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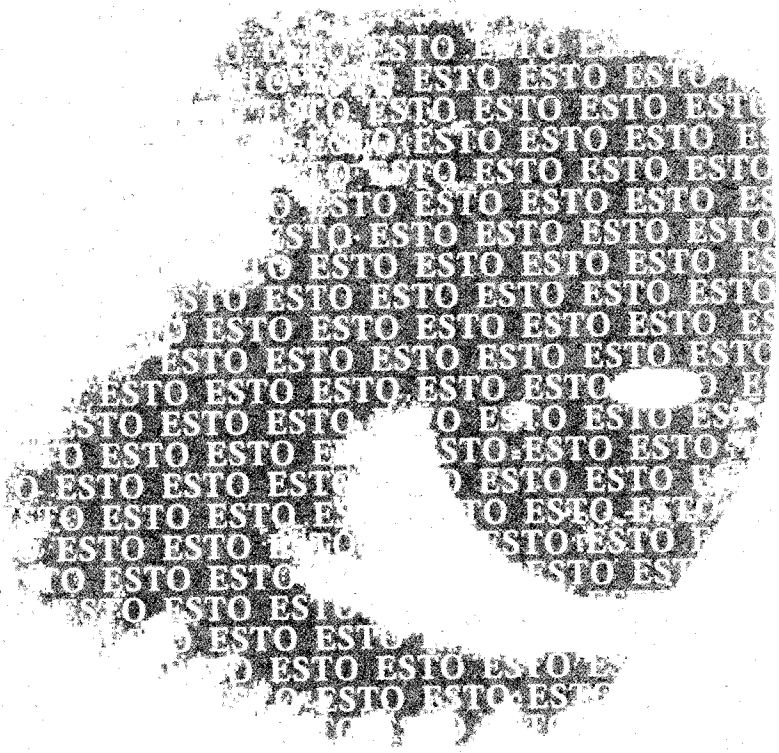

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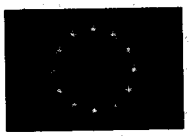

ENGLISH VERSION

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Republican campaigns may be indicative of Microsoft strategy in this regard. Perhaps aware of these possibilities judge Jackson, on the one hand buttressed his findings, laying a strong foundation for the edifice of court battles, which may ensue. And on the other hand, in order to revive the chances for a settlement, he assigned a highly respected judge and anti-trust scholar, judge Posner, to arbitrate between the parties.

In any case the next step – barring a settlement – is the judge's legal ruling next year, and the remedies/measures prescribed therein. There are two kinds of remedies. Conduct remedies would address the firm's behaviour, aiming to prevent future breaches of the law. Structural remedies would aim at changing Microsoft's position in the industry and/or its corporate structure.

Those conduct remedies which are easy to implement, and do not require cumbersome regulatory supervision will very likely be employed. They may not be enough however, and will likely be accompanied by structural ones, too. Moreover, conduct remedies have been tried before, and were flouted by Microsoft. For some of them, meticulous oversight by regulatory committees and the courts will have to be foreseen, given the scope of Microsoft activities, the technical complexity of the issues involved, and the multitude of ways in which rules can be bypassed. Moreover, Microsoft's recent forays into the telecoms and cable markets imply that conduct remedies may be focusing on yesterday's problem, and that even with oversight Microsoft's practices, as identified by the judge, may keep one step ahead of the law.

In any case the very severity of the findings of fact will make the goal of asking for structural remedies very tempting for the Justice Department. Structural remedies can include: 1) publishing the source code of the Windows operating system; 2) breaking up Microsoft into smaller clones of itself (the so-called Baby-Bills), competing with each other along all product lines; 3) breaking up of Microsoft into smaller firms along product lines; 4) a combination of the above. Compensating Microsoft for the Windows source code could cost as much as $US200 billion – which is not necessarily unaffordable, given the amounts quoted in recent buyouts (e.g. MCI-Sprint). The risk with the 'clones' remedy is they may buy each other out, rebuilding a giant company in the process. Note finally that the breakdown along product lines is more difficult after a recent reorganization in Microsoft; the judge of course could take the older structure as his starting point, to facilitate break-up along product lines.

A lighter version of a structural remedy calls for keeping the Windows source code proprietary but making public the interfaces with which applications latch onto and use the operating system. In this case, as well as in other measures mentioned above, it is crucial that all necessary technical requirements be met to guarantee that applications written for other operating systems can compete on an equal footing with applications written expressly for it.

