

CONTENT MANAGEMENT AND USABILITY OF EUROPEAN RESEARCH WEBSITES WHAT CONTRIBUTION TO THE EUROPE OF KNOWLEDGE?

Anne PIPONNIER, anne.piponnier@wanadoo.fr

Université of Bordeaux 3 (Bordeaux, France)

Abstract

This study in the field of Information and Communication Sciences deals with the new mediation devices developed by European research projects in order to disseminate the output of their research activity. This paper presents the results of a qualitative study. It describes the publishing process established by research networks in the design and development of their websites. After defining the informational and editorial characteristics of these sites, and providing a brief typology, the author analyses the content management in these devices which, in most cases choose the portal solution to develop their sites. It also addresses how this solution aims at meeting the editorial requirements of value-added sites. It provides an analysis based upon a case study of two European research projects on the usability of such communication devices. This study proposes a cartography of the usability managed in the editorial process, based upon three impact factors: use markers, cognitive markers, metacognitive markers. These observations lead to a discussion of the impact and the relevance of the concept to increase the experimental study of scientific mediation devices in the research and professional communities.

Keywords

usability indicators, information about research, thematic portals, scientific production dissemination, research projects, European Union, research websites

1 INTRODUCTION

The study proposed pursues a twofold objective: to show, on one hand, how special devices are established within research networks, with editorial features to renew the classic circuit of the scientific publication, and, on the other hand, to contribute to report on a rapidly expanding social practice in the field of research.

Our analysis focuses on the networks of actors who are involved in research and development (R&D) and are strongly incited within the framework of these to build a website as a tool of visibility of their activity.

Consequently, the sites analysed are dedicated to the R&D project they illustrate. Mostly created at the beginning of the project, when ap-

plying to the concerned project, they accompany the cycle of the project, whose development they structure while assuring its promotion.

It is thus about content-based sites which apply new information requirements and require new skills for project management and for the organization of research activities. To this end, researchers are called upon to think about the communicational challenges of their activity and not simply its informative and scientific nature. This reflection is embodied in the implementation of an editorial project designed to cater to a social and political requirement. Indeed, European researchers are henceforth placed under a double constraint: on one hand to contribute to a Europe of knowledge and on the other to participate actively in the construction of a European research space (EUROPEAN COMMISSION 2005a). They are no longer only expected to provide the capacity to model and innovate but also to make both the results of their work and the conditions of its elaboration legible and accessible to the greatest possible number of economic, political and social actors. Thus, it is this «science in action» (LATOURE 1995) that is at stake, on a wider scenario, as networks, are at stake. Consequently, research communities strive to develop sites with multiple facets: content development, mediation of information and interaction between actors and external users. The increasing importance of these devices leads to a redefining of the editorial scientific activity (communication versus dissemination) and the emergence of a reorganization of the social bond between science and society (usability versus utility).

Our analysis intends to contribute to show how and under which conditions the implementation of such a device can open up a new epistemological – new research objects – and ideological – a new interpretation of a social fact- paradigm.

We shall thus see the editorial production context of the European research sites observed, and shall subsequently look into the role played in these projects by the question of usability, and finally we seek to reveal the impact of the concept of usability on the empirical study of devices elaborated by the researchers.

2 PROBLEMS OF CONTENT MANAGEMENT OF THE WEB SITES OF EUROPEAN RESEARCH PROJECTS

To determine the editorial profile of the observed research sites, the distinguishing features of such sites should be clarified before the question of content management can be addressed.

2.1 Type of sites

In the field of Information and Communication Sciences (ICS), the study of website content is the object of an interdisciplinary approach, whose greatest merit is to reveal the complexity (LE MOIGNE 1995) of the object.

Echoing the complexity of the world and the increasing abundance of networked information, it nevertheless proposes a certain number of categories aimed at interpreting objects in the field of mediated communication. The resulting typologies, frequently used in the field of media expertise and benchmarking, can be divided into two groups: activity-based typologies – institutional, commercial, educational sites – and content-based typologies – resources, catalogues, directories, services. These, however, fail to account for an anthropological approach to *composite* objects (LE MAREC 2003), i.e. objects of knowledge partaking of a combination of devices, approaches and representations. Often complementary and interdependent – which shows their limit when faced with the complexity of the studied objects –, these typologies are nevertheless useful tools for the characterization of the observed devices. They permit the precise identification and measurement of the various degrees of relationship with the established site families.

