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BASIC RESEARCH IN INFORMATION SCIENCE IN FRANCE*

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Abstract—After a presentation of a simplified map of information science, the goals of the French academic research policy in this field are described: creation and/or development of a limited number of research teams, creation of a scientific environment (summer school, Ango-French meetings). A rapid tour of basic research outside universities followed by some discussion about the definition of research categories precede the description of some promising fields of basic research in information science in France (arising from sociology, economics, telecommunications, mass communication, mathematics and logic) as well as less promising or unpromising fields.

Before sharing with you some topics related to basic *research* in information science in France, we will try to define as precisely as possible our field of work.

(1) It is mainly concerned with *academic research.* Our partner for industrial research is the former MIDIST, now DIST (Scientific and technical information division).
(2) It is mainly concerned with the whole spectrum of *basic and applied research.* We know now that the distinction between basic and applied is purely artificial. But we know also that one cannot do applied research without an important body of fundamental research.
(3) It is concerned with what is called information science in the United States and the United Kingdom but "sciences de l'information" by many people in France.

To speak clearly, it is concerned with a new field of knowledge whose object is not purely mathematical, physical, biological, geological or social but a mixture of sociology, linguistics, economics, psychology, law and mathematics, computer science, physics, electronics, and telecommunications (see Fig. 1) [1]. Each discipline applies its concepts, explanatory procedures and theories to the intellectual content of information science, i.e. information. The problems that arise when we study information are concerned with the mutual relevance of concepts from different branches of science[2]. The nature of information science is interdisciplinary. We are describing the work of social scientists (e.g. sociologists, psychologists), physical scientists, computer scientists, mathematicians, anthropologists, etc., involved in the study of information. We are not describing the work of true information scientists, for this "species" does not really exist in France at present, the higher education system not being so organized.

1. THE DEFINITION OF AN ACADEMIC RESEARCH POLICY

Due to the autonomy of French universities, it seems impossible to establish a national academic research policy. But also, with the ever-changing character of science, it appears to us that a static definition of research categories and of the corresponding financial support is a waste of time and money. Indeed, setting of priorities and decision-making in science as well as evaluation of research are not easy tasks. They are not easy for genuine well-structured scientific disciplines; *a fortiori* they will be more difficult for diffuse or "would-be" disciplines such as the interdisciplines.

So the Ministry of Education decided to launch in 1985 a four-year support program

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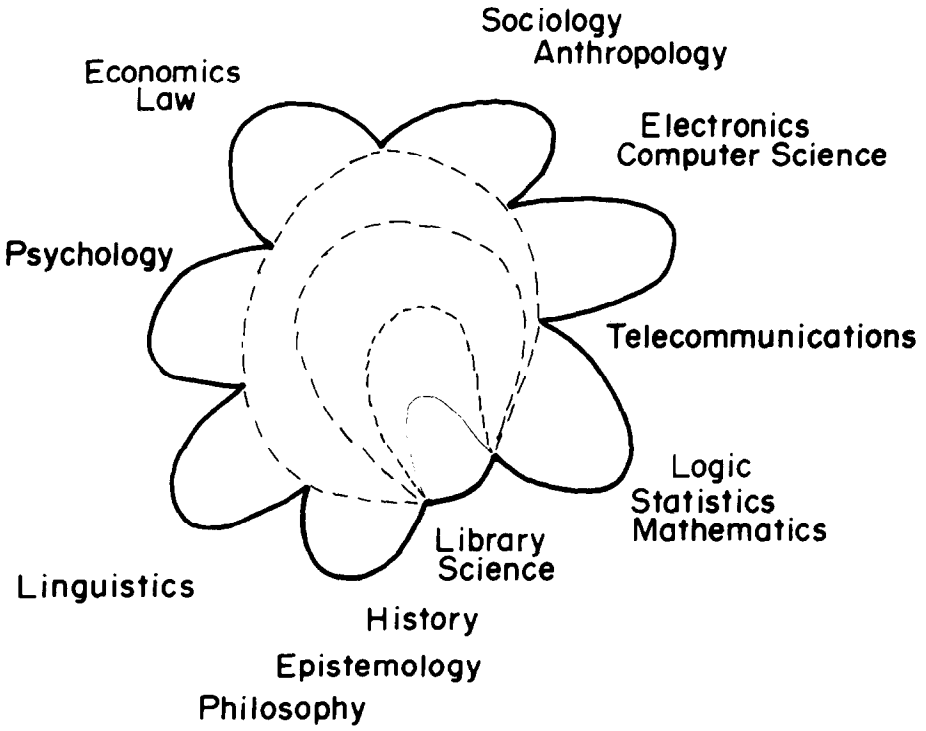

Fig. 1. Map of information science.

for fundamental information science research in close collaboration with CNRS (National center for scientific research), INRIA (National institute for research in computer science and robotics), CNET (National center for the study of telecommunications) and DIST (cited above). The main goals of this program, which is nonmission oriented and noncoercive, are:

(1) *To create or develop a limited number of research teams:* about 10 in four years. Teams grouping professors, scientists, students and technicians would undertake fundamental research as a first priority, but also applied research.