As a result of effective structural remedies: 1) operating systems, including possibly several different versions of Windows, will compete among them on their merits, and not on the basis of how many are already installed and have captive users, or application providers; 2) hardware developers will be freer to produce hardware that is not built with Windows in mind, opening the way for more innovative designs; 3) finally, and more generally, a truly open system, not bound by the type of operating system, can be more feasible in a market not dominated by Windows. The implications and lessons for EU firms and for competition regulations are multifaceted and deserve to be examined closely and at length.

scholarly activity and has already put its stamp on the basic framework conditions of research, in particular with regard to the specific needs for ICT based infrastructure.

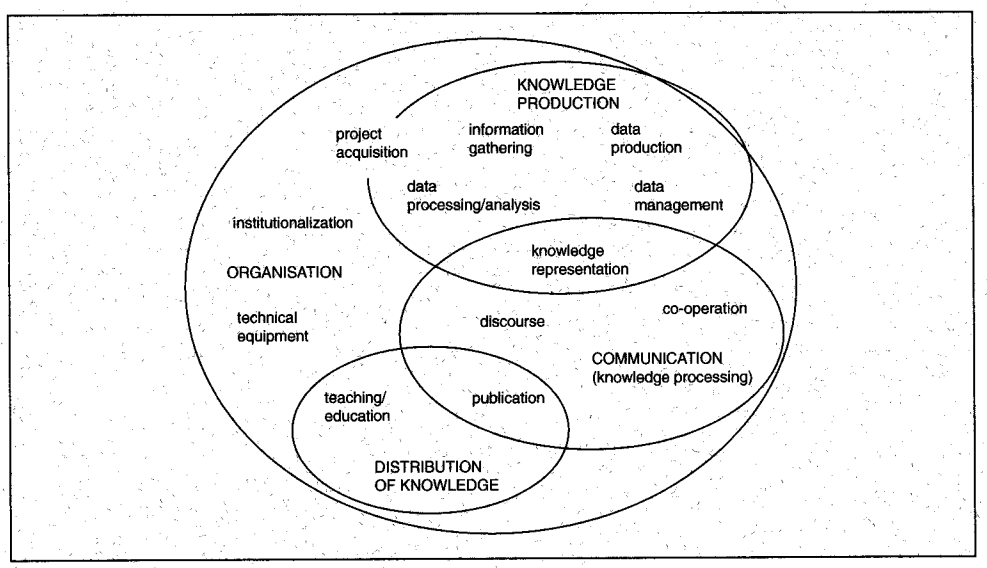
There are various types of scholarly activity: Seen from a procedural viewpoint, we may distinguish knowledge production (including information gathering as well as data production, analysis and management) from knowledge processing, i.e. scholarly communication (knowledge representation, discourse and co-operation), and knowledge distribution (publication and teaching). On an organizational level, scholarly activities need technical equipment and institutionalization. See Figure 1 for an illustration.

Using this terminology, we may analyse the changes in academia on the path from traditional science to cyberscience. Take information gathering as an example: while in the old days, libraries and documentation centres with card-file indexes and face-to-face interviews and conversations were the norm, off- and now on-line databases have revolutionized the way researchers explore the "data jungle". Recently the World Wide Web (WWW) has come to represent a new and powerful access point for information, with its specialized collections of links and pointers to resources further enhancing research tools. The first digital libraries already exist, soon virtual libraries (with no physical presence whatsoever) will follow. All this adds up to a digital information space to be searched by so-called knowledge robots ("knowbots") in the not so distant future. Or take scholarly discourse: Not so long ago, the one-to-one telephone call was the only means to communicate with fellow scholars unless you worked next door or met them in conferences and seminars. Now, scholarly communication is heavily influenced by ICTs: in particular, the internet with its various applications (email or web-based discussion lists), which has at least partly replaced the telephone, and online conferences begin to be a viable alternative to face-to-face gatherings. Table 1 shows that we are witnessing changes in all respects of scholarship (for a detailed analysis see Nentwich, 1999).