2.1.1 Type of contents

– *Content websites*

As was stated in the introduction, our study addresses sites developed within the framework of R&D projects. Thus, we are inevitably going to encounter the constituent elements of this activity – tools, methods and objectives of applied research, in these sites, as well as the distinctive features of this field of research – a research institutionalised by financing, an established research network, a territory of economic activity, social and political partners.

– *Programme websites*

Based on projects, these sites are clearly programme sites: indeed, the programme conditions the architecture and functional organization of these sites, whatever the size or domain of the project may be. However, this constraint is moderated by the dynamics generated by the project: in fact, it may be seen that in this context the producers of sites implement content management tools allowing to make permanent and to redeploy the knowledge capitalized – filing of documents, structured indexing... These are essentially non-profit sites that give priority to the production and distribution of information generated by the scientific network stimulating the research. The actors and users will mostly find in this space:

- specific and current documentation: log books, diaries, notes, reports, abstracts, glossaries, thesaurus, bibliographies, and technical index cards.
- proprietary tools: models of analysis, procedures, databases, and the results of the research – articles, syntheses, monographs, statistics, and wordlists.
- traces of the communication activities of the network – calendars, reports events, email list archives and \ or forums.

It is exactly this internet-based scenario of research in action – material traces of scientific progress, access to the work processes, recording of exchanges, questions raised by the research, that distinguishes these sites from those generally developed by organizations and research laboratories.

2.1.2 Type of organizations

– *Network sites*

Another characteristic feature of this type of activity: these sites are the work of invested researchers, mostly grouped within research teams, identified in this context, as belonging to a network. This network, often formalised at the beginning of the project and validated at institutional level through a selection process, pre-exists the project, and adds the sharing of experiences and practices.

– *Intercultural sites*

As is the case for scientific research and its studied internationalisation process (GINGRAS 2002), the network is international – at least four or five different countries are generally associated – in order to afford the project the scope it requires. However, the common publishing activity, different from the traditional activity – peer-reviewed publishing – places the actors in a strongly intercultural (PERREGAUX 2002) communicative situation. Multilingualism and thematic content areas are the most distinctive points.

– *Dedicated sites*

The sites, as programme tools, are sustained by the funds of the project they belong to. They have a specific budget, which is a condition of permanence and viability. But the development of these sites, which very often begins before the start of planning, also generally benefits from technical equipment – computers, connecting network – and human resources – technical and administrative employees – which are available in the organizations where the actors work. In fact, a very large number of the sites are hosted by one of the network institutions. But this organic link, visible on the URL of the site, gives a relative autonomy of development while respecting the server's project specifications.

– *Sites validated*

One last characteristic feature is that these sites benefit from a double pledge, scientific and institutional: on the one hand they enjoy the professional responsibility of the research actors and on the other hand they require the acceptance and support of the institution, which confers them a space of visibility.

2.2 Content management approach

Which approaches and solutions of content management do these sites choose to implement?

2.2.1 The portal, a common potential choice

A vast majority of sites, to meet their requirements in terms of contents with a high added value, make the immediate or potential choice of the portal as a global management solution for information, because it makes it possible to implement a real cycle of information management – identification, collection, processing and dissemination. Besides, «the vocation of the portal to be a single point of entry» (BENARD 2002) to information and useful applications, strongly underpins the projects to this device, federative and relatively flexible at the same time.

The portal as tool integrating information and applications – the processing and filing of documents, publication and research tools – facilitates the integration of content management techniques. Finally, it implies the possibility of answering the question of *tacit information* (POLANYI 1966), or *tacit knowledge* (BAUMARD 2000), that is generated by the actors of an organization and that can stimulate the decision-making process, even if it is informal.

2.2.2 Adopted solutions and portal profiles

As has just been seen, the sites observed choose the portal¹ solution for content management and applications, drawing from the model of the Enterprise Integration Portal (EIP) and Web Content Management (WCM).