They would also train research students and would try to offer a postgraduate diploma in information science.

Presently, five research teams or association of teams are working on:

social, political, economical aspects	Grenoble
mathematical aspects	Bordeaux, Marseille
computer science and linguistics aspects	Grenoble, Paris, Lyon
cultural aspects	Poitiers

Each team employs about two or three full-time equivalent scientists, two or three doctoral students and one or two technicians; four are offering graduate diplomas in information science. Each team receives around 100,000 to 200,000 F per year for current expenses.

So, here are some aspects of our scientific policy regarding basic academic information science research in France; here are some of our trials to nurture this "would-be" interdiscipline.

(2) *To create a scientific environment* for the expected growing community of information scientists. The effective development of scientific disciplines and professions requires some intellectual and social conditions, some nurturing conditions.

The institutional weaknesses of developing disciplines can again show up in a variety of ways. The most typical indications are the failure of communication and the maldistribution of authority.

For the first, we know that the growth of a discipline is possible only if many opportunities to communicate the scientific information they produce are offered to scientists. They need formal and informal communication tools. The creation of authoritative reference groups and journals has a significant part to play in the maturation of a developing discipline. But they must be adapted to the present state of the discipline. So we chose to create:

not a national meeting but a summer school which gives a short but intensive course on a relevant research subject;

not an international conference but small international meetings and computer communication networks (electronic conferences) organized, I must say here, with the very friendly collaborative help of the Research and Development Department of the British Library.

not a paper journal but an electronic journal . . . but this is another story. We will return to it later.

We did not wait for the launching of the program to undertake some of these actions:

(1) Three summer schools have been organized since 1983 each with 20 participant scientists, information specialists and doctoral students, gathering around 15 speakers, university teachers and scientists.

For organizing them, we have taken advantage of the existence of three growing research teams:

- one on automatic indexing of textual documents
- one on quantitative methods for the evaluation of information systems
- one on the use of the scientific and technical information stored in data bases for decision-making in science and industry.

The fourth course has dealt with the social, economic, cultural and political strategies working in the information industries sector.

(2) Five Anglo-French meetings have been organized since 1983, bringing together each time 10 French and 10 British scientists in order to improve international scientific exchanges:

- on automatic indexing
- on electronic scientific communication systems
- on the role of the information sector in industrial development
- on the use of expert systems in social sciences
- on networks and networking

Let us now turn to other French funding and research bodies in information science.

2. BASIC RESEARCH OUTSIDE UNIVERSITIES

(1) CNRS started an "integrated research effort" in communication sciences in 1985. Integration means that four departments of CNRS are concerned: sciences, engineering, social sciences and scientific and technical information. This research effort aims at developing interdisciplinary research along three avenues:

- *communication and the brain* (perception, memory, speech and information treatment): neurosciences and cognitive sciences overlap here.
- *communication between people and machines* (artifical intelligence, man-machine interface): cognitive sciences again, overlapping with computer science.

- *communication and society* (impact of communication technologies, computers, telecommunication, audiovisual media on the working of society): here the social sciences and engineering (computers, telecommunications, radio and TV broadcasting) overlap.

The objective is in four years to create laboratories and teams in the four departments or to initiate common projects between laboratories attached to two different departments. At the end of the first year, mainly individual scientists have been financed (21 of the 30 projects which have been selected). Two groups of three scientists and seven groups of two scientists were selected. This research policy remains more contractual than structural.

(2) CNET, IDATE (Audiovisual and telecommunications European institute) and INRIA are public research centers which undertake some basic research in information science.

- *CNET* has two program committees on information techniques and telecommunications sciences, coordinating research activities:

for "*information techniques*" in Paris and Lannion on:
  speech synthesis
  image synthesis
  software engineering
  artificial intelligence techniques

- for *(tele)communications sciences* in Paris, Lannion and Rennes on:
  applied mathematics
  psychophysics of vision (perception of image and speech)
  ergonomics and human factors (interactive scenario editors, communication software)
  sociology of communication (cultural practices, deregulation, geography of telecommunications, uses and practices),

and one group specializing in economic studies of networks.

- *IDATE*, mainly interested in economic and political factors in the field of telecommunication, is well known for organizing regular international conferences on:
  social experimentation in telematics
  image networks
  cost of new medias
  teleconferencing

- *INRIA*'s basic research orientation in information science is directed towards the man–machine interface, artificial intelligence and speech and image synthesis, at Le Chesnay near Paris and Sophia-Antipolis near Nice.