Scholarly activity comprises knowledge production, knowledge processing or scholarly communication, and knowledge distribution

The first digital libraries already exist, soon virtual libraries (with no physical presence whatsoever) will follow, leading towards a digital information space searched by so-called knowledge robots ("knowbots") in the not so distant future

Figure 1. Types of scholarly activity and framework conditions



scientific abstract, the abstract for the wider public in a simpler language, the theoretical and the methodological parts, the empirical findings, the conclusions, the references etc.; see Kircz, 1998). Second, we may imagine an even more detailed modularization: the text unit would be a single argument or an example/proof while all arguments are linked together not only sequentially (as we do in present "linear" texts), but also according to their level of analysis. This will offer to the readers multiple ways to access their "texts". There may be a "path through the text" for the quick, but knowledgeable reader searching to understand the main thrust of the paper, other "paths" for the interested layperson, for fellow scientists of the same specialization looking for the core result etc. Furthermore, in a fully electronic, networked environment it would be possible to have multiple links between scientific hypertexts: Redundancy of research may thus be reduced: e.g. overviews on the history or the basics of the paper's topic or definitions etc. would not have to be repeated over and over again in each new paper but simply referenced via a link to either one's own previous hypertext publications or to those of other authors. In the long run, gradually large, specialized hypertext databases or "hyperbases" may evolve. Such combined knowledge databases might revolutionize the way we think of scholarly products.

Will cyberscience finally do without paper altogether? Latest developments in screen technologies and, in particular, electronic ink/paper technologies seem to remove at least one important obstacle to a complete shift since truly mobile reading and working devices are appearing on the horizon. Even assuming that there is still a long way to go, the ongoing "pricing battles" between the commercial publishers and the libraries might come to full stop since cyberscience might eventually lead to a completely different scholarly publication model which could be run by academia itself, simply in order to cut costs (e.g. Harnad *et al.*, 1998; Pew Higher Education Roundtable, 1998; Okerson *et al.*, 1995).

The Removal of Spatial Limitations

The use of networked computers is about to free scholars from spatial limitations at least to a considerable extent: the office resources may be used even if the scholar is not physically present. Online access to E-journals and other E-publications in remote digital libraries and access to various online databases may reduce the need to have a real library close-by. So-called "extended research groups" may co-operate in a virtual environment (e.g. in a virtual laboratory or "collaboratory") while meeting at best occasionally (e.g. Finholt et al., 1997). Groupware applications may support this joint research, and virtual or E-conferences may take place on a larger scale. By the same token, cyberscience may have considerable impacts on the way research will be done in the not-so-distant future: multi-authorship may increase; the oral scientific discourse might be largely replaced by written procedures; scientific communities may be more fragmented, i.e. specialized, but interconnected world-wide; research infrastructure requirements may shift; and the positioning of more peripheral research units may change due to this development (e.g. OECD, 1998: 198). Thus, the spatial structure of academia, its "geography", seems to present new opportunities as well as challenges in the age of cyberscience.

Changing Roles in Academia

The spreading of ICTs in academia and the related concentration of resources at the office desk is about to lead to new requirements for those working in a research environment. Since these qualifications are partially too demanding to be fulfilled, at all or at least sufficiently, at the individuals' level, this may also impact on the distribution of roles in academia. Due to the increasing digitalization of the libraries, the

In the long run specialized hypertext databases or "hyperbases" may evolve. Such combined knowledge databases might revolutionize the way we think of scholarly products

Online access to E-journals and other E-publications in remote digital libraries and access to various online databases may reduce the need to have a real library close-by

Keywords

information and communication technologies, internet, electronic publishing, future of academia, sociology of the sciences, digital libraries

Note

1. This paper is based on research carried out at the Institute of Technology Assessment of the Austrian Academy of Sciences in Vienna. The project homepage is: **http://www.oeaw.ac.at/ita/ebene4/e2-2a17.htm.**

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encouraged and structural changes made in a way that can contribute to socio-economic development and improvements in quality of life.

- *Constant demand for increased specialization* - The increased competitiveness of changing market conditions and continuous and rapid technological evolution make it essential for companies to adapt their skills to the constantly changing environment. Firms must therefore be able to respond rapidly to forces such as technological innovation, trade liberalization and market deregulation. This implies growing demand for specialized skills and higher levels of qualification in both the service and manufacturing sectors. This makes knowledge management an essential factor that strongly affects the learning process and the specialization of workers. Lifelong learning has now come to take on a strategic role for firms (Fergusson, 1999).

- *New working style and labour market* - Market globalization is producing huge changes in the labour market both at production process level and at organizational level. It has required dynamism and flexibility in company management and organization to fit in with the needs of the market. A changing market has meant jobs for life have given way to fixed-term contracts. This obliges workers to continuously update their professional knowledge and skills in order to remain employable.