If we refer to the analytical description of corporate portals (BENARD 2002), it transpires that devices set up in Web sites are hybrid while also being content gateways (with a more or less developed application dimension) and specialized portals. Once again we see, in all the sites observed, the number of the portal's functional bricks:² presentation brick, directory, specific database, crawler plus the appropriate bricks to the content portal, such as the publication of information – content management-, storage, collaborative tools.

Furthermore, these portals decline special content specific of the research: research agenda, scientific news, colloquia and seminars, resource catalogues and databases, papers database, publications, structure and resources directories, researchers' sites, researchers' yearbook, lists of experts, information services.

What finally distinguishes these research-oriented portals is that they associate a rigorous scientific approach to the network specifications, allowing all the user groups to both retrieve and produce information.

3 USABILITY, PUBLISHING PROJECT'S VECTOR

We now examine more precisely, the nature of the publishing project within these sites and how the question of usability may act as structuring element.

1. Defined by Parisot as «lieu d'information, de communication, de coopération et de travail pour une communauté d'acteurs constituée autour de lui» (PARISOT 2002).
2. Groups of applications composing portal's structure.

3.1 The publishing project

Four main functions organize the publishing project:

- publication: i.e. production and management of project papers (peer-to-peer working);
- dissemination: communication of referred information produced by the network to the external users;
- collaborative watch: exchanging information between participants;
- project management: feedback on the process, management control.

These functions, which imply all the participants in the entire publishing process, may afford the project site a strong integration-driven dimension when they display relevant management tools.

The choice of the portal as a federative content tool must permit the coherent organization of these functions by associating the appropriate information management techniques to the portal: categorization – access to the information by arborescence, content aggregation – by-subject grouping of different source information-, workflow – management of the document life cycle – to quote only the main clauses.

These management techniques are partially determined by the process of validation of the information generated – collection, sorting and validation – within the framework of the scientific but also by the analysis of the needs of the actors and the public target so as to profile information by groups of users.

3.2 Approach of usability in the Web sites observed

In this context of research oriented Web sites that seek to facilitate the use and the traffic of knowledge within broad communities of practice, how is the question of usability addressed and how does it constitute a relevant control lever for the clarification of the publishing project?

3.2.1 The context of observation

— *The concept of usability*

Usability³ is a generic name with multiple facets according to authors and context of use (technical systems generally, computers, networks).⁴

A central concept in research in ergonomics, particularly in the studies on Human-Machine Interaction (HMI),⁵ usability has two do-

3. «Capacité d'un système à permettre à ses utilisateurs de faire efficacement ce pourquoi ils l'utilisent. Afin que le travail soit fait, le système «utilisable» doit non seulement être facile à utiliser, mais aussi fiable et efficace».
4. *Le Grand Dictionnaire terminologique*, available at <<http://www.granddictionnaire.com>>. For a terminological review, see the paper by Jonas Löwgren on the site *Usability matters*, available at <<http://www.ida.liu.se/labs/aslab/groups/um/>>.
5. Human Machine Interface (HMI): speciality of computer and cognitive science which studies the exchange of information between a computer system and the user

mains of application: computer ergonomics and Web ergonomics, and has been the object of abundant literature, one of the leading figures being J. Nielsen. In the case of the Web, the concept of usability makes possible to develop an application-based approach. Its role, according to Nielsen, is twofold: «to set the direction for the design and to check that the design works».⁶

With a view to making navigation within a site as user-friendly as possible, this initiative is centred around tools and methods that may optimise the dialogue between users and Web interface designers: tips, recommendations, evaluation criteria, good practices and even standards, based mainly on the contributions of research in cognitive ergonomics, the sociology of use, and mediometric studies.

— *Usability and portal*

With the development of portal generation, the question of usability has to deal with the issue of the management of the ever-increasing complexity of the technical system. Indeed, if «the way of presenting the information, so as to make it clear and easy of access, is the key of the use of a portal» (BENARD 2002), the choice of this device implies several questions for the designers and the users, notably regarding the division of the informative space – definition of portlets-, the qualification and categorization of information, its maintenance and accessibility in the system. How, during the management of this publishing process, do the project leaders deal with the question of usability, how does the interaction between the technical device and the actors of the network contribute to the maturation of the editorial project? These are some of the questions that our observation will attempt to answer.