3. THE DEFINITION OF RESEARCH CATEGORIES

When defining research policy, one can adapt as CNRS has a priority scheme. Three domains have been defined:

- The first domain at the interface of the *neurosciences* (neurobiology, neurophysiology, neuropharmacology, neuropsychology and computer science) and the *cognitive sciences* (psycholinguistics, logic, computer science, cognitive psychology, linguistics).
- The second domain at the interface of the *cognitive science* and the *engineering sciences* (computer science, electronics, cybernetics, mathematics (modeling). Modeling and simulation of human communication are used.

- The third domain studies the social *impact* of communication techniques. It is the domain of the social sciences. They are used to analyse the reactions of different social groups confronted with these techniques: their acceptance or refusal. They try also to evaluate the effect of these new communication modes on power and hierarchy mechanisms.

If it is true that these three domains correspond to the three levels where research has ɔtained important results, is there a true epistemic unity of the field? Certainly, the same ıestions are raised in the three domains: What are the mechanisms by which people per-ive information, process it, and communicate it to others, and how is it possible to model, plicate or simulate these mechanisms by machines? So the unity appears to be theoreti-ıl, in the sense that what is wanted is a formalization of brain and psychic mechanisms, eceding a possible instrumentalization. But, is it possible as postulated in the research ogram that the same mechanisms are working in human communication and in intracel-lar communication? This deliberate choice of priorities can eventually lead to an epis-mological error.

Instead of this so-called objective choice of research priorities, one can prefer a more agmatic method. That is, to reactivate exchanges, interactions, debates, controversies nong the community of information scientists and after necessary negotiations to let nerge new research directions and opportunities, with the necessary feedback from other ational scientific communities. We think this is the way we must choose.

4. SOME PROMISING FIELDS OF BASIC RESEARCH IN INFORMATION SCIENCE IN FRANCE

(1) arising from *sociology*, especially sociology of science with some borrowings from anthropology, the use of material from documentations data bases to determine the structure of fields of scientific and technical research, more generally to analyse the dynamics of science and technology.

The method, *co-word analysis* has been developed jointly at the Centre de Sociologie e l'Innovation de l'Ecole Nationale Supérieure des Mines de Paris and the CDST of the NRS. It is based upon analysis of co-occurrence of the keywords used to index scientific nd technical articles, patents and reports by documentation centers and databases. This ıethod emphasizes the existence and evolution of networks of problems. It uses a set of ɔmputer programs, collectivety called "LEXIMAPPE," which are designed to draw raphs, "maps" which depict the most significant associations of keywords within a given t of documents [3].

In theoretical terms, co-word analysis uses two recent findings of the sociology of ience which have shown how problem networks are constructed. Scientists actively build ridges between their work in the laboratory and the wider sociopolitical context. In order ɔ understand the content and evolution of scientific research, it is necessary to consider ıese links. They can be discussed in terms of a set of interrelated problems $P_1, P_2, P_3, \ldots, P_n$) that a group of acts see as being interdependent. For example, the ɔlution of P_1 is directly or indirectly connected to the solutions found for $P_2, P_3 \ldots$. efining problems and establishing links between them always involves conflicts. But as ifferent actors compete to impose their research priorities, a balance of power is struck hich stabilizes for at least a short time the organization of a problem network.

Co-word analysis represents an attempt to *map* the evolution and temporary stabili-ation of such problematisations. How is this done? Here a second finding in the sociol-gy of science is important. Studies of the rhetoric of scientific texts have shown the role ıat *words* play in focussing the attention of a reader on specific problems raised in an arti-le and on the way they are linked to other, more general preoccupations of a scientific ɔmmunity. Given this rhetoric and the fact that it serves to highlight certain words in a

text, it seems reasonable to assume that professional indexers will identify them in order to describe the problem content of articles entered into bibliographic databases.

This qualitative method differs from other, mainly quantitative methods which use counting procedures [4], as for example, co-citation analysis. Moreover, quantitativists have displayed greater interest in the development of quantitative methods than in the elaboration of the theoretical significance of methods or findings.

(2) Arising from *economics, politics* and *sociology* (media sociology), the study of the information industry sector.

Starting from the study of cultural industries (TV, radio, newspaper), the GRESEC (Groupe de recherche sur les enjeux de la communication) of the University of Grenoble. is extending its methodology to information industries [5,6]. Very strong convergences can be noted between the two sectors, as a result of extensive use of computerization and networking. So, the cultural industries, which now are different from the information industries, by their "procès" of labour, the socioeconomic status of their actors, the conditions of valuation of their products, *will they* in the near future merge with the information industries to form a vast sector of what is called the communication industries? We think, definitely yes.

(3) Arising from *computer science* and *telecommunications*, the study of electronic scientific communication systems.