  Moreover, a new model of work organization stimulates a new approach to work which is more independent in terms of time and location, e.g. home-working and tele-working, which produce an independent and flexible working style requiring continuous individual learning.

- *The need for continuous adaptation and active participation as society evolves into a highly technological information society* - This means involving people not sufficiently computer-literate to benefit in full from the possibilities offered by the penetration of technology in a social context (electronic commerce, smart houses, intelligent cities etc.) in continuous informal learning so as to satisfy the desire for the knowledge offered by the information society (virtual museums, library access, etc.) and to seize every opportunity to maintain and enhance their social integration.

The library in the new lifelong-learning scenario

In the scenario described above it is clear that the school years are no longer sufficient by themselves to equip individuals with all the knowledge they will need during their life. The traditionally strict temporal sequence —from schooling to higher education, education to work, etc.— also needs to be re-examined. Today these phases are becoming more closely integrated into a lifelong-learning scenario, based on a horizontal technological approach in terms of methodologies, tools and services.

In this increasingly complex environment, in which both individuals and organizations are faced with a growing need for information, libraries can actively contribute to the process of change. An example of how libraries can play a central role as a core social institution for lifelong learning is given by the "learning city" projects in the UK: "Learning Cities explicitly use learning as a way of promoting social cohesion, regeneration and economic development which involves all parts of the community." (Learning Towns and Cities). Learning Cities libraries provide spaces for the access to innovative learning products, tools and telematic networks. This "learning place" can be attended by citizens, students, workers, the unemployed, pensioners, consumers (Morrison &

Traditional education concentrated in the years before joining the job market is no longer adequate to meet the demands of the current scenario

- Mechanisms to perform content-based search;
- Methods to integrate various search engines and to "mine" data from heterogeneous collections;
- 'Ontologies' to allow users to search for information using terms from domains with which they are most familiar.

Several applications are being developed based on user modelling to improve the filtering and interactive search experience in Web-based environment (Brajnik and Tasso, 1994). A user model is a knowledge source which contains explicit assumptions on all aspects of the user that are relevant to the interactive behaviour of the software application. User modelling technology has also been integrated into information filtering system (Ambrosini, *et al.*, 1997), (Schick, *et al.*, 1990).

Classification and indexing: Manual methods for classification are inadequate for digital libraries. Automated classification systems differ significantly in their approaches, depending on the type of content under consideration. The classification of audio, musical notation and maps presents additional research challenges.

Query expansion and refinement: Queries may span multiple digital libraries systems and, if not filtered, may return excessive amounts of data that can overwhelm networks and systems as well as the user's cognitive abilities. Query expansion and filtering techniques would allow users to refine queries and reduce the size and complexity of the information they seek.

Securing information and auditing access: Mechanisms must be provided to allow multiple authorized users to operate in a distributed digital libraries environment while preserving privacy, integrity and intellectual property rights.

User interfaces: User interfaces must incorporate a wide variety of techniques in order to provide rich interaction between users and the information they seek. A digital library's presentation systems must be flexible and highly customizable.

Several US agencies, including NASA, DARPA, and NSF, have, over the past few years, set aside a considerable amount of money to support research into digital libraries. Other countries, including Canada, the UK, France, Italy, and The Netherlands have also invested in this field. As a result of these activities, a number of recent symposia, workshops, and conferences have been devoted either wholly or in part to digital library issues. Such strong encouragement from governments, industry and professional associations has already produced high level results in the sectors mentioned above. An example is furnished by IDL, a prototypical intelligent digital library service (Semeraro, *et al.*, 1997). This system integrates learning tools and object-oriented techniques in order to effectively and efficiently perform the task of capturing the information to be stored and indexed by content in a digital library. In this way all the tasks relating to information capture and semantic indexing can take advantage of the use of learning systems for layout analysis, document classification and understanding. Three different groups or categories of people can interact with IDL either to modify or query its contents: the library administrator, the librarian and the end users. Thus, the interaction with IDL requires new approaches at both the professional and user levels.

In the European scenario, since 1990 the Telematics for Libraries programme (DGXIII) has helped increase cooperation between libraries from different countries by supporting a number of projects involving the development of standards, prototypes and pilot environments.

Some of these projects improve active participation in defining common standards for document identification, data communication,

In order to make optimal use of their material, digital libraries need more sophisticated classification and query systems

Mechanisms are needed to ensure privacy, integrity and intellectual property constraints are observed in multi-user, distributed systems