3.2.2 Method and tools of observation

The concept of usability, pragmatic in nature, acts in the professional field on the performative level: its use targets the improvement of the system or the product observed, henceforth widely associated to the quality process⁷ implemented by the organization. The ensuing approach is consequently evaluative in nature, whether it is located in a *bottom-up* initiative (diagnosis of the interface), or *down* (diagnosis of choices of conception). The indicators that it begins to build are actually marked by the underlying evaluative function, and the observation criteria are strongly related to the technological state of devices, which are not very stable. Thus, the transfer of this concept in the field of the research to ICS requires a certain number of methodological precautions: that which appears in the professional domain as an effective productiv-

6. Extract from an interview of Melissa Reyen. *Publish* <<http://www.publish.com/article2/0,,1762057,00.asp>>. [cited 19 February 2005].

7. Especially in the institutional research sites. We can quote for instance in France, the webpage «Ergonomie», CNRS. Direction des Systèmes d'information. Available at <http://www.dsi.cnrs.fr/bureau_qualite/ergonomie/ergonomie.asp>.

ity tool, must, in empirical research on computerized media, free itself of the paradigm of evaluation which might limit the frame of the study and force the results of the observation. However, if it seems utopian to free oneself totally from an evaluation, and if it is always precarious to reach the famous critical distance notably within the framework of a participating observation⁸ such as our own, at least we shall try to limit figures within the framework of this study.

This part of our study is notably based on the results of a qualitative study begun in 2004 (CHAMPOLLION 2004; PIPONNIER 2005) on two representative European Web sites, a network, the Réseau Européen d'Intelligence Territoriale (REIT)⁹ and an observatory, the Observatoire de l'École Rurale (OER). For this study, we crossed several approaches: site observation – analysis of contents and ergonomics –, study of the technical documents of a project – specifications, analyses of follow-up, reports of meetings, conclusions and intermediate reports – observation of the participants of working sessions – note taking, conversation analyses.

This method, while offering the advantage of not detaching the study from its object during the analysis – the site as the communication authority – from its immediate environment – the research project in progress –, makes the concept of usability a relevant element for a heuristic approach of the publishing project.

To collect the data for our observation, we built three guides: the first one is object-oriented –(the Web site), two others, discourse oriented–(project documents and communication situations).

3.2.3 Analysis and interpretation of the data

The cross analysis of both variables of observation, on one hand, what actors say and do, and, on the other hand, what the inquiry allows to collect, allows to loose a certain number of indicators relative to the status of usability in the publishing project.

From the results obtained, it is possible to draw up an initial cartography of usability according to three impact factors: use markers, cognitive markers and meta-cognitive markers.

Use markers

In the projects observed, the programme strongly encourages the actors to create a Web-based platform for the production and exchange of scientific activity. The conception of the site draws the support for its architecture and the minimal drawing of its interface from the project's scientific argument which defines a certain number of orientations and activities, and this initial task of categorization of information makes it

8. Our casework on devices in progress is both based upon external observation (independent investigation) and internal observation (associated research).

9. REIT, available at <<http://msh.univ-fcomte.fr/reit/indexsp.html>> and OER, available at <<http://www.grenoble.iufl.fr/rural>>

possible to produce a set of design cards, before stabilizing the homepage around a convincing structure, i.e. in the case of these projects, accurately define the perimeter of the activity, the axes of orientation, the project actors and the services offered. The choice of portal, which imposes working on the definition of the functional and specific bricks, facilitates this information categorization and renders homepage content planning easier.¹⁰ But it leaves the question of legibility up to the designers: clear titles, appropriate size of stamps, colour codes are managed differently and evolve during the project. Site accessibility management, what the project's specifications are, is also defined through the stable URL, the choice of linguistic versions, and simplification of the navigation by arrows and return buttons, the presence of a site map, for instance.