With the modernization of the French telephone network, the development of a large public national public switching network and the implementation of a videotex network, it is now possible to study more extensively scientific communication and the use of electronic systems of publishing, conferencing, etc. Our group in Paris (DBMIST) is specializing in this field, in collaboration with groups in Bordeaux [7] and Grenoble. For example, we have built the first French electronic scientific journal (in information science).

This is a two-way videotex system which permits its users to read as well as to write, using only a Minitel, a compact, easy to use, stand-alone video terminal. Replacing the paper telephone directory, this terminal is widely used in France.

Instead of being an electronic replicate of a paper journal, this is a truly interactive system, functioning without a panel of referees. This idea of expanding the panel of reviewers to include all of the researcher's peers is an intriguing one. The question which is raised is, if editorial committees are a "mal nécessaire" as a lot of studies have proved, why not try to work without them? So any interested reader who has access to a Minitel is able to see the original article, and the debate or controversy going on, and to enter this debate. The opportunities for research collaboration expand enormously with such a system, the time-lag between research and publication of results being greatly reduced. The researcher will browse or read entire papers online although some users may want systems to provide hard copy as well for longer papers. Its hybrid name JOURNALREVUE (NEWSPAPER-JOURNAL) reveals that a hybridization of formal and informal processes is being tested.

The exciting idea behind this project, and more generally behind the "electronization" of information is that we will be able to use each *word* entering the system and form with them a lot of byproducts, such as bibliographic data banks, citation banks, co-word banks, terminological banks, translation banks, etc.

Speaking of videotex, one must note that the strong development of videotex systems in France has produced much research on the analysis and follow up of new information and communication technologies, for example on the *socialization* of a technique, e.g. the place that a communication system can take in the social and cultural environment of its users. The results of this research are of great interest for the library and information sector.

(4) Arising from *philosophy* and *epistemology, mass communication* and *linguistics*, the study of communication and of popularization of scientific knowledge.

The study of science always falls into two categories:

- (a) The logic of discovery (investigation)
- (b) the logic of exposition (description).

In the first case, one tries to describe epistemological dimensions in order to learn how scientific objects and concepts have been built. In the second case, we must consider the results of research and the knowledge produced by science, and must identify the strategies of the actors in order to realize their communication to the specialists and the non-specialists. This is an often forgotten objective of information science.

Research on popularization of science belongs to this second category. One group in Poitiers is now working in this field trying to understand:

at the text level { the reformulation of scientific discourses / the linguistic procedures which are used

at the image level { the place of the iconic symbols / their role in the translation of concepts.

(5) Arising from *mathematics* and *logic*, the introduction of measure and metrics in the field of information, leading to *informatics, bibliometrics*, or *scientometrics*, and more generally to the elaboration of a mathematical apparatus for information science.

Two groups in Bordeaux (Groupe de recherche sur l'évaluation des systèmes d'information et de communication[8]) and Marseille (Centre de recherche rétrospective—CRRM[9]) are questioning the lack of a mathematical apparatus specifically for the study of the communication of information. The existing mathematics has been generally developed for the physical sciences. If we are correct, we think that the only mathematical theory which has been built specifically for the social sciences is game theory. Statistics and probability have not been developed for the study of the social sciences.

Marseille is working mainly on scientometrics, trying to define scientometrics indicators. Bordeaux specializes in new quantitative methods: percolation theory, fuzzy set theory, possibility theory, graph theory.

5. THE LESS PROMISING AND UNPROMISING FIELDS OF BASIC RESEARCH IN INFORMATION SCIENCE IN FRANCE

(1) Arising from *linguistics* and *computer science* (or computer science and linguistics): studies of automatic indexing, automatic translation, information retrieval theory and experimentation.

There are numerous places where groups of scientists are doing research in these fields: Marseille, Grenoble (three groups), Lyon (two groups), Besançon, Nancy, Lille, Paris (seven groups), Clermont-Ferrand, Toulouse. They are generally experimenting on small samples with small computers. Generally, their objective is to develop a practical system. This seems to be a very close scientific community isolated from the world community. We feel, truly, disappointed with them.

(2) Arising from *psychology*, one man from Montpellier started ten years ago an interesting study on the relation between the communication habits of scientists and heuristic processes. But he stopped five years later. So, our weakness in user studies seems clear.

(3) Arising from *law*, the studies of legal aspects of authorship, legal aspects of data bases, and transnational data flows are done by individuals more on a practical basis than on a scientific basis.

CONCLUSION

We have tried to present:

- how we define French academic research policy in information science.
- how other policies are defined by other funding and research bodies.
- two ways of defining the content of these policies.
- some promising fields of basic research in information science in France.
- but also some less or unpromising fields of basic research in information science in France.

This is certainly a partial and incomplete presentation. But it seems difficult to us to be completely objective and exhaustive in a so rapidly moving and fuzzy sector.

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