed? Therefore it is just impossible to let one country have the key role in any field.

Second, data protection is not guaranteed. Data can be stolen. On line questions can be listened to. No communications are protected.

Related to the linguistic problem there is a risk of cultural alienation; any country which accepts being only a user and not bringing its own store to the exchange of information would be progressively losing its culture.

As far as economic problems are concerned, there is a direct link between transborder data flow and worldwide location of activities. Multinational or supranational companies which are the main operators of data flows have the possibility of geographically dissociating markets, factories,

research centres, management, control and maintenance. The danger is that industrial employment may be located in developing countries and intellectual added value service placed close to the top management. For small industrial countries, there is the risk of being reduced to the consumer stage. In that case, these countries will have only industrial employment, public services, shops and keyboarding terminals.

For all these reasons, each industrialised country has decided to be more active in data production and data dissemination through different supports and channels. Euronet was an answer to the unbalanced exchange of information between European countries and the U.S. As a matter of fact Euronet was a very effective catalyst for developing data transmission networks in each member country. Euronet has also greatly helped the creation of on line services in Europe. However, the information industry in Europe is still too weak and the information flow between U.S. and Europe is too unbalanced.

Because of this weakness, European governments are generally subsidising information services very heavily, for they are not inclined to be very aggressive in the market. There are still too many information services and centres in Europe which are not industry minded, which are not professional and which hope to live in a protected environment. As a result governments are not pushing and encouraging the use of information coming from abroad. Therefore, the main transborder information traffic in the field of Science and Technology is centred on multinational companies. Small and medium size enterprises, academic research centres, practitioners of all kinds are using the information available in their own country only. That is the reason why the Euronet traffic for ST information is so low after 3 years of operation, in comparison with the transatlantic traffic. That is also the reason why the American on line vendors sometimes have difficulties in marketing their services in Europe.

With some paradox, the free flow of information in the Western world depends on the capacity of Europe to develop a true information industry able to compete with American and Japanese information services and to create a balanced information flow between all these countries – in other words a fully interdependent situation.

A last point should be given some attention. It

deals with the voluntary restriction in information flow. There is now a big controversy in the United States as to whether or not the socialist countries are getting too many benefits from the openness of American science. It is significant that the export to the Soviet Union of Science Citation Index tapes produced by ISI has been recently blocked by the Reagan Administration. A panel on this topic held at the recent ICSU-AB Full Board Meeting showed clearly that if for scientific information (as an outcome of basic research) it would be damaging and dangerous to create any restriction in its flow, the situation is different for technical information. Here it appears that giving free access to any non-confidential, non-classified technical reports should no longer be the rule. In order to be made available this literature should be exchanged. No decision has been taken yet but the present trend is clear. Here again it appears that

the only way to overcome political barriers is to develop exchanges and interdependent links.

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