— *Discursive:*

The Web site, defined in the project conception as the tool of activity's visibility, runs the risk of being conceived as a brochure-ware site, and is limited to manage the ergonomics of surface if it does not work on contents mediatisation. At the same time, the project actors are aware of potentials and risks of certain devices for the credibility of their activity – publishing references, flashes – and often decide to set up a reflection on the editorial profile and specifications of the site. Another fact is that these increasing reflections in work in progress may have a strong impact on the profound aspects of site ergonomics – effective presentation of objectives, precise content explanations, analysis of information needs, definition of the target –.

The evolution of the title columns and editorial content shows the preoccupation about working and intercultural dimensions.

— *Organizational:*

Confronted with new and decisive editorial practices for the project life, the actors are confronted with the alternative of workflow management or controlled management run by a dedicated apparatus device such as the editorial committee. In the projects observed, the choice of an editorial committee is partially linked to financial resources, albeit only to a certain extent. The editorial committee is rather clearly considered as a specific and relevant tool of editorial process: selection and validation of the information for publication on the site, content organization and life cycle of contents, graphic chart. Drawing from networking experience and the practices of the scientific publication whose field it is expanding, the editorial committee streamlines the activities of production and diffusion of the information by drawing up procedures recorded in a quality process. The presence of this authority in the project organizational chart is an original marker of usability in this type of sites.

10. The general standard is: a vertical axis of informational content structured in three columns – information on organization, leading article, news; a horizontal axis with logo and title at the top and information about the publication, contacts, sponsoring and partnership at the bottom.

Cognitive markers

The indicators of learning usability are listed here:

- *Control of technical tools:*
The consideration of the question of usability is first and foremost indicative of a certain degree of appropriation of the technical tools useful for its implementation-.
- *Integrative Approach*
Based on a good knowledge of the working environments – network architecture, technical constraints, software solutions, the usability management may create a better synergy between tools, methods and productivity. Aided by the work of the editorial committee, it can contribute to greater integration between technical devices, network actors, scientific and management objectives -.
- *Acquisition of knowledge and skills*
The progressive management information device, with or without editorial committee, mobilises each one of the actors, although to differing degrees, on new procedures of analysis and qualification of information. This work implies the identification and the traffic of new abstract tools – notions, concepts –, of the techniques involved – computer and documentary – and new skills in the editorial field – preparation and revision of typescripts, design, various editorial styles, adapted to the screen constraints, to the types of contents and to user needs.
- *Development of expertise*
In the course of the editorial process observed we witness, by thinking about devices and the implementation of good practices, the development of expertise. While unevenly distributed within a network, it gives life to the project, notably thanks to the regulating effects of the editorial devices, and renders it attractive for its interlocutors.
- *Autonomy of the teams*
Eventually, the coverage of usability as a development condition for the site favours auto administration of the device.

Meta-cognitive markers

What is the cognitive impact of usability on the project in general?

- *Organization*
The implementation of editorial procedures respecting a certain number of usability rules can have a rather strong impact on the organization of work – horizontal management of the activity-, diversification and redistribution of tasks within the network – segmenta-

tion and/or reorganization of chains of procedures-, transversability – increased communication and interaction around common questions, improvement of internal coherence.

— *Regulation*

Usability as the vector of the editorial project can be an agent of de-compartmentalisation of the activity, notably in the portal device, which often tends to privilege only content aggregation. It can moderate the as yet strong broadcasting logic in the projects observed and strengthen dialogue between designers and users.

— *Decision helping*

The usability management incites actors to agree on technical and procedural choices and on the conditions of their application, and can be an indication of the project productivity curve.

— *Strategy*

Finally, the usability's implementation conditions render it possible to envisage the project's evolution capacity and guarantee certain durability, in a fluctuating technical and information context.

4 TOWARDS THE CONSTRUCTION OF A NEW SPACE FOR THE PRODUCTION OF THE KNOWLEDGE WITHIN THE RESEARCH INFORMATION SYSTEM

At an output of this study on the modalities of content management and usability of European research projects, we can extract, from the two-year longitudinal study and from the results of the case study presented herein, a set of remarks, which will highlight the specificity of our study object.

The methodological framework adopted, places our research on a point of confrontation in constant and renewed interaction around three centres of attention of the editorial projects observed: the researcher's point of view – as broadcasting, receiving, mediator of scientific information-, the observer's point of view – observing a technical-practical interaction in progress – and the user's point of view – receiving the message and reinterpreting it according to the device. The surplus of these projects arises from the confrontation of these three points of view, which are eventually conjugated in an unstable economic and political perspective.

4.1 Usability and paradigm of the project

Usability is a very common approach in the recent developments of organizational analysis and research into information systems, but it is an initiative still relatively little exploited in the ICS where it is present on a scattered way through studies addressing the socio-cognitive uses of devices (LE MAREC 2002), scientific mediation (CALLON 1988), the economy of the document (HARNAD 2001), the semiology of the computerised media (STOCKINGER 2003).

When the appropriation of the device establishes a research determining axis, notably in the educational and cultural contexts of use – scientific exhibitions, virtual museums, for example – and certain institutional contexts – e-administration, unique counter of information access – this one envisages a stable object – CD-ROM – or unstable but fixed object for the needs of the study – the Internet site as the place of representation of an interaction -, where the editorial project is considered as finished or at least stabilized.

The project's approach is undoubtedly necessary to re-qualify a certain number of devices and readdress the question of uses in a dynamic perspective. The actors and the designers of content sites are reluctant to expose the creation process of their publishing work, at the same time forced by a strongly competitive informative market on the network and worried about giving a successful image of their activity, out of the chances of the discovery and of the experimentation. The end users out off considering the profit that they can derive from the communication on the editorial project, if it they are not designers themselves or involved in a production process. The question of usability as the vector of the editorial project is thus tangible today only for certain organizational and economic levels when it is aided by the development of the processes connected to the quality initiative. In this context, the scientific project site, as a research object, builds a peculiarity, which places it in a dynamic with great potential, especially since it tends to become one of the key elements of the communication device of the scientific research at international level.

4.2 Usability, content management, use: the editorial triangle in debates

Thus, it will be clearly useful to revise a certain number of concepts and their interrelations in order to approach the peculiarity of the device. A re-examination of the concept of usability in the test of new corpuses of projects dedicated to research, but also, and in a more fundamental way, a re-examination of the notion of use within the framework of a practice. Indeed, a new editorial relationship is set up in the research project sites, which is rather far from the classic editorial process. Integration within the same team of activities until now strongly segmented and distributed to clearly different professional and economic actors not only poses new questions for a sector which feels threatened but introduces a new profile of actors, factor of instability both for the editorial system and for the research system in general.

4.3 The conditions of a new flow of knowledge

Described as strongly registered in a «réseaux socio-techniques» (CALON on 1988), the science being made, finds in the devices observed new conditions of its expansion, and new social and economic interactions.

Do the sites of scientific communities tend to give to show «the life of (new) laboratories» (LATOUR 1995)? In front of the scale of such questions, at the most we can here tempt some lines of questioning

- *A new figure of the scientific author?*
The implementation of the scientific activity creates the conditions of a more or less strong move of research activity towards activities of communication and mediation. Are we talking about a movement or rather reorganization? Is this also observed in all the sectors of scientific activity and at every research level?
- *A new status of scientific document?*
What are the conditions of validation and perennisation of documents? What is their influence on the traditional networks of scientific publication? What kind of relationship do they have in the cultural and economic regard of record management and open access to them?
- *A new laboratory?*
What are the material traces of the activity? What are the regularities and the numbers? How much does the «laboratory» want to reveal?
- *New public?*
Who does the scientific project site address? What are the categories of users? Does the site build a new public?
- *A new space of scientific mediation*
Last but not least, do these devices establish (do they constitute) the weft of a new fabric of scientific mediation? Do they bear the signs of a reorganization of scientific activity within society?

REFERENCES

- (BAUMARD 2002) BAUMARD, P. *Tacit Knowledge in Organizations*. London: Sage, 2000.
- (BENARD 2002) BENARD, J.-L. *Les portails d'entreprise: conception et mise en œuvre*. Paris: Hermès, Lavoisier, 2002.
- (CALLON 1988) CALLON, M. *La science et ses réseaux*. Paris: La Découverte: Conseil de l'Europe: Unesco, 1988.
- (CHAMPOLLION 2004) CHAMPOLLION, P.; PIPONNIER, A. «Première approche du processus qualité dans les sites web interculturels» [electronic resource]. ISDM. Colloque TICE Méditerranée 26-27 novembre 2004, no 18. <http://www.grenoble.iufm.fr/rural/Doc2004_05/TIC%20Mediterranee.doc>. [cited 16 February 2005].
- (DAVENPORT 2001) DAVENPORT, T. H.; GROVER, V. «Special issue [electronic resource]: Knowledge Management». *Journal of Management Information Systems*. v. 18, n. 1 (2001), p. 3-4. <http://jmis.bentley.edu/articles/v18_n1_p3/index.html>. [cited 16 February 2005].
- (EUROPEAN COMMISSION 2005a) EUROPEAN COMMISSION. Cordis FP6. *Information Society Technologies* [electronic resource]. <<http://www.cordis.lu/ist/home.html>>. [cited 16 February 2005].
- (EUROPEAN COMMISSION 2005b) EUROPEAN COMMISSION. Information Provider's Guide, *Practical guide to Accessible web design* [electronic resource]. <http://europa.eu.int/comm/ipg/rule7/rule7_guide6_en.htm>. [cited 16 February 2005].

- (FAYARD 2002) FAYARD, P. *Culture stratégique et technologies de l'interaction* [electronic resource]: *La création du savoir au Japon*. Rapport d'Ambassade, Tokyo-Japon/ADIT (Agence pour la Diffusion de l'Information Technologique), Strasbourg. <<http://www.adit.fr>>. [cited 16 February 2005].
- (FAYARD 1996) FAYARD, P. «Toward the sharing of intelligence: Historical dynamic and current trends of Public Communication on Science and Technology in Europe». *Revue de l'Intercom*. Sao Paulo (Brésil), 1996.
- (FORD 2002) FORD, D.; CHAN, Y. *Knowledge Sharing in a Cross-Cultural Setting* [electronic resource]: *a case study*. Queens Schools of Business. <http://business.queensu.ca/kbe/papers/abstract_02_09.htm>. [cited 16 February 2005].
- (GINGRAS 2002) GINGRAS, Y. «Les formes spécifiques de l'internationalité scientifique». *Actes de la recherche en sciences sociales*. n. 141-142 (2002), p. 31-45.
- (HARNAD 2001) HARNAD, S. «The self-archiving initiative. Freeing the refereed research literature online». *Nature*. v. 410 (2001), p. 1024-1025.
- (LATOUR 1995) LATOUR, B. *L'activité scientifique*. Paris: La Découverte, 1995.
- (LE MOIGNE 1995) LE MOIGNE J.-L. *La modélisation des systèmes complexes*. Paris: Dunod, 1995.
- (LE MAREC 2002) LE MAREC J. *Ce que e terrain fait aux concepts: vers unethéorie des composites*. Habilitation à diriger des recherches. Université de Paris 7. (9 mars 2002).
- (NOUGIER 2005) NOUGIER, J.-F. *Usabilis* [electronic resource]: *Web & Software Usability Consulting*. <<http://www.usabilis.com/gb/index.html>>. [cited 19 February 2005].
- (PARISOT 2002) PARISOT, R. *Portail internet*. Paris: EMS, 2002.
- (PERREGAUX 2002) PERREGAUX, C. *Pourquoi des approches interculturelles en sciences de l'éducation*. Bruxelles: De Boeck, 2002.
- (PIPONNIER 2005) PIPONNIER, A. «Le dispositif de diffusion mis en œuvre par l'OPER: une approche des stratégies de communication au service de la recherche et de la formation». In: *L'enseignement scolaire en milieu rural et montagnard*. Tome3. (Besançon: Presses Universitaires Franc-Comtoises, 2005).
- (POLANYI 1966) POLANYI, M. *The Tacit Dimension*. London: Routledge & Kegan Paul, 1966.
- (STOCKINGER 2003) STOCKINGER, P. *Portails et laboratoires pour la recherche et l'enseignement*. Paris: Hermès, Lavoisier, 2003.
- (USABLE 2005) USABLE web [electronic resource]: *970 links about web usability*. <<http://usableweb.com/>>. [cited 16 February 2005].